Review of Lease Obligations and Assessment of Impacts to Public Trust Resources and Values

State Oil and Gas Leases PRC 1824 and PRC 3150 Terminations and 4H Shell Mounds Disposition

JANUARY 2025

Prepared for:

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MISSION STATEMENT

The California State Lands Commission provides the people of California with effective stewardship of the lands, waterways, and resources entrusted to its care based on the principles of equity, sustainability, and resiliency, through preservation, restoration, enhancement, responsible economic development, and the promotion of public access.

Project Geographic Location

Shell Mound	Latitude	Longitude
Hazel	N 34°22.993′	W 119°34.083′
Hilda	N 34°23.313′	W 119°35.766′
Heidi	N 34°20.543′	W 119°31.181′
Hope	N 34°20.445′	W 119°31.908′

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Acronyms and Abbreviations

Acronym/Abbreviation/ Short Term	Definition
1994 MND	Appendix A1, Adopted Mitigated Negative Declaration
4H Platforms	Platforms Hilda, Hazel, Hope, and Heidi
4H shell mounds	Remnant drill muds, shell hash, and sediment remaining after removal of 4H Platforms
AMEC	AMEC Earth & Environmental Inc.
CDFW	California Department of Fish and Wildlife
CDP	Coastal Development Permit
CESA	California Endangered Species Act
Channel	Santa Barbara Channel
Chevron	Chevron U.S.A., Inc.
Coastal Commission	California Coastal Commission
County	County of Santa Barbara
DGPS	differential global positioning system
District	Santa Barbara County Air Pollution Control District
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
ERM	Effects Range Median
ESA	federal Endangered Species Act
Fugro	Fugro West Inc.
GHG	greenhouse gas
Leases	Leases PRC 1824 and 3150
Lessee	Chevron U.S.A., Inc., Atlantic Richfield Company (now BP, PLC), Exxon Mobil Corporation
Liaison Office	Joint Oil/Fisheries Liaison Office
M	moment magnitude
MARE	Marine Applied Research and Exploration
mg/kg	milligrams per kilogram
MND	Mitigated Negative Declaration
NOAA Fisheries	National Oceanic and Atmospheric Administration’s National Marine Fisheries Service

Acronym/Abbreviation/ Short Term	Definition
Operating Procedures	Procedures for Drilling and Production Operations from Existing Facilities on Tide and Submerged Lands Currently under State Oil and Gas Leases
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PM_{10}	coarse particulate matter; particulate matter with a diameter of 10 microns or less
$PM_{2.5}$	fine particulate matter; particulate matter with a diameter of 2.5 microns or less
Project	Chevron's 4H Platform Removal Project
Regional Board	Central Coast Regional Water Quality Control Board
Review	Review of Lease Obligations and Assessment of Impacts to Public Trust Resources and Values
ROV	remotely operated vehicle
SAIC	Science Applications International Corporation
Sanctuary	Channel Islands National Marine Sanctuary
SCUBA	Self-Contained Underwater Breathing Apparatus
SLC	California State Lands Commission
Trawlers Association	Southern California Trawlers Association
USACE	U.S. Army Corps of Engineers

Executive Summary

In 1957, the California State Lands Commission (SLC) issued State Oil and Gas Lease PRC 1824.1 (PRC 1824) to Standard Oil Company of California (Standard Oil, now Chevron U.S.A., Inc. [Chevron]) and Humble Oil and Refining Company (now Exxon Mobil Corporation). In 1964, the SLC issued Lease PRC 3150.1 (PRC 3150) to Richfield Oil Corporation (later Atlantic Richfield Company [ARCO], now BP, PLC) and Standard Oil. These leases were associated with oil and gas production from Platforms Hilda, Hazel, Hope, and Heidi (collectively, the 4H Platforms), which were installed offshore of Santa Barbara County from 1958 to 1965.

Chevron removed the platforms in 1996, following the SLC's 1994 adoption of a Mitigated Negative Declaration (1994 MND, Appendix A1, item 54, August 3, 1994) and approval of Chevron's 4H Platform Removal Project, which was subject to a mitigation monitoring program and stipulations that, in part, were intended to identify and eliminate future conflicts with commercial trawl fishing from the remains of subsea "shell mounds" consisting of empty mussel shells and sediment covering an inner layer containing drill muds and cuttings.

Ownership of the submerged land on which the shell mounds lie is as follows:

- The Hilda and Hazel shell mounds lie on state sovereign land.
- The Hope and Heidi shell mounds lie on state sovereign land that was granted to the County of Santa Barbara (County), in trust for the state, with minerals reserved to the state (Chapter 846, Statutes of 1931, as amended).

In the more than 25 years since the platforms' removal, Chevron has fulfilled six of the seven stipulations to SLC's approval of the Project. Trawl tests designed to fulfill the final stipulation, to successfully trawl over the shell mounds, failed. Pursuant to subsequent direction by the SLC, Chevron submitted multiple reports to SLC staff related to shell mound disposition, and also worked with the Joint Oil/Fisheries Liaison Office to resolve conflicts with commercial fishermen, the latter resulting in the signing of Trawler Compensation Agreements in 2013–2014 with commercial fishermen who hold permits to trawl for California halibut (*Paralichthys californicus*) or sea cucumber (*Apostichopus* spp.) in the area. Chevron maintains that the Trawler Compensation Agreements meet the intent of the final stipulation, and thereby fulfill its remaining lease obligation. Chevron therefore submitted an application to terminate (i.e., surrender or quitclaim) its interests in Leases PRC 1824 and PRC 3150 (the Leases).

This Review of Lease Obligations and Assessment of Impacts to Public Trust Resources and Values (Review) is intended to provide the SLC, other agencies, tribal nations, and the public with information on the following:

- Chevron's renewed application to terminate the Leases after signing Trawler Compensation Agreements with 17 commercial fishermen in 2013–2014 that provided compensation for the installation of navigational equipment on their trawl vessels to help them avoid the shell mounds.
- SLC staff's evaluation of historical records related to the Leases and the SLC's adoption of the 1994 MND (Appendix A1) and approval of the Project.
- An assessment of impacts to public trust resources and values associated with the continued presence of the 4H shell mounds on the sea floor if they are not removed. This Review summarizes various sediment and biological studies performed at the site, including the following:
  - Three studies that analyzed the chemical and physical composition of the shell mound sediments (Fugro 2000; de Wit 2001; AMEC 2002).
  - Three studies that documented the fauna present at the shell mounds and compared results to those found at other habitat types in the area (de Wit 1999; Bomkamp et al. 2004; Page et al. 2005a).
  - Five studies that examined the potential for contaminant release from the mounds into the surrounding waters and marine species (MEC 2002; SAIC 2003a; Bemis et al. 2014; AMEC Foster Wheeler 2015; SLC 2024 [Appendix C2).
  - Five geophysical surveys of the bathymetry of the mounds that were conducted from 1996 to 2021.
  - Two video and photographic surveys of the shell mounds conducted using remotely operated vehicles (ROVs) in 1999 (de Wit 1999) and 2022 (Appendix C3).
- An assessment of full removal of the 4H Shell Mounds that discusses the process and potential impacts arising from that work, see Appendix A.

A draft of this Review was subject to a technical peer review in 2022 coordinated by Ocean Science Trust (Appendix C4). Peer reviewers included experts in marine biology, geology and geophysics, and marine toxicology. The peer review considered the Review's scientific rigor, the comprehensiveness of cited literature, whether conclusions in Chapter 2, Issue Area Assessment, and Chapter 3, Comparison of Effects with Full Removal of the Shell Mounds, were backed by science, and whether the Review properly supported decision making. The Review was revised to address comments made by the peer reviewers. Further, in response to peer review comments, the SLC contracted with the consultant team to prepare a new mussel study (Appendix C2), which was conducted in 2023, analyzing the current potential for bioaccumulation of contaminants at the shell mounds.

This Review was developed as an informational document and is not intended to comply with or replace the provisions of the California Environmental Quality Act (Pub. Resources Code Section 21000 et seq.).

Summary of Assessment Findings

The analysis that follows in this Review is based on a wide range of peer-reviewed scientific literature and technical studies (cited throughout the Review), including the 2023 mussel study (Appendix C2) and a recent ROV survey (Appendix C3, ROV Survey Technical Report). As noted above, analysis and discussion of impact evaluations in Chapter 2 were independently peer reviewed by impartial scientists coordinated by Ocean Science Trust in 2022 (Appendix C4). Notable findings of the Review include the following:

- Physical stability of the mounds has been demonstrated through geophysical surveys in 1996, 1999, 2004, 2009, and 2021, as well as ROV surveys (most recently in 2022, Appendix C3) that showed **no evidence of slope failure** despite repeated physical disturbance of the shell mounds by platform removal activities, including explosive cutting of platform pilings and platform jacket removal, two trawl test events, placement of temporary marker buoys, two debris removal events, two vibracore surveys, and minor earthquakes.
- Although analysis of sediment cores from the shell mounds and prior sampling show some trace contaminants, **high sedimentation** associated with the region **continues to entomb the mounds** and the remnants of those contaminants.
- Surficial bottom sediments near the shell mounds contained elevated barium concentrations that likely were derived from drilling wastes, but Phillips et al. (2006) concluded that chemical contaminants are **not being remobilized from the shell mounds**, and that without a large physical disturbance, the contaminants within the shell mounds **will likely remain sequestered**.
- Some contaminants detected in studies of the shell mounds, such as heptachlor epoxide, are **not associated with oil and gas development** and likely originated from other point or area sources not associated with the shell mounds.
- The lack of contaminant dispersal from the mounds to the overlying water column is supported by studies conducted of the mounds' profiles using a **remotely operated vehicle** in 2022 (Appendix C3) and a **mussel bag study**

conducted in 2023 (Appendix C2). In particular, the mussel bag study in 2023 was compared to a similar study at the mounds in 2003 and showed **no apparent trends in contaminant accumulation** in the tissues of mussels exposed at the mounds, and no **significant difference from shallow and deep reference sites** that were used for comparison.

- Invertebrates collected at the shell mounds found **no change in accumulation of metals** in 2013 versus samples collected in 2002.
- Mussels deployed at the shell mounds in 2003 and 2023 remained healthy through an approximately 2-month exposure, even showing **significantly faster growth at some of the shell mounds** compared to reference sites (SAIC 2003a; Appendix C2).
- Resident organisms at the mounds, such as bat stars, sea cucumbers, and rock crabs, are **not prey species for higher-trophic-level organisms**, such as marine mammals and sharks, which limits the potential for bioaccumulation of contaminants that may be present.

The alternative to retaining the shell mounds in their current condition is to remove them via dredging and dispose of them at an offshore or onshore location. However, disturbing the mound sediments would introduce contaminants into the water column. Therefore, in addition to this Review, for purposes of comparison and to allow a thorough analysis, a preliminary analysis document was prepared discussing impacts that would be associated with shell mound removal. The removal analysis document was drafted in 2013 and updated in 2022 to reflect changes in where mound materials could be disposed of (Appendix B). A comparison of the potential effects of leaving the mounds in place versus removal of the mounds is provided in this Review.

Table ES-1 provides a summary of findings associated with leaving the 4H shell mounds in place and compares those findings with those for removal of the mounds. Refer to the analysis in Chapter 4 of Appendix B, Assessment of Full Removal of the 4H Shell Mounds, and the comparison in Table 3-1 (in Chapter 3 of this Review) for the basis of the findings in Table ES-1.

Table ES-1. Summary of Assessment Findings

Issue Area/Effect	Intensity of Effect	
	Mounds Left in Place	Mounds Fully Removed Through Dredging (Effects During or After Removal)
Commercial Fishing		
Adversely affect commercial fisheries due to contaminant exposure	Low, unless major disturbance occurs	Potentially high
Adversely affect commercial fisheries due to presence of mounds preventing trawling or interfering with various gear types	Low, trawler agreements limit risk	None
Marine Water Quality		
Adversely affect marine water quality due to mound contaminants	Low	Potentially high
Marine Biological Resources		
Adversely affect the marine invertebrates and fishes inhabiting the 4H shell mounds	Low	Potentially high
Geologic and Seismic Hazards		
Release embedded contaminants due to a shift or collapse of the 4H shell mounds	Potentially moderate	Low
Recreation, Public Access, and Land Use		
Adversely affect public access or recreational use of the area where the 4H shell mounds are located	None	None
Air Quality and Greenhouse Gases		
Result in emissions of air quality pollutants and/or greenhouse gases that exceed applicable thresholds	None	Potentially major
Coastal Processes and Sea Level Rise		
Cause changes in littoral transport, wave action, or other processes	None	None
Influence or be affected by projected sea level rise	None	None

Table ES-1. Summary of Assessment Findings

Issue Area/Effect	Intensity of Effect	
	Mounds Left in Place	Mounds Fully Removed Through Dredging (Effects During or After Removal)
Cultural and Paleontological Resources		
Disturb or damage cultural or paleontological resources in the vicinity of the 4H shell mounds	None	None
Environmental Justice		
Cause disproportionate impacts to minority or low-income populations in regional port communities	Low	Potentially major
Navigation, Transportation, and Traffic		
Interfere with offshore navigation, transportation, or traffic	None	Potentially moderate
Increase vehicle miles traveled and/or reduce level of service at intersections onshore	None	Potentially major
Noise		
Generate noise that exceeds applicable thresholds or that creates a public nuisance	None	Low
Public Safety and Hazards		
Create a hazard or otherwise adversely affect human safety	Low	Low
Scenic Resources		
Adversely affect a scenic viewshed or other scenic resource	None	Low

Note: 4H = Hilda, Hazel, Hope, and Heidi

1 Introduction

This Review of Lease Obligations and Assessment of Impacts to Public Trust Resources and Values (Review) is intended to provide the California State Lands Commission (SLC), other agencies, tribal nations, and the public with information on the following:

- Chevron's renewed application to terminate Leases PRC 1824 and PRC 3150 (Leases) after signing Trawler Compensation Agreements with 17 commercial fishermen in 2013–2014 that provided compensation for the installation of navigational equipment on their trawl vessels to help them avoid the four shell mounds that remain at the sites of the previously removed Hilda, Hazel, Hope, and Heidi (4H) Platforms. Chevron maintains that the agreements satisfy the intent of the final stipulation imposed by the SLC with respect to the removal of the 4H Platforms, and with it, Chevron's remaining lease obligation.
- SLC staffs' evaluation of historical records related to Leases PRC 1824/3150 and the SLC's 1994 adoption of a Mitigated Negative Declaration (MND) (Appendix A1) and approval of Chevron's 4H Platform Removal Project (Project).
- An assessment of impacts to public trust resources and values associated with the continued presence of the 4H shell mounds on the sea floor if they are not removed (Chapter 2, Issue Area Assessment). This Review summarizes various sediment and biological studies performed during the terms of the Leases, including the following:
  - Three studies that analyzed the chemical and physical composition of the shell mound sediments (Fugro 2000; de Wit 2001; AMEC 2002).
  - Three studies that documented the fauna present at the shell mounds and compared results to those found at other habitat types in the area (de Wit 1999; Bomkamp et al. 2004; Page et al. 2005a).
  - Five studies that examined the potential for contaminant release from the mounds into the surrounding waters and marine species (MEC 2002; SAIC 2003a; Bemis et al. 2014; AMEC Foster Wheeler 2015; SLC 2024).
  - Five geophysical surveys of the bathymetry of the mounds that were conducted from 1996 to 2021.
  - Two video and photographic surveys of the shell mounds conducted using remotely operated vehicles (ROVs) in 1999 (de Wit 1999) and 2022 (Appendix C3).
- An assessment of full removal of the 4H Shell Mounds that provides a discussion of the process and potential impacts arising from that work, see Appendix A.

A draft of the Review was subject to a technical peer review in 2022 coordinated by the Ocean Science Trust (Appendix C4). Peer reviewers included experts in marine biology, geology and geophysics, and marine toxicology. The peer review considered the Review's scientific rigor, the comprehensiveness of cited literature, whether conclusions were backed by science, and whether the Review properly supported decision making. The Review was revised to address comments made by the peer reviewers. Further, in response to peer review comments, the SLC contracted with the consultant team to prepare a new mussel study analyzing the current potential for bioaccumulation of contaminants at the shell mounds, which was conducted in 2023 (Appendix C2).

In addition to this Review, in 2013, the SLC caused to be prepared a preliminary discussion of impacts associated with shell mound removal. That analysis was updated in 2022 to reflect changed circumstances for disposal of mound materials (Appendix B). A comparison of the potential effects of leaving the mounds in place versus removal of the mounds based on the analysis in this Review and in Appendix B is provided in Chapter 3.

This Review was developed as an informational document and is not intended to comply with or replace the provisions of the California Environmental Quality Act (Pub. Resources Code Section 21000 et seq.).

1.1 Leases PRC 1824/3150 and Production History

The history of the 4H shell mounds includes the initial issuance of Leases PRC 1824 and PRC 3150, drilling of and production from the wells, formation of the shell mounds, removal of the platform structures, and the process for terminating the leases and determining the final disposition of the mounds. These are described in detail in the following subsections and are summarized in a chronology in Appendix A2.

In 1957, the SLC issued State Oil and Gas Lease PRC 1824.1 (PRC 1824) to Standard Oil Company of California (Standard Oil, now Chevron U.S.A., Inc. [Chevron]) and Humble Oil and Refining Company (now Exxon Mobil Corporation). In 1964, the SLC issued Lease PRC 3150.1 (PRC 3150) to Richfield Oil Corporation (later Atlantic Richfield Company [ARCO], now BP, PLC) and Standard Oil. Refer to Figure 1-1, Lease and Shell Mound Locations.

In 1957, the SLC authorized construction of Platform Hazel (installed in 1958) within PRC 1824; Platform Hilda was approved and installed per PRC 1824 in 1960 (Figure 1-2, Designs of the 4H Platforms). Production of oil and gas reserves continued within the nearby Carpinteria Offshore Oilfield under PRC 3150 with the SLC's approval of Platforms Hope and Heidi in 1964 and 1965; both platforms were installed in 1965.

Collectively, these four platforms are known as the 4H Platforms. Oil and gas produced at each of these platforms were transported via subsea pipelines to the Carpinteria Processing Facility adjacent to the Chevron Pier in the City of Carpinteria. As of 2024, this facility was proposed for decommissioning and remediation by Chevron (City of Carpinteria 2024).

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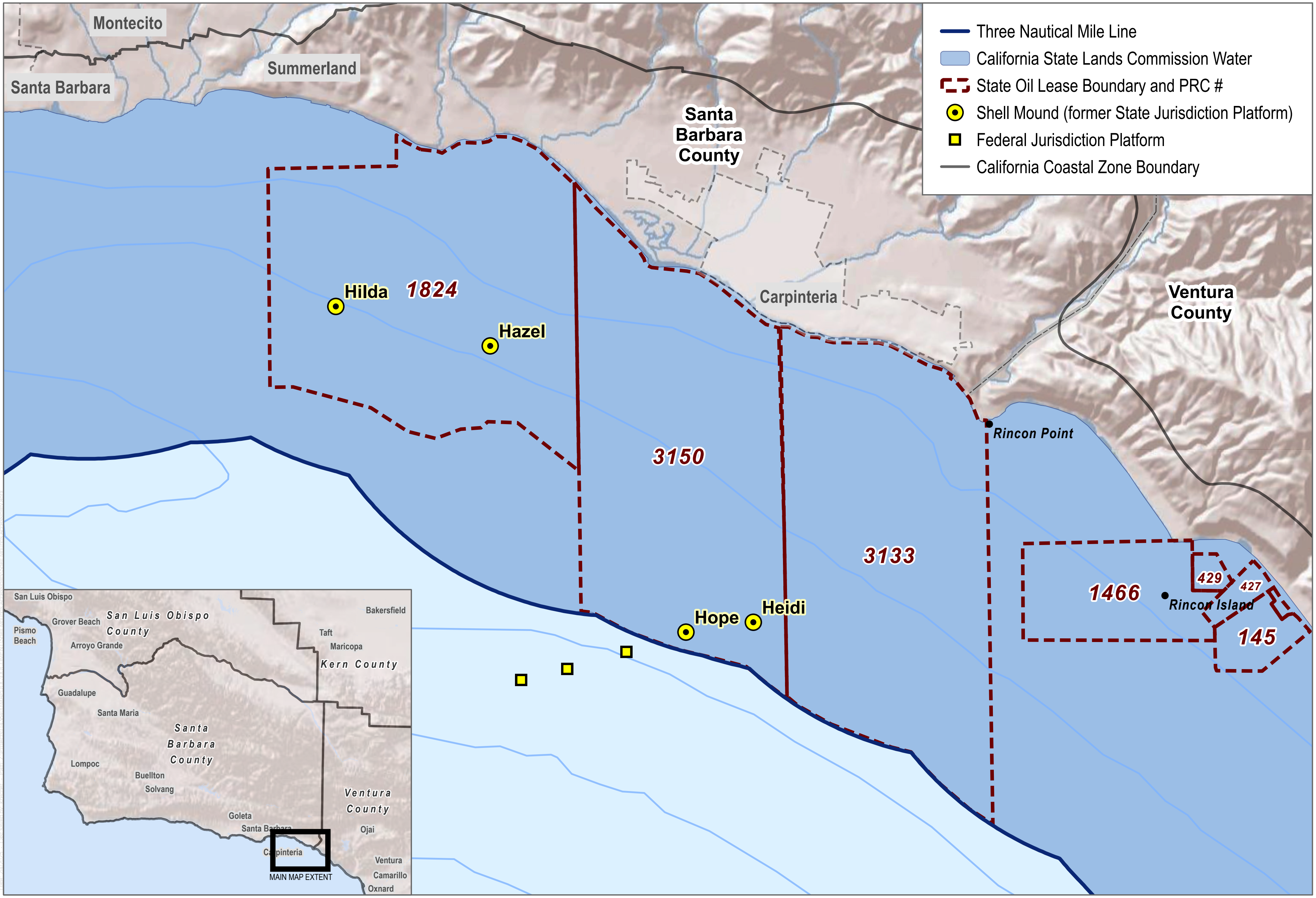

SOURCE: County of Santa Barbara

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FIGURE 1-1

Lease and Shell Mound Locations

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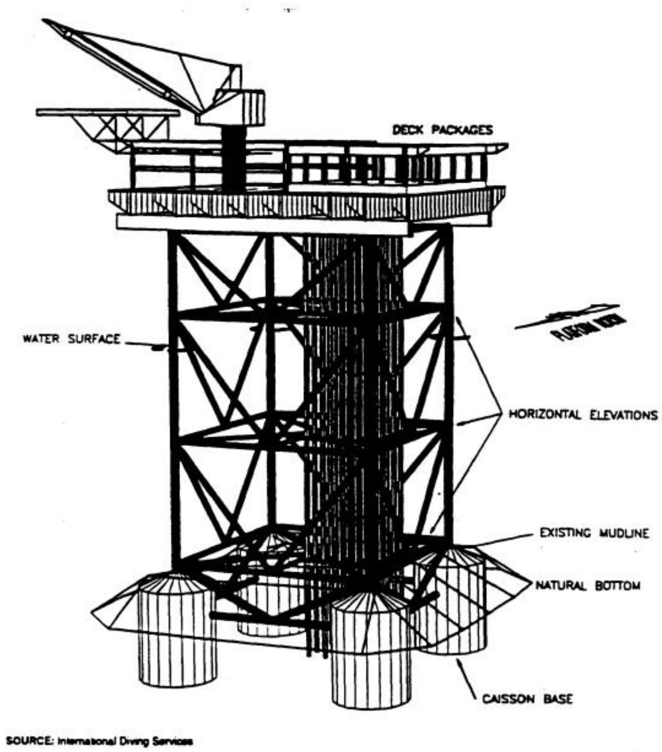
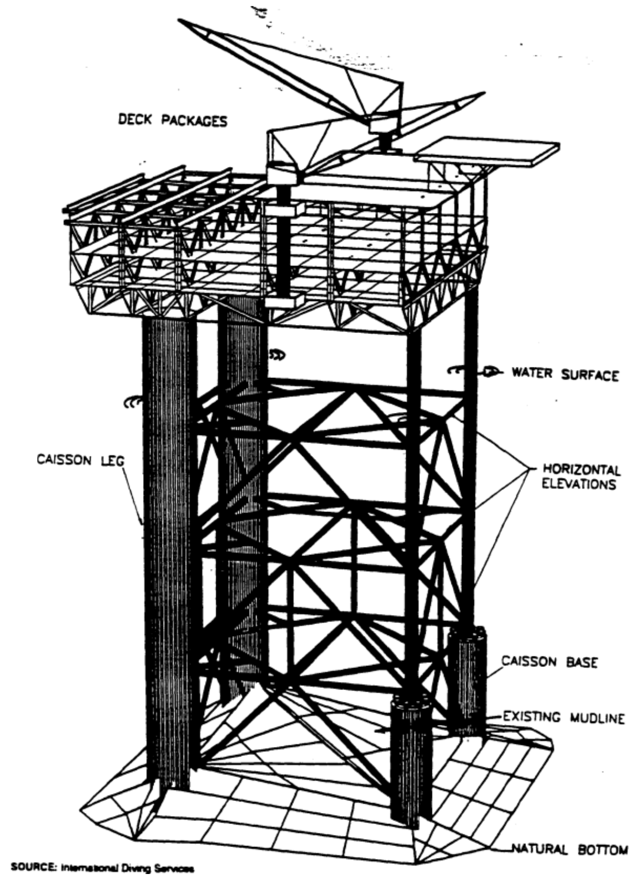
Figure 1-2. Designs of the 4H Platforms



Note: Platform Hazel, the first platform installed within Lease PRC 1824, included a tower 75 feet square and 170 feet high with a 110-foot-square deck. The tower was anchored by four 40-foot-high, 27-foot-diameter caissons with bases that were originally jetted approximately 20 feet below the natural mudline at the site.



Note: Platforms Hilda, Hope, and Heidi were constructed with a different design that incorporated 54-inch-diameter platform legs within either full-length caisson legs extending from above the water surface to below the existing sea floor, or caisson bases only. For either caisson type, 8 to 12 piles below each of the caisson legs anchored the structure.

In 1994, the SLC acted on a plan by Chevron and its partners (collectively, Chevron) to decommission and remove the 4H Platforms; the SLC adopted an MND (State Clearinghouse No. 94051016) (1994 MND) (Appendix A1, Adopted Mitigated Negative Declaration) and approved the 4H Platform Removal Project (Project), subject to a series of stipulations contained in Exhibit C of the August 1994 Commission Meeting (Calendar Item 54, August 3, 1994) (SLC 1994). One of the stipulations in Exhibit C required Chevron to conduct test trawls to confirm site clearance following an SLC-approved trawl plan, and to notify the SLC upon the successful conclusion of the trawls. The 1994 MND explicitly assumed that the shell mounds would be left in place and would be trawlable, and nothing in the 1994 MND or Exhibit C stipulations identified a reasonable alternative if the test trawls were not successful (see Appendix A1). Chevron removed the platforms in 1996, and consistent with the 1994 MND, the subsea "shell mounds," consisting of empty mussel shells, sediment, and an inner layer containing drill muds and cuttings, were allowed to remain. Additionally, the SLC approved partial abandonment of platform jacket anchors and those portions of the platform jackets that were inextricably intermingled with the shell mounds. At Platforms Hilda, Hope, and Heidi, the platform support structures were cut below the sea floor surface; however, at the Hazel Platform, a different type of support caisson was used during construction, and the platform support caissons were cut above the sea floor, leaving a portion of the four caissons extending from 3 to 12 feet above the shell mound. Following platform removal, Chevron conducted two debris removals and succeeded in removing the majority of remnant oil rig debris (Calendar Item C65, September 3, 1999) (SLC 1999a).

Ownership of the submerged land on which the shell mounds lie is as follows (see also Figure 1-1, Lease and Shell Mound Locations):

- Platforms Hilda and Hazel shell mounds lie on state sovereign land.
- Platforms Hope and Heidi shell mounds lie on state sovereign land that was granted to the County of Santa Barbara (County), in trust for the state, with minerals reserved to the state (Chapter 846, Statutes of 1931, as amended).

The former 4H Platforms and shell mound sites were not subject to any surface leases from the SLC or the County because oil and gas leases issued to operators provide a right to use as much of the surface of the land as is reasonably necessary for the capture and extraction of the subsurface oil and gas resource.

Since platform removal, Chevron has fulfilled six of the seven stipulations of the SLC's 1994 approval, but has been unable to expressly fulfill stipulation No. 5, which directed Chevron to notify the SLC upon the successful completion of test trawls in the area within a 1,000-foot radius of each platform. Chevron performed trawl tests over the shell mounds in 1996 and 1997, but these tests failed when trawl netting and equipment snagged on portions of each shell mound. Chevron, pursuant to directives by the SLC and in coordination with the Joint Oil/Fisheries Liaison Office (Liaison Office), worked to address commercial trawlers' claims that the shell mounds unduly interfered with California halibut (*Paralichthys californicus*) and sea cucumber (*Apostichopus* spp.) fishing operations, and caused economic harm from damaged or destroyed fishing nets, lost time, lost catches, and/or preclusion from fishing in one or more of the 4H shell mound areas. Chevron could have released its interests in Leases PRC 1824 and PRC 3150 by quitclaim, but Chevron would have remained liable for unfulfilled obligations, namely resolution of the trawlers' claims.

1.2 Disposal of Drill Muds

During early well drilling and production at the 4H Platforms, oil-based and water-based drill muds were used during drilling and were discharged with clean drill cuttings to accumulate on the sea floor beneath each platform.[1]

From 1955 through 1969, the SLC, in consultation with the California Department of Fish and Wildlife (CDFW),[2] the Central Coast Regional Water Quality Control Board, and others, permitted oil companies to discharge cleaned drill cuttings and non-oil-based drilling muds into state waters from platforms and mobile drilling facilities operating on state tide and submerged lands oil and gas leases. The SLC's practice at the time of permitting the disposal of cleaned drill cuttings and non-oil-based drill muds at sea is described in a Negative Declaration adopted by the SLC in June 1980 (SLC 1980).

At Platform Hazel, drill muds and cuttings piles occasionally covered the platform's discharge pipe, located approximately 15 feet (5 meters) above the sea floor. CDFW biologists/divers Carlisle, Turner, and Ebert, who conducted Self-Contained

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1 Drill muds (also called drilling fluids) are used to maintain hole integrity and to lubricate the drill bit. Drill cuttings are particles of crushed rock ranging in size from approximately 0.002 millimeters (clay-sized) to greater than 30 millimeters (1.18 inches) (coarse gravel) produced by the grinding action of the drill bit as it penetrates the earth. Water-based muds made up the majority of all drilling muds used from production platforms in California (O'Reilly 1998, as cited in MEC 2002). Water-based muds consist primarily of non-toxic inorganic constituents (including clay, calcium chloride, gypsum, potassium chloride, and sodium chloride) and insoluble and non-toxic organic binding agents, such as starch, xanthan gum polymers, and lignite. Some oil-based muds were also used in production of the Santa Barbara Channel platforms; these muds replaced the aqueous component with petroleum compounds, including diesel oil, brine, emulsifying agents, viscosity agents, and various other additives. Due to their high cost relative to water-based muds, oil-based mud use was infrequent (less than 1% of the muds used at the 4H Platforms), and their use was banned in California waters in the early 1970s (MEC 2002).

2 The California Department of Fish and Game changed its name to the California Department of Fish and Wildlife effective January 1, 2013.

Underwater Breathing Apparatus (SCUBA) dive surveys at Platforms Hazel and Hilda shortly after their installation, reported the following (Carlisle et al. 1964, pp. 44, 57):

> Washed cuttings, resulting from drilling operations, have been deposited on the ocean bottom, under the tower, through an underwater outfall pipe. The opening of this outfall pipe was 85 feet below the sea surface. After 3 years, the cuttings pile, conical in shape, extended above the pipe opening, and had a basal diameter of about 120 feet. This was in spite of the operator's attempt to jet the pile and spread it out at a lower level. Its composition was predominantly a fine silt…. It developed as a smooth-surfaced, silty pile without holes for shelter, so it did not attract fish nor did it offer a suitable substrate for the attachment of plants or animals….
>
> … Once in a while, fish were seen swimming through the cloud of cuttings falling from the pipe, but this appeared to be only an attempt to move from point "A" to point "B" in the shortest time. When the pile became so high that it hampered further disposal of cuttings and blocked the outfall opening, a jetting operation was undertaken in an effort to disperse the pile. About all this accomplished was to level the top of the cone and to cover the encrusting organisms on the tower below 75 feet with a layer of mud. The fishes were apparently unaffected other than to lose a potential food supply. At the time of our last observation, the pile was a gently-sloping cone 120 to 150 feet across the base and 20 to 25 feet deep.

Following the 1969 Santa Barbara oil spill, which occurred on a federal lease on the Outer Continental Shelf, the SLC imposed a moratorium on offshore oil drilling from existing or new wells on state lands that lasted from 1969 through 1973. In December 1973, the SLC adopted the Procedures for Drilling and Production Operations from Existing Facilities on Tide and Submerged Lands Currently under State Oil and Gas Leases (Operating Procedures) (SLC 1973), lifted the moratorium, and permitted resumption of drilling operations on a lease-by-lease basis predicated upon SLC staff review for compliance with the Operating Procedures and upon final approval by the SLC. The Operating Procedures related to disposal of drill muds and cuttings were contained in Section II.D, Production Procedures, Waste Disposal, which stated the following, in part:

> All waste discharged into the ocean from drilling and production operations shall be treated so as to comply with the discharge requirements of the Regional Water Quality Control Board. Oil, tar, or other residuary products of oil, or refuse of any kind from any well or facility,

such as drilling mud that contains substances which are toxic to fish life, and chemicals shall be disposed of on shore in a dumping area in conformance with local regulatory requirements.

After adoption of the Operating Procedures, Standard Oil applied to resume drilling operations under Leases PRC 1824 and PRC 3150. In January 1975, the SLC determined that Standard Oil's applications would be considered only after preparation of an Environmental Impact Report (EIR), which was prepared and subsequently certified by the SLC in October 1976 (SLC 1976). Drilling operations from the 4H Platforms then resumed in accordance with lease terms and conditions and SLC regulations. Notably, Standard Oil's resumption of drilling did not include discharge of drill muds or cuttings to the sea floor. Instead, the EIR described the proposed handling of drilling muds and cuttings as follows (SLC 1976):

- **Drill Cuttings.** Cuttings are estimated to be 224 and 325 cubic yards per well (Carpinteria and Summerland, respectively), or from 3,390 cubic yards for the expected 12 wells up to 10,340 cubic yards for the maximum possible number of wells (36 wells). Drill cuttings will be contained in cans and hauled ashore by work boat to Port Hueneme for transport to the J&J disposal site at 5th and Harbor Streets, west of Oxnard, California.
- **Drilling Mud and Excess Cement.** While drilling is in progress, approximately 850 barrels of excess drilling mud and 10 barrels of excess cement slurry will be hauled ashore from each well. The excess mud and slurry will be transported in tanks on the work boat to Port Hueneme during the three to five weekly trips; it will then be hauled to the approved disposal site.

1.3 Shell Mounds Formation

Diving surveys conducted between 1960 and 1970 did not note a shell hash covering the mounds. After cessation of the discharge of muds and cuttings to the sea floor, the platform legs and subtidal structures quickly became covered with large California mussels (*Mytilus californianus*), other invertebrates, and algae, which also supported mobile invertebrates and fish. As these encrusting biota and associated resources died, were predated, or were scraped off by divers during platform cleaning, the shells and other organic material settled to the bottom onto the existing mound of drill muds and cuttings. The shell debris, along with the in situ drill muds and cuttings and naturally deposited sediments, formed a roughly conical "shell mound" under each of the four platforms, which was documented in 1975 at Platforms Hilda and Hazel. At that time, divers found that the piles were armored by fallen mussel shells more than 1.5 feet

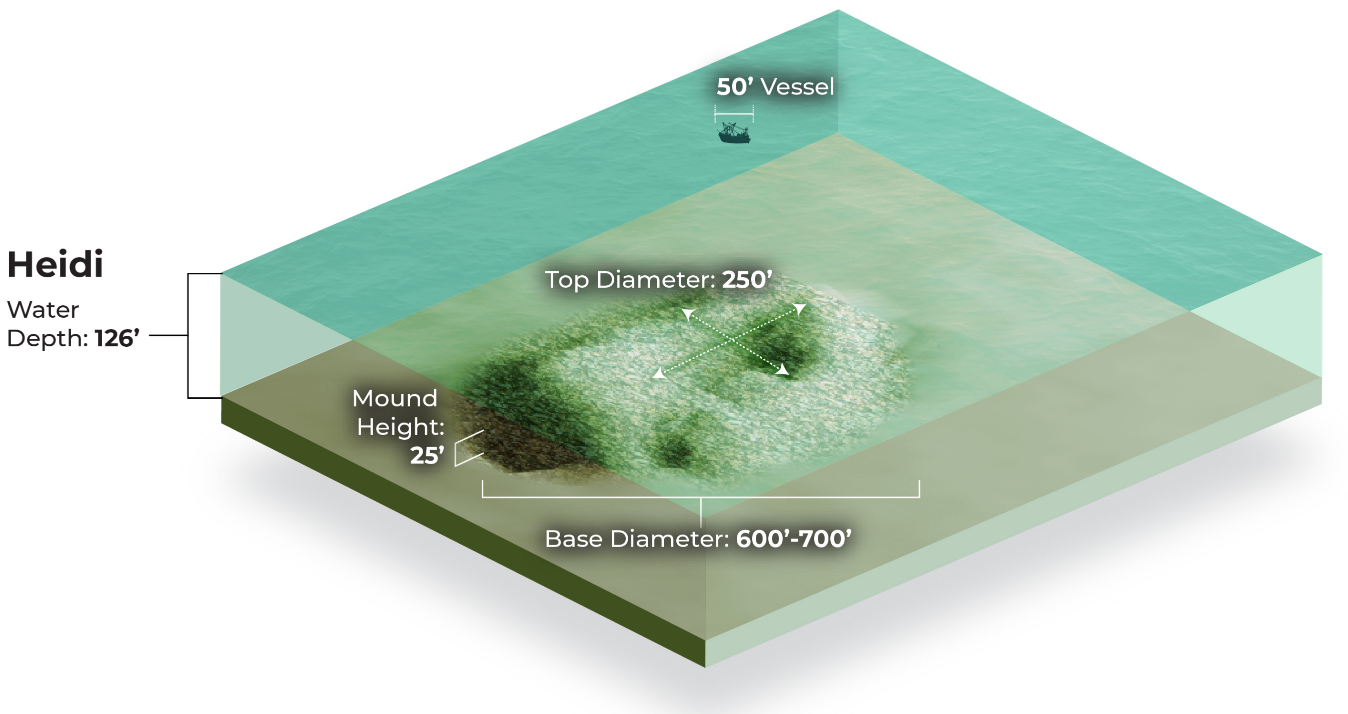
(0.5 meters) deep (Bascom et al. 1976). Page et al. (2005b) described this process as follows:

> Off the coast of southern and central California, oil platforms provide hard substrate for the attachment of sessile and semi-mobile organisms. The principal components of this assemblage at depths of <15 m are mussels. Waves/swell, storm events and platform cleaning dislodge clumps of the mussel community, which fall to the seafloor. This "faunal litterfall" provides a food subsidy to benthic consumers and alters the physical characteristics of the seafloor by creating a hard substrate mound. The phenomenon of shell mound formation has been documented at most oil platforms off the coast of California.

Until removal of the 4H Platforms in 1996, organisms on the platform structures continued to fall and accumulate on the sea floor, encasing the mix of drill cuttings and muds, natural sediments, and existing shell debris in a solid "shell hash" that was 1 to 7 feet (0.3 to 2 meters) thick. A cross-section of each shell mound is shown in Figure 1-3, and a three-dimensional representation of one example mound (Platform Heidi) is shown in Figure 1-4. The current state of the shell mounds, including results of ROV surveys conducted in 2022 and a mussel bag study conducted in 2023, is described in Chapter 2.

Figure 1-3. Cross-Sections of 4H Shell Mounds

Figure 1-4. Three-Dimensional Representation of 4H Shell Mound Heidi



1.4 4H Platform Removal and Debris Cleanup

Under the terms of the Leases, Chevron was to leave the platforms intact and turn them over to the SLC at lease termination; however, the SLC retained an option under the Leases to order removal and restoration activities prior to surrender of the premises, as follows (Lease PRC 3150.1, Section 14; Lease PRC 1824, Section 14, contains similar language):

> Lessee shall surrender the premises with all permanent improvements thereon or, at the option of the State and as specified by the State, the Lessee shall remove such structures, fixtures and other things as have been put on the leased lands by the Lessee and otherwise restore the premises.

In 1993, Chevron submitted the proposed Project to the SLC. On August 3, 1994, the SLC adopted an MND that analyzed potential impacts of removing the 4H Platforms (State Clearinghouse No. 94051016) (Appendix A1) and approved the Project, subject to seven stipulations and a mitigation monitoring program, which were incorporated into the Project (Calendar Item 54, August 3 1994) (SLC 1994). References to the shell mounds and the drill muds and cuttings within the mounds occur throughout the 1994 MND (see Table 1-1).

Table 1-1. References to Shell Mounds, Muds, and Cuttings in the 1994 MND

1994 MND Page	Text
2-21	Depth of burial of Platform Hazel's caisson bases and cross members varies across the platform base…. the disposal pile and associated marine growth reach approximately 26 feet above the natural mudline. Abandonment operations will remove the platform legs to the top of the caisson base or at least 1 foot below mudline, whichever is higher. A post-abandonment survey of the site will confirm the condition of the remaining mound.
5-7 to 5-8	[O]ver 90 percent of discharged drilling-fluid solids settle[d] directly to the bottom, beneath the platform…. [P]revious studies conducted underneath Hazel and Hilda indicate substantial piles at the base of the structures. According to Carlisle et al., 1964, drill cuttings formed an irregularly shaped pile that reached 25 feet [7.6 meters] in height and 250 feet [76 meters] in diameter when the initial drilling was completed. [I]n 1976 at platform Hilda … divers found that the cuttings pile was skewed to the west, reaching a maximum height of 38 feet [12 meters] near the western face of the platform, in the area of the conductors (Simpson 1977). As the conductors provided the densest area of attachment places for invertebrates on the platform, the study speculates that the pile may have been highest at that location due to the addition of mussel clumps that had torn loose in storm or had fallen from the pipes of their own weight. A 1964 study indicated that the cuttings pile (without shells at the time), reached a maximum height of 25 feet [7.6 meters] (Carlisle et al. 1964). The 1976 data suggest that the layer of shells had increased to as deep as 15 feet [4.6 meters] in some places (Bascom et al. 1976).
5-10	[C]uttings mounds accumulated at the base of the platforms will likely remain largely intact…. Overall bottom topography near the former platform areas will remain as low-lying mounds.

Table 1-1. References to Shell Mounds, Muds, and Cuttings in the 1994 MND

1994 MND Page	Text
5-28	Cuttings piles accumulated at the base of the caissons will likely be disturbed, but remain largely intact, as a result of the removal process. Impacts to water quality will result in short-term turbidity and localized redistribution of bottom sediments…. Observations by Simpson (1977) have indicated that much of the disposal piles located at the platform base may be solidified, with thick layers (18–20 feet) of shells and other material covering the inner layer of hardened drill cuttings. Therefore, due to their weight and composition, cuttings piles will not likely be heavily resuspended by platform removal operations.
5-55	The substrata around these structures are composed of a mixture of drill cuttings and shells which have broken off the platform pilings. This does not appear to be suitable habitat for many rockfish species (Love and Westphal 1990). In his study of Platforms Hazel and Hilda in 1976, Simpson indicated that the California mussel and various starfishes of the genus *Pisaster* (*P. andochraceous and P. giganteus)* were found … on the cuttings pile below.
5-56	While the cuttings piles beneath the platforms were originally devoid of sea life, shell accumulation provided an uneven substrate surface suitable for further invertebrate life. Invertebrates living on the cutting piles beneath Hazel and Hilda included anemones, crabs, sea cucumbers, and numerous species of starfishes and batstars (Simpson 1977).
5-65	Other encrusting organisms existing on the accumulation of shells atop the cuttings piles would likely be damaged by the physical removal of the jackets. Caisson removal would leave open pits on the sea floor and alteration of the cuttings piles would occur. As a result, benthic organisms and other invertebrates on cuttings piles would be eliminated and/or dislodged from their substrate. These impacts would be confined to localized regions. Due to the relative abundance of this resource, no significant impacts will occur.

Source: Appendix A1.
MND = Mitigated Negative Declaration

In its 1994 approval of the Project, the SLC did not require removal of the 4H shell mounds (Calendar Item 54, August 3 1994) (SLC 1994). The 1994 MND indicated that the shell mounds would remain in place. For example, on page 5-10 of the 1994 MND, the SLC states that "[C]uttings mounds accumulated at the base of the platforms will likely remain largely intact…. Overall bottom topography near the former platform areas will remain as low-lying mounds." Pursuant to Stipulation No. 5 to the Project approval, the SLC required Chevron to perform test trawls over the debris clearance area at each platform location (see below and Appendix A1):

> Within 10 working days of the completion of the project, Chevron shall submit a "trawl plan" (Plan) to the SLC for its approval. Such Plan shall provide for test trawls over the debris clearance area at each platform location, specifically the area within a 1,000 foot radius from each platform. Such Plan shall also provide for the use of conventional trawling gear, i.e., gear without modifications that would allow it to clear seafloor obstructions, comparable to that which would be used by commercial fishermen in the region. The SLC will review such Plan in consultation with the Joint Oil/Fisheries Liaison Office. Chevron shall proceed with the test trawls within thirty (30) days of receiving notification of SLC approval of the Plan and shall notify the SLC upon the successful conclusion of the trawls.

Stipulation No. 7 (see Appendix A1) required additional actions to address potential impacts to commercial fishermen who expressed a desire to trawl in the areas where the 4H Platforms had been located for 30 to 35 years:

> If in the future any portion of a platform related structure or pipeline abandoned in place becomes exposed, Chevron shall, within 90 days of being notified, identify the nature of the exposed material and submit one of the following to the SLC for its review and approval:
>
> - with respect to the caisson(s) of Platform Hazel, a plan to reduce or eliminate potential conflicts with commercial fishing activities;
> - with respect to an offshore section of a pipeline and its appurtenances, a remediation plan which shall contain an alternative removal procedure; and
> - with respect to the beach and shorezone area described in Stipulation 6, a removal plan.
>
> Upon approval by the SLC, Chevron shall implement the submitted plan on a schedule and in the manner specified by the SLC.

The SLC's adopted mitigation monitoring program for the 1994 MND also addressed impacts associated with the accumulation of debris on the ocean bottom during operations of the platforms and from the dismantling operations. The following is from Mitigation Measure 4 of the 1994 MND (see Appendix A1, Exhibit D):

> a) Verification of site clearance will be performed as part of the final debris recovery operation utilizing a high resolution side-scan sonar survey. A description of the survey shall be submitted to the Commission [SLC] for its review and approval prior to the conduct of such survey.
>
> b) Suspect targets or debris will be plotted for positive verification and recovery.
>
> c) The debris located will be recovered by divers to complete the site clearance verification. A test trawl will be conducted over each site as provided by Stipulation 5 as contained in Exhibit "C" and made a part hereof by this reference.
>
> Monitoring: Staff of the State Lands Commission will periodically monitor the site clearance operations and will check the side-scan sonar records and the trawl report to verify that all debris has been removed.

The California Coastal Commission (Coastal Commission) included a similar condition in its related Coastal Development Permit (CDP) approved in 1995. Condition 7 of CDP E-94-006 states the following, in part:

> Prior to Chevron's quitclaim or assignment of leases PRC 1824 and PRC 3150, Chevron shall submit to the Executive Director and the SLC an analysis, to include supporting information, of whether or not debris identified in the above surveys and attributed to Chevron shall be removed. If the Executive Director determines that removal of the debris attributed to Chevron is necessary to avoid an unreasonable risk of snagging by trawl nets, this matter shall be set for public hearing before the [Coastal] Commission for the purpose of determining whether or not this coastal development permit shall be amended to require debris removal.

In addition, U.S. Army Corps of Engineers (USACE) Permit 94-50801-TW, Special Condition 7, required Chevron to conduct monitoring after platform removal, including the preparation and execution of a "trawl plan" and survey of the area with an underwater ROV or high-resolution side-scan sonar.

In 1996, Chevron removed the platforms, leaving the subsea shell mounds on the seabed at each platform site. Each well was cut off 1 foot (0.3 meters) below the mudline, and multiple cement plugs were placed in the well bores at various depths, ranging from one near the sea floor to one above (or across) the production zone, which could be several thousand feet below the sea floor. Chevron deemed the caisson bases, which contained concrete, too heavy for safe handling by barges, so their steel cross beams and vertical legs were cut to 1 foot (0.3 meters) below the mudline and removed, with the caissons abandoned in place to minimize bottom disturbance. As noted in Section 1.1, Platform Hazel is constructed differently from the other three platforms, and remnants of its large caissons extended above the mudline upon removal of other infrastructure. Those remnant caissons are exposed approximately 3 feet above the mound on one side and 10 to 12 feet on the other side. In addition, the pipelines associated with 4H Platform operations were cleaned, capped, and abandoned in place. The Platform Hope pipelines were rerouted to transport continued production from Platforms Gail and Grace directly from federal waters to shore instead of through Platform Hope.

Following removal of the platforms, the final phase of the Project involved removal of debris identified during pre-abandonment surveys or lost during platform removal operations. Site cleanup and debris removal was conducted from July 31 through August 19, 1996, and all debris targets were reportedly removed. The next step was to conduct a trawl test to ensure that trawling gear would not catch on the remaining shell mound materials and thereby be damaged or lost. On August 6, 1996, Chevron submitted its post-abandonment trawl test plan, which was reviewed and approved by SLC staff in consultation with the Liaison Office, which concurred with the plan. Staff from the Coastal Commission, CDFW, and USACE also approved the plan.

Trawl testing over the former 4H Platform sites began on August 19, 1996, using commercial bottom trawl fishing gear and with SLC staff on board the trawl vessel to monitor operations. The start date was within 30 days of receiving notification of SLC approval of the trawl plan, consistent with Stipulation No. 5. Testing was conducted on a regular schedule up to the end of October 1996, at which time deteriorating weather conditions caused the remaining trawl tests to be performed on an intermittent basis through December 20, 1996. During that period, the trawl test nets snagged repeatedly on the rough surfaces of the shell mounds, leading Chevron to conclude that it was not feasible to make the shell piles trawlable for commercial fishing activity.

From June 18 to 19 and June 23 to July 3, 1997, Fugro West Inc. (Fugro), under contract to Chevron, conducted two additional phases of trawl tests, using roller nets, at the abandoned 4H Platform sites. The roller nets snagged 11 times at the former platform sites: Hilda (three times), Hazel (five times), Hope (two times), and Heidi (one time) (Fugro 1997, as cited in Chevron 2005). Pursuant to Stipulation No. 5, Chevron was required to "notify the SLC upon the successful conclusion of the trawls"; however, Stipulation No. 5 did not provide direction for any alternative action in the event that trawl testing was unsuccessful. Refer to Section 1.5 for details on how this conflict has been addressed to the satisfaction of the trawl fishermen in the area.

Dive and underwater video surveys conducted in 2013 and 2022 showed that there is foreign debris, including anchor chains, pipes, beams, other assorted metallic objects, and abandoned lobster traps at all four shell mound sites.

1.5 Shell Mounds Disposition Environmental Review and Lease Termination Process (including Current Lease Termination Proposal)

As noted in Section 1.4, 4H Platform Removal and Debris Cleanup, when the SLC approved Chevron's 4H Platform Removal Project in 1994, the SLC did not require removal of the shell mounds below the platforms. In fact, the 1994 MND explicitly stated that "cuttings mounds accumulated at the base of the platforms will likely remain largely intact. Overall bottom topography near the former platform areas will remain as low-lying mounds" (Appendix A1). The 1994 MND explicitly excluded removal of the shell mounds, and even allowed for the abandonment, in place, of parts of the platform jacket infrastructure that were intermingled with the mounds. Moreover, the 1994 MND did not find any adverse environmental impacts on commercial fishing or fish stocks as a result of the platform removal project. Rather, the SLC found that "one of the benefits of the removal project" was that the previously inaccessible area would now be available to fish, including trawling (Appendix A1). Consequently, related to the adoption of the 1994 MND and mitigation measures for the Project, the SLC included seven stipulations as part of approval to address concerns voiced by the public.

Upon discovery that the mounds were not trawlable and Chevron could not easily comply with Stipulation No. 5 , Chevron began working with SLC staff to formulate options to achieve the benefit to commercial trawlers that was anticipated to be a result of the platform removal. In January 1998, the SLC's executive officer directed Chevron to undertake the following as an interim step to resolve conflicts with commercial fishing operations while other solutions were considered (Hight, pers. comm., 1998):

> [I]mmediately set and maintain one (1) spar buoy with a radar reflector at the center of each shell mound site. It is understood that the location marking of the mounds in this manner is temporary … until final disposition of the mounds can be determined.

In late January 1998, Chevron installed one spar-type buoy designed for short-term use to mark each shell mound. The buoys were found to be unreliable because they moved, broke loose, or sank. Chevron made various improvements to the buoys and replaced lost ones in 1998 and 1999, and in 1999 contracted with a third party to periodically inspect the buoys, resulting in more rapid replacement of the buoys when damaged or destroyed (SLC 1999b).

At the December 3, 1999, SLC meeting (Item 75) (SLC 1999b), SLC staff reported to the SLC Commissioners on the status of the interim commercial fishing measures. At this meeting, the SLC received comments that the only way to clear the sites was to remove the mounds (L. Krop, Environmental Defense Center); other commenters (D. Frumkes, Sport Fishing Association, and G. Cota and C. Miller, commercial fishermen) stated that the cost of removing the mounds should be used to rehabilitate and enhance California halibut habitat in coastal estuaries (SLC 1999b, pp. 79–108).

Trawlers also voiced concerns about the reliability of the buoys placed by Chevron at the shell mound sites. The SLC discussed the issue of compensation to fishermen whose equipment was damaged on the mounds, and requested information on the appropriateness of requiring Chevron to provide equipment with differential global positioning system (DGPS) technology to trawlers who operated in the shell mound vicinity. The SLC subsequently directed Chevron to take the following measures (SLC 1999b):

- Maintain at least one spare buoy to replace lost or damaged buoys
- Enter into contracts for inspection of the buoys at least twice monthly
- Act on all claims for damages claimed to be caused by the shell mounds within 1 month of receipt or such additional time as the claimant and Chevron shall jointly agree to:
  - Notify staff in writing upon receipt of shell-mound-related damage claims
  - Engage a qualified and experienced third party to visually inspect the damaged equipment before any claim is denied

- Implement mediation procedures subject to review and approval by the SLC's Executive Officer for all claims denied by Chevron
- Purchase and install a DGPS system in the vessels of trawlers who had fished in the Santa Barbara offshore waters for at least 1 year

In 1999, the SLC directed Chevron to take core samples from each mound, under supervision by SLC staff, to determine the thickness of the shell cover, the internal makeup of the mound, and whether any contaminants were present in the mound in an effort to determine the feasibility of removing the shell mounds to meet the intent of Stipulation No. 5 (Calendar Item C65, September 3, 1999) (SLC 1999a). Chevron also agreed to prepare a technical report to assess the feasibility of shell mound removal and evaluate the potential short- and long-term environmental impacts of mound removal as compared to in-place abandonment. The technical report (de Wit 2001) suggested it would be feasible to remove the mounds using a clamshell bucket dredge or by trawling using a dragline dredge, although either method would result in resuspension of contaminated sediments in the water column. Coastal Commission staff briefed the Coastal Commission in April 2001 (Item 5a) (California Coastal Commission 2001a) on the findings of that report, and at a June 2001 hearing (Item 11b), the Coastal Commission voted unanimously to require that Chevron file an application to amend its CDP to provide for removal of all the shell mounds (California Coastal Commission 2001b). The de Wit (2001) report also prompted the SLC to initiate preparation of a Draft Program EIR/Environmental Assessment (EA) to evaluate other options, such as full mound removal or a pilot project of partial removal.

On December 20, 1999, Chevron informed SLC staff of exposed caisson(s) at the Platform Hazel shell mound. In March 2000, in compliance with the SLC's Stipulation No. 7 (Appendix A1, p. 206), Chevron identified the nature of the exposed material and identified its plan to reduce or eliminate potential conflicts with commercial fishing activities, as follows (Steinbach, pers. comm., 2000):

> [T]he southeast caisson (#1) … is exposed approximately 3′ [feet] on the near side of the mound and 10–12′ [feet] on the away side. There is another caisson (#2) that apparently is just slightly exposed with a fabricated flange and flange cover protruding from the shell mound. In developing plans to mitigate the conflicts with commercial trawling activities due to the exposure of the caisson, we have identified several options. These options range from removal to various types of mitigation. However, any selection among these options depends greatly upon the final disposition of the mounds.… Chevron has implemented interim measures to reduce potential impacts to commercial fishing. These

> measures include buoys at each of the mounds, and will soon include an enhanced conflict resolution process and installation of GPS equipment on commercial trawl vessels that operate in the area. All of these measures are specifically designed to reduce potential impacts to commercial trawlers in the area of the shell mounds and should provide adequate protection to commercial fishermen until the final proposal is implemented.

In May 2001, SLC staff directed Chevron to submit an application that specified a range of potential modifications to the Project, from leaving the shell mounds in place to removal of the mounds. Chevron submitted an application to quitclaim Leases PRC 1824 and PRC 3150 in accordance with SLC staff's direction.

In July 2001, Chevron submitted an application to the Coastal Commission to amend its decommissioning CDP in response to a Coastal Commission finding on June 6, 2001 that because trawl tests indicated the shell mounds could not be trawled without snagging gear, "Special Condition 7 of the Coastal Development Permit E 94-006 requires Chevron to apply forthwith for an amendment to remove the four shell mounds located at the former sites of Platforms Hazel, Heidi, Hilda and Hope" (California Coastal Commission 2001b). Chevron's application to the Coastal Commission stated the following:

> Chevron agrees to remove the four shell mounds located at the former sites of Platforms Hazel, Heidi, Hilda, and Hope if determined appropriate by the agencies with jurisdiction following consideration of the results of the CEQA/NEPA [California Environmental Quality Act/National Environmental Policy Act] environmental review, including project alternatives, and determination of (1) feasibility of shell mound removal, and (2) whether the benefits of shell mound removal outweigh any adverse impacts of the removal operation.

Pursuant to the California Environmental Quality Act, SLC staff solicited public input on Chevron's application to quitclaim Leases PRC 1824 and PRC 3150 through a Notice of Preparation, held a public scoping meeting in Santa Barbara in June 2002, and published a Draft Program EIR/EA in December 2003 (SAIC 2003b). A Program EIR/EA, as opposed to a Project EIR, was prepared based on the perceived need to do the following:

- Resolve Chevron's obligations for the shell mounds under the 4H Platform Leases, approved 4H Platform Removal Project, and Coastal Commission CDP through appropriate amendments and/or decisions to implement the selected final project.

- Resolve concerns about potential adverse water quality and marine biological effects that could result from the shell mounds in their current configuration and/or during activities related to their final disposition.
- Define and analyze one or more actions described within seven programmatic alternatives that would enable agencies to select and implement the final disposition of the shell mounds and Hazel Platform caissons in a manner that would have the least impact and greatest overall long-term benefit to the environment. The alternatives were (1) dredging and removing the shell mounds, (2) capping the mounds with sand, (3) enhancing the mounds as artificial reefs, and (4) leaving the shell mounds in place combined with off-site mitigation (including enhancing Carpinteria Salt Marsh) for impacts to fishing and other resources.
- Address concerns and legal requirements of, and resolve conflicts among, federal, state, and local agencies with jurisdiction over the shell mounds so that all approvals needed to implement the selected final project could be obtained. The EA component of the analysis was intended to support future permitting decisions by USACE and other federal agencies consistent with the National Environmental Policy Act; the SLC did not have any formal co-lead agency relationship with a federal agency.

More than 600 written comments were received on the Draft EIR/EA, and 85 comments were provided during the public hearing. The following agencies provided comments:

- **Local:** County of Santa Barbara Board of Supervisors, County of Santa Barbara Department of Planning and Development, Port of Long Beach, Santa Barbara County Flood Control and Water Conservation District, South Coast Air Quality Management District, Ventura County Resource Management Agency, and Ventura County Air Pollution Control District
- **State:** Coastal Commission, CDFW, the Central Coast Regional Water Quality Control Board (Regional Board), Carpinteria Salt Marsh Reserve, and University of California at Santa Barbara
- **Federal**: Minerals Management Service, National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries), and USACE

The comments raised issues regarding the technical feasibility of the alternatives and the adequacy of the evaluation of environmental impacts. The comments also indicated clear differences of opinion among the agencies on which alternative(s) would be preferable based on potential environmental impacts. Following the public review of the Draft EIR/EA, the SLC explored an additional alternative that included a pilot project to assess effects of mound removal on a smaller scale. From 2003 through 2008, the SLC met at various times with regulatory agencies—including the Coastal Commission; CDFW; NOAA Fisheries; U.S. Coast Guard; USACE; and local entities, including the County—to discuss the feasibility of removal, potential alternatives to removal, and how to properly address and resolve Stipulation No. 5 from the 1994 Project approval. Chevron continued to revise its applications in response to various agency and public concerns from 2003 through 2008. However, after USACE indicated that an unacceptable amount of contaminated material could be released into the water column during the proposed dredging operation (Allen, pers. comm., 2015), making permit approval for shell mound removal unlikely, efforts to reach a final resolution on the shell mounds were paused. The EIR/EA was not finalized.

Throughout this period, Southern California Trawlers Association (Trawlers Association) members expressed concern that trawlers who fished in the area tore their nets on unmarked shell mounds because buoys placed by Chevron near the shell mounds drifted off location and were not replaced expediently (McCorkle, pers. comm., 2010). Chevron noted that it received reports of missing or out-of-place buoys from fishermen and the Liaison Office, and that it checked the shell mound buoys twice a month, weather and sea conditions permitting, and replaced any missing or out-of-place buoys when weather and sea conditions permitted safe deployment (Hill, pers. comm., 2010).

In June 2013, Chevron reached a settlement with the Trawlers Association, facilitated by the Liaison Office, to purchase upgraded navigation systems that allow trawlers to avoid the 4H shell mounds and prevent damage to their trawling equipment. Chevron reimbursed any trawler who had already incurred such costs, which were estimated to be $40,000 per trawler; 16 commercial trawlers who met agreed-upon eligibility requirements entered into Trawler Compensation Agreements with Chevron, and a 17th trawler signed on in 2014. No additional trawlers have notified the Liaison Office, Chevron, or SLC staff of their potential eligibility. As part of these Trawler Compensation Agreements, the trawlers agreed to release the state and County from all liability relating to the shell mounds. The settlement with the Trawlers Association is claimed by Chevron to address both the direction of the SLC (SLC 1999b [Item 75]), and the concerns that formed the basis for Stipulation No. 5.

In July 2013, the SLC's Executive Officer, after consultation with the Liaison Office, released Chevron of its obligation to maintain buoys on the 4H shell mounds (Lucchesi, pers. comm. 2013), stating the following:

> The parties affected by the placement of the buoys appear to be in agreement that maintenance of the buoys will no longer be required. Therefore, the January 14, 1998 order establishing the interim buoy measure is no longer in effect and Chevron is released from the obligation of maintaining the buoys on site per that prior order once the money has been paid to the trawlers. Please note that this letter only authorizes the release of the marker buoys obligation and does not reflect the CSLC's position on the final disposition of the shell mounds.

Also In 2013, SLC staff renewed efforts to respond to Chevron's intent to terminate the Leases and resolve the final disposition of the 4H shell mounds by directing Chevron to submit a new application to the SLC. Chevron's revised proposal had two primary objectives:

- **Retention of the shell mounds and Hazel Platform caissons on the sea floor**. As proposed by Chevron, this component was intended to avoid adverse environmental impacts associated with disturbing the shell mounds.
- **Enhancement of marsh habitat within Basin 3 of Carpinteria Marsh**. As proposed, this component was intended to compensate for impacts to California halibut and other fish species, as well as to trawling fisheries, related to the 4 acres of sea bottom that would remain covered by the mounds.

As before, SLC staff commenced its review pursuant to the California Environmental Quality Act by issuing a Notice of Preparation and holding a scoping meeting in Carpinteria on Chevron's revised proposal; 14 written comments were received.

However, after completing the scoping process, SLC staff determined that the SLC has no subsequent action to take that requires (or even allows) preparation of an EIR or similar environmental document because Chevron complied with the stipulations adopted by the SLC when it adopted the 1994 MND and approved the Project, and because the shell mounds are a baseline condition, meaning that leaving them in place would not be a "project" or impact the existing environment. With that legal constraint, the SLC undertook preparation of this Review to provide information to the SLC to respond to Chevron's request to terminate the Leases. A Preliminary Draft Review was prepared in 2015 but was not finalized.

In 2022, Chevron submitted a new application to the SLC to terminate Leases PRC 1824 and PRC 3150.[3] The 4H shell mounds would remain in place in their current configuration unless otherwise specified by the SLC.

In addition to the Trawler Compensation Agreements, as part of its application to terminate Leases PRC 1824 and PRC 3150 and to finally resolve Stipulation No. 5 and, with it, Chevron's remaining lease obligations, Chevron proposes to donate money to the Kapiloff Land Bank Fund (https://www.slc.ca.gov/kapiloff/) for future environmentally beneficial projects. Stipulation No. 5 is the only outstanding stipulation from SLC's approval of the Project, and, after decades of efforts to satisfy the stipulation, Chevron maintains that the intent and purpose of this stipulation, and with it all remaining Lease obligations, has been fully satisfied, making termination of Leases PRC 1824 and PRC 3150 appropriate.

Work to complete this Review resumed upon Chevron's 2022 application, and initially included a new ROV survey of the shell mounds, revision of the Review document, and peer review of the Review document by a scientific panel convened by the independent non-profit organization Ocean Science Trust (Appendix C4). Among the recommendations from the peer review was that an updated mussel study be conducted at the shell mounds to determine whether leaching of contaminants from the mounds had changed since a similar study was conducted in 2003 (SAIC 2003a). That updated mussel study (Appendix C2) was conducted in 2023, and the results inform the analysis in Section 2.2, Marine Biological Resources, of this Review.

1.6 Authority/Agencies with Jurisdiction

The primary authority with jurisdiction over the shell mounds and Lease terminations is the SLC; however, other federal, state, and local entities have some level of review authority based on existing approvals and permits that are tied to the former operation of the 4H Platforms. These authorities are described below.

1.6.1 California State Lands Commission

The SLC was established by the State Lands Act of 1938, effective June 11, 1938. Public Resources Code Division 6, Parts 1 through 3, provides statutory authority for the

3 The southern portion of Lease 3150 (not occupied by the shell mounds) is now Lease 7911 and is not held by Chevron (see Figure 1-1). Lease 7911 was terminated by the Commission in 2019 (Item 98, June 28, 2019).

administration and control of state lands. Section 6301 et seq., which specifies the role, authorities, and responsibilities of the SLC, provides the following:

> The Commission [SLC] has exclusive jurisdiction over all ungranted tidelands and submerged lands owned by the State…. The Commission shall exclusively administer and control all such lands, and may lease or otherwise dispose of such lands, as provided by law.

Pursuant to Public Resources Code Sections 6801–6932 (Chapter 3, Oil and Gas and Mineral Leases, added by Chapter 548, Statutes of 1941), the SLC oversees the leasing and management of all state oil and gas and other mineral interests on sovereign lands. This authority includes the issuance and termination of state oil and gas leases. Leases PRC 1824 and PRC 3150 allow for quitclaim of Lessee (Chevron) rights at any time, but do not authorize the Lessee's release from any lease obligations, as follows (Lease PRC 3150.1, Section 14; Lease PRC 1824, Section 14, contains similar language):

> Lessee shall surrender the premises with all permanent improvements thereon or, at the option of the State and as specified by the State, the Lessee shall remove such structures, fixtures and other things as have been put on the leased lands by the Lessee and otherwise restore the premises.

1.6.2 County of Santa Barbara

The state granted the surface of certain submerged lands to the County, including the sites where the Hope and Heidi Platform shell mounds are located (Chapter 846, Statutes of 1931, as amended). A copy of the grant to the County can be found on the SLC website at www.slc.ca.gov/Programs/Grantee_Regions.html. Although granted public trust lands are managed locally, the California Legislature delegated to the SLC residual and review authority over sovereign public trust lands granted in trust to local governments. The mineral interests underlying the grant remain with the state, within SLC's jurisdiction.

The County has stated over the years that it has "a vested interest in assuring that any decision regarding post abandonment activities be environmentally sound and to the benefit of the County's residents." In 2013, the County requested (1) an updated fish biopsy analysis with sample biota from each shell mound site both to verify that leakage of contaminants has not occurred and to document baseline conditions for future sampling; (2) a protocol and funding for future sampling of the shell mound sites to monitor for potential leakage of contaminants; (3) a qualitative analysis (if a quantitative method is infeasible) of the effects of a substantial seismic event and the corresponding potential release to the water column of the shell mound contaminants; and (4) inclusion of the plugging of legacy Summerland area oil wells in potential funding alternatives. Item 1 was completed as part of a study conducted by AMEC Foster Wheeler (2015). Item 2 is included as part of this Review, specifically in response to a seismic event. Item 3 is included as Appendix D to this Review, 2022 Update of Geotechnical Evaluations, and is analyzed further in various subsections of Chapter 2 of this Review. Item 4 has been addressed separately by the SLC and is not tied to this Review or the proposed termination of the two subject Leases.

1.6.3 California Coastal Commission

The Coastal Commission has authority to issue a CDP for development activities proposed within state waters, which includes the sites of the former 4H Platforms and the areas where the 4H shell mounds remain. In 1994, Chevron submitted a CDP application to remove the 4H Platforms, but it did not propose to remove the shell mounds. In 1995, the Coastal Commission approved CDP E-94-6 to remove the 4H Platforms. Special Condition 7 of CDP E-94-6 requires, in part, that, "If the Executive Director determines that removal of the debris attributed to Chevron is necessary to avoid an unreasonable risk of snagging by trawl nets, this matter shall be set for public hearing before the [Coastal] Commission for the purpose of determining whether or not this coastal development permit shall be amended to require debris removal." After failing multiple trawl tests in 1996 and 1997, in 2001, Chevron released the Shell Mound Technical Report (de Wit 2001), which concluded that the mounds likely could be removed without using explosives (e.g., by a clamshell bucket dredge). Coastal Commission staff briefed the Coastal Commission in April 2001 (Item 5a) (California Coastal Commission 2001a) on the findings of that report, and at a June 2001 hearing (Item 11b) (California Coastal Commission 2001b), the Coastal Commission required Chevron to apply for an amendment to its CDP to remove the four shell mounds to avoid an unreasonable risk of snagging by trawl nets. In July 2001, Chevron submitted an amendment application to the Coastal Commission to remove the shell mounds. That amendment application remains incomplete, in part due to USACE's indication that an unacceptable amount of contaminated material could be released into the water column during the proposed dredging operation (Allen 2015), making permit approval for shell mound removal unlikely.

1.6.4 Central Coast Regional Water Quality Control Board

The Regional Board would need to approve removal of the 4H shell mounds through issuance of a Section 401 water quality certification under the Clean Water Act, but does not have any discretionary actions related to the Lease terminations or leaving the shell mounds in place. Regional Board staff commented in 2015 as follows (von Langen, pers. comm. 2015):

> Regional Board staff could support the removal of the mounds if done correctly to minimize environmental impacts. If the mounds were to be removed it would likely trigger an ACOE [U.S. Army Corps of Engineers] 404 and Regional Board 401 Water Quality Certification. If the mounds are left in place, there should be adequate environmental mitigation to compensate for any long-term low-level effects.

1.6.5 U.S. Army Corps of Engineers

USACE issued a permit (94-50801) for removal of the 4H Platforms. Special Condition 7 of the permit required Chevron to conduct monitoring after platform removal, including the preparation and execution of a "trawl plan" and survey of the project area with an underwater ROV or high-resolution side-scan sonar. Removal of the mounds was not part of the project evaluated by USACE and is not part of the permit, nor is removal required to comply with the USACE permit. As of 1998, USACE considered Chevron to be in compliance with the terms and conditions of the permit. USACE's last stated position is that "[t]he shell mounds were not contemplated by the Corps to be removed/excavated as part of our permit action…. The [USACE] Permit does not require removal of the shell mounds" (Castanon, pers. comm., 1998). USACE also stated more recently that an unacceptable amount of contaminated material could be released into the water column during the proposed dredging operation (Allen, pers. comm., 2015).

In 1997, the USACE stated the following (Castanon, pers. comm., 1997):

> Special condition 7 [of USACE permit number 94-50801-TW] required Chevron to conduct post-construction monitoring to ensure that all seafloor obstructions and debris referred to in the permit are cleared from the project area. The seafloor obstructions and debris referred to in the permit are pieces of the platform topsides, jacket, or equipment that may have fallen while in operations or during transfer to the materials barge and exposure of abandoned pipelines and power cables that were abandoned in place. The Corps does not consider the shell mounds to be 'debris' for purposes of compliance with the Department of Army permit….

> … Removal of the mounds was not part of the project description provided by Chevron nor was such activity evaluated by the Corps. The Corps considers Chevron to be in compliance with the terms and conditions of the permit and has no intention of modifying the permit unless requested to do so by Chevron prior to the permit expiring in December 1997. Such a modification may require issuance of a supplemental public notice and environmental assessment.

A 1998 follow-up letter from USACE stated the following (Castanon, pers. comm., 1998):

> In our Environmental Assessment we concluded (for recreational and commercial fisheries) that "[s]ince post-abandonment surveys would be conducted and all man-made obstructions (e.g., pieces of the topsides, jacket, and equipment used during operation) would be recovered after the removal of the platform structure, impacts are expected to be minimal." Our position that the mounds are not considered "debris" for purposes of compliance with our permit remains unchanged. The shell mounds were not contemplated by the Corps to be removed/excavated as part of our permit action…. The Department of the Army Permit does not require removal of the shell mounds. This issue is considered closed.

More recently, regulatory agencies that would need to approve any proposal to remove the 4H shell mounds have remained concerned about the final disposition of the mounds, mostly regarding the potential impacts of removing the mounds. USACE staff commented to the County as follows (Allen, pers. comm., 2015):

> In regards to the 4H Shell Mounds our position has not changed. Based on the most recent information we have received for the proposed removal of the shell mounds (several years ago), an unacceptable amount of contaminated material could be released into the water column during the proposed dredging operation. I believe the last proposal involved a smaller-scale pilot project which would be used to evaluate the level of contamination that could occur during the removal of the mounds and evaluate the effectiveness of alternative dredging methods. However, we had similar concerns with the proposed pilot project because it could also result in an unacceptable amount of contaminated material being released into the water column.

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2 Issue Area Assessment

This chapter describes the existing setting in the vicinity of the shell mounds for various issue areas, and identifies the potential effects on public trust resources and values associated with permanently leaving the 4H shell mounds in their current configurations on the sea floor. Effects are evaluated in this chapter from two primary sources: the physical presence of the shell mounds on the sea floor, and the potential for release of contaminants from the shell mounds caused by a major seismic event. Removal of the shell mounds is not analyzed in this chapter; however, an effects analysis of shell mounds removal is provided in Appendix B.

This chapter is organized by the following issue areas that are relevant to the existing setting and the final disposition of the shell mounds:

- Marine Water Quality (Section 2.1)
- Marine Biological Resources (Section 2.2)
- Commercial Fishing (Section 2.3)
- Geologic and Seismic Hazards (Section 2.4)
- Other Issue Areas (Section 2.5)
  - Air Quality and Greenhouse Gases (Section 2.5.1)
  - Coastal Processes and Sea Level Rise (Section 2.5.2)
  - Cultural, Tribal Cultural, and Paleontological Resources (Section 2.5.3)
  - Environmental Justice (Section 2.5.4)
  - Navigation, Transportation, and Traffic (Section 2.5.5)
  - Noise (Section 2.5.6)
  - Public Safety and Hazards (Section 2.5.7)
  - Recreation, Public Access, and Land Use (Section 2.5.8)
  - Scenic Resources (Section 2.5.9)

Given the duration of 4H Platform production and the lengthy decommissioning and lease termination process, many special technical studies have been conducted at the 4H shell mounds to characterize the environment and aid in assessing various applications by Chevron. Table 2-1 summarizes these studies in chronological order. These studies and their findings are incorporated as appropriate in this chapter.

Table 2-1. Environmental Studies Conducted at the 4H Shell Mounds

Year	Study
1964	**Carlisle et al.** Investigations conducted by CDFW biologist divers, under contract to the Western Oil and Gas Association, of offshore oil drilling installations, including the effects of depositing drill cuttings on the sea floor. Twenty-seven dives over a 3-year period were made at Platform Hazel after its installation in 1958. Dive surveys also occurred at Platform Hilda for a 5-month period in 1960 after its installation.
1976	**Bascom et al**. Southern California Coastal Water Research Project scientists' updated study of sea life near Platforms Hilda and Hazel, designed "to update the past work and investigate more thoroughly the effects of these platforms on marine ecology." The studies obtained facts about the quantity and quality of sea life on and near Platforms Hazel and Hilda, and compared data with sea life at nearby control sites and prior studies of sea life at the platforms.
1976	**McDermott-Ehrlich and Alexander**. Chemical analyses of nearby sediments and of the tissues of several marine organisms around Platforms Hazel and Hilda. Sediment and animals were taken from near both platforms and compared to hard-bottom and soft-bottom reference sites. Sediment samples from all collection sites were analyzed for four materials: copper, zinc, volatile solids, and hexane extractable materials. Collection and analyses of animals and sediments at 14 sites within 0 to 787 feet (240 meters) of Platforms Hazel and Hilda and at two control sites at the same water depth, one rocky and one with a soft sandy bottom.
1994	**Fugro.** High-resolution bathymetric surveys of the shell mounds prior to platform removal.
1999	**de Wit**. Characterized biological habitat at the four shell mounds and at natural substrate areas using remotely operated vehicle (ROV) video/still photography, diver observations, and diver-collected macroinvertebrates. Study objectives were "to characterize the current shell mound macro-epibiota community and, where possible, to compare that community with 'natural bottom' habitats within the same depth zones and with that documented in a prior study." Diver-biologists completed eight dives (approximately 160 minutes of bottom time) at the two shallowest shell mound sites (Hazel and Hilda).
2000	**Fugro**. High-resolution bathymetric surveys and vibracore sampling of the shell mounds after platform removal.
2001	**de Wit.** A more detailed survey of the physical, chemical, and biological characteristics of the mounds than that conducted in 1999. The primary

Table 2-1. Environmental Studies Conducted at the 4H Shell Mounds

Year	Study
	objectives of the 2001 study, which was performed under contract with the SLC, were as follows: ▪ Collect and analyze data on the physical, chemical, and biological characteristics of the shell mounds using ROV video/still cameras and cores collected on each shell mound using a pneumatic vibracore; 15 sediment core samples, ranging from 11.5 to 30 feet (3.5 to 9.1 meters) in length, were collected during 5 days of vibracoring at the shell mounds. ▪ Analyze physical and chemical characteristics and potential impacts to resources from both shell mound removal and their continued existence in place based on results from laboratory analyses of site-specific samples. ▪ Identify feasible methods of removing the shell mounds.
2002	**AMEC**. SLC-contracted study that collected sediment from all four shell mounds by vibracore and conducted standardized analyses of sediment chemistry for contaminants of concern, toxicity, and bioaccumulation. Samples analyzed for contaminants and toxicity to investigate whether the material in the mounds met Federal Ocean Dumping Law criteria for disposal at the U.S. Environmental Protection Agency-designated LA-2 Dredged Material Ocean Disposal Site, located south of San Pedro, California.
2002	**MEC**. Chevron-commissioned study at six sites (four shell mound; two reference) of the potential for contaminants to accumulate in organisms that occur on the shell mounds. Divers collected dominant invertebrates and three box core sediment samples and deployed three sizes of fish/crab traps. Box core samples were sieved through a 1-millimeter sieve to collect infaunal organisms (resident organisms living in close and continuous contact with sediments). Crab traps were deployed for 2 days. For tissue residue levels that were determined to be significantly elevated above ambient conditions, authors identified the specific chemicals and compared these constituents to available seafood consumption advisory levels to assess the potential for seafood consumption concerns.
2003	**SLC.** SLC-contracted investigation (SAIC 2003a) involving (1) placement of caged mussels, which filter food from the water column, and semipermeable membrane devices (devices) in replicate groupings at the 4H shell mounds and off-site control sites for a 2-month period to assess contaminant leaching from the shell mounds into surrounding waters; and (2) sampling and analysis of sediments surrounding the shell mounds to evaluate physical and chemical properties of the adjacent bottom sediments for comparison with those of the shell mound materials. Caged

Table 2-1. Environmental Studies Conducted at the 4H Shell Mounds

Year	Study
	mussels were tethered above the shell mounds and at reference sites for 57 to 58 days February through April 2003, and then their tissues were analyzed for contaminants. The devices provided additional estimates of contaminants in the water column. The study also analyzed surficial sediment quality near the shell mounds, and measured ocean current direction and strength. An updated version of this study was conducted in 2023 (Appendix C2).
2004	**Fugro**. High-resolution bathymetric surveys of the shell mounds after platform removal (as cited in Chevron 2005).
2004	**Fugro.** Evaluation of seismic stability of the 4H shell mounds using a simplified geometric model and various assumptions regarding material composition. Updated in 2022 (see below).
2004	**Padre Associates**. A review of various sources that included sedimentation rates/ocean currents in the vicinity of the shell mounds.
2004	**Padre Associates and Castagnola Tug Service**. Analyzed the effects of an anchor strike on the shell mounds and the amount of shell mound surface that would be disturbed/displaced during a worst-case anchor strike event.
2004 and 2005	**Bomkamp et al.** and **Page et al**. (2005a) University of California at Santa Barbara studies to explore the effect of the presence of oil and gas platforms on mobile benthic invertebrate species on shell mounds. Authors compared abundance and populations of mobile macroinvertebrates on (1) shell mounds beneath Federal Platforms Gina, Houchin, and Hogan; (2) shell mounds at the former 4H Platform sites 5 to 6 years after platform removal (i.e., with no overlying platform structure); and (3) five control sites at adjacent soft-bottom areas in the Santa Barbara Channel. The studies, which did not include contaminant sampling, used the following data collection approaches: ▪ Sampling of invertebrates within band transects using SCUBA at the shallow sites (depth less than115 feet [35 meters]), which included shell mound only (Hazel, Hilda), shell mound under platform (Gina), and soft-bottom habitats. ▪ Sampling of commercially important crabs (primarily *Cancer* spp.) and other mobile macroinvertebrate species using baited commercial traps at the shallow and deep sites, which included shell mound only (Hazel, Hilda, Heidi, and Hope), shell mound under platform (Houchin and Hogan), and soft-bottom sites.

Table 2-1. Environmental Studies Conducted at the 4H Shell Mounds

Year	Study
	▪ Recording of species present and estimated densities of macroinvertebrates in historical photographs taken at shell mound Hilda prior to platform removal.
2009	**Fugro**. High-resolution bathymetric surveys of the shell mounds after platform removal (as cited in Chevron 2012).
2012	**Dunford et al**. An evaluation of ecological benefits provided by work that was proposed at the time (enhancement of the Carpinteria Salt Marsh) as compensation for the ecological cost of leaving the 4H shell mounds in place. Used habitat replacement cost as a methodology, focusing on fish biomass rather than broader ecosystem services.
2014	**Bemis et al**. U.S. Bureau of Ocean Energy Management-contracted study to assess if contaminants (notably polycyclic aromatic hydrocarbons [PAHs]) migrate from shell mounds into the marine environment, thus posing a risk to marine organisms. Study placed PAH-absorbing devices on thin margins and thick sections of two shell mounds below nearshore Pacific Outer Continental Shelf platforms and at a control site near each platform.
2015	**AMEC Foster Wheeler.** Analysis of tissue concentrations of various chemical constituents of concern in resident organisms collected in 2013 from the 4H shell mounds.
2021	**Fugro.** High-resolution bathymetric surveys of the shell mounds after platform removal.
2022	**Fugro**. An updated evaluation of static and slope stability at the shell mounds using the same simplified geometries and general material properties/parameters as in the Fugro 2004 analysis, but using current methodologies and analytical procedures (Appendix D to this Review).
2022	**MARE.** ROV survey of the shell mounds and vicinity, with an analysis of the biotic communities present on the shell mounds compared to the surrounding soft sediment areas (Appendix C3 to this Review).
2024	**SLC.** SLC-contracted investigation involving placement of caged mussels at the 4H shell mounds and an off-site shallow reference location for 2 months to assess contaminant leaching from the shell mounds into surrounding waters. Caged mussels were tethered above the shell mounds and at the reference site for 56 days from September through November 2023, then their tissues were analyzed for contaminants (Appendix C2 to this Review). This study was conducted for comparison with the similar study from 2003 (SAIC 2003a).

2.1 Marine Water Quality

2.1.1 Setting

Regional sources of chemical and bacterial contaminants in ocean water include municipal wastewater discharges, natural oil seeps, wastewater discharged during drilling operations at offshore oil and gas platforms, stormwater and river runoff, and discharges from commercial and recreational vessels. Discharges from sewage treatment plants, offshore oil platforms, industrial facilities, and power plants are regulated under federal and state individual and general National Pollutant Discharge Elimination System permits.

Discharges of treated sewage may include a variety of contaminants, including bacteria, polychlorinated biphenyls (PCBs), metals, and polycyclic aromatic hydrocarbons (PAHs), although the majority of these contaminants are contained in the biosolids that are removed during treatment (e.g., Katsoyiannis and Samara 2005). From 2010 to 2019, the Goleta Municipal Sewage Outfall discharged, on average, approximately 3.7 million gallons per day of effluent flow from the treatment plant into the ocean (Goleta Sanitary District 2019). The combined Santa Barbara (El Estero), Montecito, and Carpinteria wastewater facilities discharge approximately 15 million gallons per day of secondary-treated wastewaters into the ocean (Regional Board 2010, 2012, 2017). Summerland discharges 0.3 million gallons per day of tertiary-treated wastewaters to the ocean in the vicinity of the shell mounds (Regional Board 2013).

There are also more than 40 naturally occurring oil and gas seeps in the Santa Barbara Channel (Channel). The three major seep areas in the Channel are Point Conception, Coal Oil Point, and near Fraser Point on Santa Cruz Island, although other known and unmapped seeps also occur in the waters offshore of Santa Barbara/Rincon, including an area offshore of Carpinteria near the shell mounds (Hostettler et al. 2004).

The rate of oil seepage from seeps on the South Ellwood anticline, offshore of Coal Oil Point, approximately 15.5 to 22 miles (25 to 35 kilometers) west of the 4H shell mounds (Lorenson et al. 2014), is one of the highest in the world. The South Ellwood anticline is the western continuation of the Rincon anticline, with the Hope and Heidi Platforms' shell mounds located on the crest (see Figure 2 in Johnson et al. 2017) where the dissolved hydrocarbon plume extends several miles down-current from the vents. The seeps are a major source of marine pollution, and the oil they release accumulates in large slicks. This natural seepage releases more hydrocarbon gases than all the mobile sources (mostly automobiles) in Santa Barbara County (NOAA 2008). It is estimated that 3,500 to 7,100 gallons (100 to 170 barrels) of oil and approximately 75 tons of natural gas seep every day into the Santa Barbara region (Office of National Marine Sanctuaries 2019). Gas seepage has been noted in the vicinity of the shell mounds, but has not been tied to a particular source, and it appears to predate removal of the 4H Platforms (Poulter, pers. comm., 2014; AMEC Foster Wheeler 2015;).

Marine waters above seeps may contain concentrations of hydrocarbons that are 2.5 to 18 times higher than reference sites located far away from seeps (Reed and Kaplan 1977). Stuermer et al. (1982) reported dissolved hydrocarbon concentrations of 1 to 6 micrograms per liter (which is equivalent to 1 to 6 parts per billion) in waters above the Coal Oil Point seep, compared to concentrations of 0.2 to 1 micrograms per liter in a reference area. Relatively higher hydrocarbon concentrations (45 to 100 micrograms per liter) occur in sediment pore waters near active seeps. Because of the presence of seeps, waters and sediments in the Channel have high but spatially and temporally variable background hydrocarbon concentrations.

Hydrocarbons introduced into the marine environment from natural seeps differ in volume, concentration, and composition from those released by leaking wells and oil spilled from platforms, tankers, and pipes (Office of National Marine Sanctuaries 2019). Seeps introduce hydrocarbons to the marine environment over large areas and can have variable hydrocarbon composition, including methane and other, higher-chain hydrocarbons. Releases from natural seeps can dissolve in the water column, bubble to the atmosphere, sink, or end up as balls of tar along the coast (Office of National Marine Sanctuaries 2019).

In addition to natural seeps, improperly abandoned offshore oil wells contribute to submarine oil and gas seepage. For example, wells off the coast of Summerland in the vicinity of the shell mounds were known to release oil and gas into the marine environment. Releases from these sources have resulted in beach closures in the community of Summerland, most recently in the summer of 2015. The SLC has been actively capping the leaking wells in Summerland since 2018 to address this issue, and releases have become less frequent (SLC 2020).

Hydrocarbon released by leaking wells, pipes, and spills from platforms and tankers typically is heavier than that released in natural seeps, and can contain compounds introduced from the drilling and refining processes. These releases, which occur from a single point rather than a dispersed area, generally occur over shorter periods than natural seep releases (Office of National Marine Sanctuaries 2019).

Prior to the formation of the shell hash, Carlisle et al. (1964) noted that "depositing washed drill cuttings on the bottoms at these sites was neither deleterious nor beneficial to the marine life in the area." In 2019, survey work found that the benthic fauna that were living around oil platforms were typical of mid-shelf fauna found across the Southern California Bight (Gillett et al. 2019, 2020), which includes the 4H shell mound sites. However, the total abundance of benthic organisms found in samples collected near oil platforms was somewhat lower than what was typical for the region.

The shell mounds are not a major known source of contamination to the surrounding waters within the Channel because contaminants contained within the mounds are thought to be confined (SAIC 2003b). As long as the shell mound remains intact at the base of a platform, it is considered to provide a natural "cap" to local contaminants (Schroeder and Love 2004). Two lines of evidence support this conclusion. One is a logical observation: the fact that the mounds still contain volatile organic compounds beneath the shell hash layer suggests that they have not been exposed to the water column, or they would have reacted and been chemically altered or degraded. The second line of evidence is the results of several scientific studies that tested the sediments and biota surrounding the shell mounds for evidence that contaminants were leaching from the 4H shell mounds into the water column. These studies include physical and chemical analysis of core samples taken from the mounds and reference sites (de Wit 2001; AMEC 2002), bioassay toxicity testing of mixed sediment from the mound core samples (AMEC 2002), chemical analysis of surface sediments collected from the mound surface (SAIC 2003a), testing of contaminant levels in water immediately above the mounds (SAIC 2003a; Bemis et al. 2014), analysis of tissue samples from invertebrates (MEC 2002; AMEC Foster Wheeler 2015) and rockfish collected at the mounds (AMEC Foster Wheeler 2015), and exposure and testing of mussels moored above the mound surface for an extended period in 2003 and 2023 (SAIC 2003a; Appendix C2). The studies related to biological toxicity and bioaccumulation are described in Section 2.2. The results of the various physicochemical tests are described further below.

De Wit's (2001) analysis of core samples indicated that a wide range of metals were elevated in concentration within the shell mounds as compared to the natural sediment reference. Of those that were elevated over background levels, most exceeded Effects Range Low but not Effects Range Median (ERM) thresholds. Nickel exceeded ERM at the Hazel and Hilda Platform sites, and PCBs exceeded ERM at the Hazel Platform site. De Wit's study (2001) did not determine what particular PCB was present in the sample. The 2002 subsequent core sampling and analysis conducted by AMEC Earth & Environmental Inc. (AMEC) indicated that the mounds contained several metals at levels exceeding toxicity thresholds[4] within some portion of the core sample at higher concentrations than observed in the de Wit study: barium and chromium at all four mounds, selenium at the Hazel and Hilda Platform sites, and zinc at the Hazel and Heidi Platform sites (AMEC 2002). Notably, the reference site also exceeded thresholds for barium, although it was two orders of magnitude below the levels observed in the shell mound samples. AMEC also found that the shell mound sediment was moderately contaminated with petroleum hydrocarbons, PAHs, and PCBs, while no PCBs or PAHs were detected at the reference site.

The only organic compound found to exceed effects thresholds in the AMEC study was the PCB compound Aroclor 1254, which exceeded Apparent Effects Thresholds[5] and/or ERM thresholds at the Hazel, Hilda, and Hope Platform sites. Aroclor 1254 was typically used in electrical equipment, such as transformers and capacitors, but was also included in some formulations of hydraulic fluid for lubricating and cutting oils. Aroclor was also used in well drilling as a chemical tracer to determine if drilling fluid had penetrated into core samples (e.g., Wertman 1958). It is possible that Aroclor 1254 was a component of the drilling muds used at some time in production of the 4H Platform wells; however, this cannot be confirmed.

To determine how metals and other contaminants within the mounds may be spreading to surrounding sediments, Science Applications International Corporation (SAIC) conducted sampling of six locations surrounding each mound (generally from 50 to 350 feet from the edge of each mound) and compared these to two reference sites distant from the mounds. Notable findings included the presence of the PCB Aroclor 1254 in sediments surrounding the Hazel, Hilda, and Hope Platform sites, but not near the Heidi Platform site or the reference sites, and elevated levels of barium in the sediments adjacent to each of the shell mounds (ranging from non-detectable to approximately 2,000 milligrams per kilogram [mg/kg]). However, none of the metals or other contaminants showed a clear pattern of contaminant spread surrounding the mounds, which led the SAIC authors to conclude that distribution of drilling waste solids was likely caused by individual events, such as platform removal, trawling, or anchoring. If local currents were causing the spread of shell mound contaminants, a clearer pattern of contaminant spread would be expected (SAIC 2003a).

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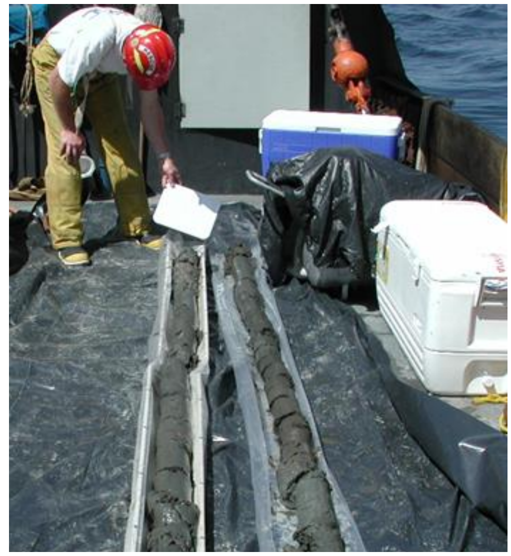
4 Effects Range Median or apparent effects threshold.

5 Apparent Effects Thresholds are benchmarks based on empirical relationships between sediment concentrations and observed toxicity bioassay results or observed benthic community impacts.



Photograph of an extruded shell mound core (AMEC 2002).

Finally, two studies investigated whether contaminants might be leaching from shell mound sediments to the water column above (SAIC 2003a; Bemis et al. 2014). Both deployed semipermeable membrane devices above the mound surface; the SAIC study was conducted at the 4H shell mounds, and the Bemis et al. study was conducted at Platforms A and B in federal waters, locations near the 4H shell mounds. Unfortunately, the data from the 2003 study appear to have been affected by laboratory contamination, which made most results unreliable. The only usable results from that study are that PCBs in waters near the shell mounds were below measurable levels. The Bemis et al. study found that total PAHs were significantly elevated in samples collected above the mounds, but remained low (approximately twice the concentration of the control sample). The source of the hydrocarbons at Platforms A and B was not certain, but the authors speculated that the source could be natural oil seepage at or near the platform, a leaking well head or pipeline, or remnants within the shell mounds. The patterns of PAHs observed above the mounds did not indicate migration of hydrocarbons from the mounds. Further, the PAH levels measured by Bemis et al. (2014) are roughly 10% of the 2019 Ocean Plan Water Quality Objective (SWRCB 2019) for protection of human health of 8.8 nanograms per liter, indicating that migration of hydrocarbons from the mounds is highly unlikely to cause human health concerns. No separate objective is established for aquatic life.

The results of the AMEC and SAIC sampling were also analyzed in a peer-reviewed article (Phillips et al. 2006); however, no new analysis was provided that was not presented in the prior analyses. This study concluded that surficial bottom sediments near the shell mounds contained elevated barium concentrations that likely were derived from drilling wastes. However, the study also concluded that chemical contaminants are not being remobilized from the shell mounds, and that without a large physical disturbance, the contaminants within the shell mounds will likely remain sequestered. Phillips et al. (2006) did not, however, evaluate the effects of a large physical disturbance.

Various studies also evaluated bioaccumulation in organisms on or above the mounds. The results of these studies are relevant to marine water quality and are described in Section 2.2, Marine Biological Resources.

2.1.2 Effects Assessment

As summarized in Section 2.1.1, Setting, the physicochemical studies conducted for the shell mounds found that some low levels of contaminants are present in the shell mounds, but that the surface layers of the existing shell mounds are not highly toxic. Those studies also concluded that contaminants were not being released from the shell mounds to other areas or to the water column. This is consistent with studies from the North Sea that contaminants have low water solubility and remain bound to the particles rather than being susceptible to leaching into the water column (OSPAR 2016). Most contaminants are also located in the shell mounds' inner layer and are covered by a top layer of uncontaminated material (Bernstein et al. 2010), minimizing the potential for exchange with the water column or of contaminant dispersal during minor disturbances. Further, sedimentation will continue to slowly cover the shell mounds (de Wit 2001). Sedimentation rates in the Santa Barbara Channel during the period from 220,000 years ago to present range from approximately 0.03 to 0.06 inches (0.7 to 1.5 millimeters) per year (Marshall et al. 2012). A memorandum submitted by Chevron as part of its 2005 application to the SLC (pp. 63–69) states that sedimentation rates are 0.04 to 0.08 inches (1 to 2 millimeters) per year, and cited de Wit (2001). A habitat equivalency assessment conducted for removal of the mounds assumed that after 70 years, 4 inches (101.6 millimeters, or 1.45 millimeters per year) of sediment would accumulate over the shell mounds, and that at that point, the shell mounds would have a similar habitat value to soft-bottom habitats (Dunford et al. 2012). This sedimentation will further bury contaminated sediments and make the shell mounds less likely to release or disperse contaminants into the surrounding water column. Therefore, the studies support that the shell mounds are not considered a major known source of contamination to the surrounding water quality under continuation of existing conditions. Studies did suggest that organisms on the mounds may be accumulating some contaminants in their tissues, but results have been inconclusive (MEC 2002; SAIC 2003a; Bemis et al. 2014; AMEC Foster Wheeler 2015; Appendix C2). The most recent studies in 2023 indicate that contaminant leaching to mound organisms has not changed significantly in 20 years (Appendix C3). This is discussed in Section 2.2, Marine Biological Resources.

However, a major earthquake could disturb the shell mounds and result in contaminant releases, with the degree of release and impacts to marine water quality related to the extent of shell mound disturbance (see Section 2.4, Geologic and Seismic Hazards). Impacts would also be affected by ocean currents that would slow settling of disturbed materials and cause contaminants to reach greater distances. In general, contamination of the water column would be expected to be localized and short term because dissolved contaminants would disperse from the shell mounds and particulates would settle to the sea floor. These predictions have been studied to an extent during movement and dredging of cuttings piles in the North Sea and United Kingdom continental shelf (Marappan et al. 2022).

Studies in the North Sea and United Kingdom continental shelf evaluated the water quality effects of major disturbance of cuttings piles, beyond the level that would reasonably be expected during an earthquake (summarized in Marappan et al. 2022). At the United Kingdom Hutton oil field, drill muds deposited since 1984, which included water-based, diesel-based, oil-based, and synthetic muds, were moved using a high-pressure water jet. This activity caused major resuspension and deposition, and site investigation after this activity suggested that significant movement of contaminants from the cuttings was limited to within 984 feet (300 meters) the cuttings pile, although some cuttings-derived components were detected to approximately 3,281 feet (1,000 meters) from the cuttings pile. Macrobenthic communities were found to be similar to those prior to the disturbance, but those communities were already considered highly modified by prior activities (Marappan et al. 2022).

At the Albuskjell field in the North Sea, cuttings were removed from one location using a suction dredge and ejected at another sea floor location, resulting in disturbance of solids and suspension and drift of smaller particles. Marappan et al. (2022) reported that most solids settled near the dredge exhaust, but smaller particles were measured at 492-foot and 820-foot (150-meter and 250-meter) stations, and at a reference station 2,6,25 feet (800 meters) from the dredge exhaust. Elevated concentrations of metals were observed at 328 feet (100 meters) and 820 feet (250 meters), but not at 1,640 feet (500 meters) from the dredge exhaust. For total hydrocarbons, an increase in levels was identified following cuttings relocation, with concentrations reaching 100 mg/kg at a 328-foot (100-meter) distance from the exhaust compared to around 10 mg/kg under baseline conditions before dredging. Beyond 328 feet (100 meters) from the dredge exhaust, total hydrocarbons were also increased to approximately 10 mg/kg, although a baseline number for that zone was not provided (Marappan et al. 2022). Marappan et al. (2022) reported that the level of contaminants in the water was not particularly high, and was comparable to the levels observed from produced water during rig operations. Finally, Marappan et al. (2022) reported that water currents will disperse and dilute the contaminants, which are mainly bound to particles that will resettle, and the local seabed is expected to recover to the condition prior to the dredging within a few years. However, no direct evidence is provided to support that contention.

Those studies relate to recent and exposed drilling muds and cuttings, rather than the conditions at the shell mounds. The shell mounds' mud and cuttings are overlain by a protective 1- to 7-foot-thick layer of shell fragments and sediments accumulated for over five decades, reducing their exposure to the environment and the potential for exchange with the water. The most recent drilling muds date to the 1970s and have experienced substantial chemical degradation since that time. However, the Marappan et al. (2022) case studies provide some indication of how cutting piles could be dispersed in the event of an earthquake.

An anchor strike is unlikely to expose the drill cutting layers of the shell mounds. An analysis conducted for Chevron (Padre Associates and Castagnola Tug Service 2004) calculated the effects of a standard anchor pull and a more extended anchor drag across the mound surface. The worst possible scenario they considered was an 85- to 90-foot vessel with its storm anchor deployed and dragging free. Under this scenario, approximately 0.6 to 1.0 cubic yards of shell mound surface would be displaced, leaving a hole 61 to 87 inches long by 28 to 34 inches wide by 16 to 17 inches deep. At that depth of disturbance, the drill muds within the path of the anchor would most likely still be overlain by a shell hash layer, which ranges from 1 foot to 7 feet deep. If the anchor drag was in a location of thinner shell hash, the amount of drill muds and cuttings that would be exposed would result in a period of contaminant release until the exposed area was depleted of contaminants or covered.

Another way that contaminants could potentially be exposed is through gradual deterioration of the shell hash caused by regional-scale changes in ocean pH and temperature, both of which speed dissolution of the calcium carbonate that provides the structure for the remnant shells (e.g., Chadwick et al. 2019). Lower ocean pH decreases the availability of carbonate ions, the building blocks of calcium carbonate as incorporated in exoskeletons, shells, and hard corals. Waters in the Santa Barbara area have experienced a decline in pH over the past three decades; however, ocean acidification rates are slower around the Channel Islands than in nearby coastal waters (Office of National Marine Sanctuaries 2019). The pace or timing of shell dissolution at the shell mounds cannot be accurately predicted due to the high variability in shell dissolution rates between species and over time and as the more resistant calcitic layer becomes physically eroded, exposing less resistant internal layers (Marshall et al. 2008; Nienhuis et al. 2010). Only shells exposed at the surface of the mounds would be expected to experience substantial dissolution because the more anoxic conditions within the mound would limit those chemical processes. Other changes in water chemistry and temperature can also strongly affect dissolution rates (Rodolfo-Metalpa et al. 2011). It is reasonable to expect that the shell hash would be somewhat reduced in thickness within a scale of decades, but will continue to provide a protective layer over the underlying drilling muds and cuttings for the foreseeable future.

2.2 Marine Biological Resources

2.2.1 Setting

The 4H shell mounds were formed by shell-fall and drilling muds deposited on the sea floor during construction, operation, and decommissioning of the 4H Platforms. Drilling muds were deposited onto the seabed during drilling of wells for each platform. Within a year or two of operation, a thriving community of marine animals and some algae was established on the platform legs. This community included a large population of shelled organisms, primarily consisting of mussels (*Mytilus* spp.), scallops (family Pectinidae), barnacles (*Balanus* spp.), and other mollusks, such as rock oysters (*Chama arcana*) and jingleshells (*Pododesmus cepio*). Non-shelled invertebrates also covered the platform legs, including anemones and some algae, such as giant kelp (*Macrocystis pyrifera*) and feather boa kelp (*Egregia menziesii*). In turn, these supported communities of sea stars, fishes, and other marine animals (Carlisle et al. 1964). Over the decades of platform operation, the abundant shells from this community dropped to the sea floor around the base of the platform or were mechanically removed by wave motion or by divers cleaning the platforms. The communities that established on and around the platforms were lost when the platforms were removed, eliminating the source of shells and organic material that created the shell mound habitat. Over time, the community established on and around the shell mounds changed due to the lack of new shells and other material falling from above.

Under past and existing conditions, the shell mounds provide hard-substrate habitat. This habitat type is relatively rare in the Channel, which is primarily composed of soft-bottom habitat (i.e., mud and sand) (Krause et al. 2012).

The following section provides a chronology of surveys conducted on the 4H shell mounds to determine the character of the marine biological community these structures have supported to date. It then provides the findings of the most recent surveys that describe the community on the shell mounds and the adjacent marine biological seascape.

2.2.2 Surveys of the 4H Platforms and Shell Mounds

Surveys dating back to the construction of the 4H Platforms and as recently as 2022 have documented the biological communities that established around the 4H Platforms and that continue to live on and adjacent to the shell mounds. The earliest studies only describe the biological character of the two shallower platforms, Hazel and Hilda. The Hope and Heidi Platforms were not surveyed until the ROV surveys in the late 1990s, presumably due to their greater depth prohibiting divers from collecting information on their biological character. The following section provides a summary of surveys of the marine biology completed at the 4H shell mounds to date.

Carlisle et al. (1964) provides the earliest accounts of the platforms, limited to the Hazel and Hilda Platforms. The account of Hazel includes descriptions of the site from SCUBA dives that were completed immediately prior to its construction in 1958, and then monthly for 2.5 years following construction of the platform. This account documents the rapid establishment of the platform ecosystem after the platform was installed. When Carlisle et al. (1964) completed their report, the shell mound at the Hazel Platform had not formed and the mound at the platform base consisted entirely of drill cuttings generated by platform activities. This feature was described as a "gently-sloping cone 120 feet across at the base and 20 to 25 feet deep" that had been formed by discharge from a vertical outfall pipe. No biological activity associated with this feature was reported by Carlisle et al. (1964). The surveys of the Hilda Platform were less extensive, beginning in August 1960, approximately 3.5 months after that platform's construction was completed and ending in December 1960. As Carlisle et al. (1964) state, their observations of the Hilda Platform were insufficient to draw "valid conclusions" about the established ecology of the marine community, but they expected a similar pattern of abundance to Hazel due to its proximity. Their relatively brief observations supported this premise.

In August 1970, CDFW biologists dove around the Hazel and Hilda Platforms, according to Bascom et al. (1976) and Mearns and Moore (1976). These dives do not appear to have constituted formal surveys, and no publications describing the findings exist. However, observations of the number of fishes are noted by Bascom et al. (1976), as relayed to the author by the CDFW biologists in personal communications. These are used by Bascom et al. (1976) to delineate approximate trends in the early establishment of marine communities on the platforms.

In 1975, formal surveys were conducted at both the Hilda and Hazel Platforms and are reported in Bascom et al. (1976) and Mearns and Moore (1976). Transect lines were laid across both platforms, and two control stations within 0.6 to 1.2 miles (1 to 2 kilometers) of the platforms were also surveyed for comparison, representing either a naturally occurring hard or soft substrate site. Fishes, invertebrates, and other marine organisms were identified and counted by SCUBA divers. For the first time at the 4H shell mounds, fishes and invertebrates (crabs and mussels) were collected for tissue sampling for chemical contaminants. Sediment samples were also taken for chemical analysis and characterization of the benthic infaunal invertebrate community. By this point (1975), the shell mounds had formed a sufficiently thick layer of shell-fall (1.6 feet [0.5 meters] thick, according to Bascom et al. [1976]), so the clam-shell-style sediment sampler and diver core sampling were ineffective on the mounds; therefore, sediment samples were not taken. Instead, divers collected shell material from the mound surface. These surveys also collected data on ocean currents and sedimentation rates. Ocean currents were measured for 32 days approximately 23 feet (7 meters) above the bed adjacent to the mounds by an ocean current meter. Sediment deposition rates were measured using sedimentation tubes deployed on the sea floor for 23 days. During the SCUBA surveys, it was apparent that the size and diversity of fish and invertebrate populations on the shell mounds had increased in the 15 years since the surveys reported by Carlisle et al. (1964) were completed, and most likely since the accounts by CDFW biologists from their dive in 1970.

The 1994 MND (Appendix A1) relied primarily on Simpson (1977) for characterizing the biology of the 4H shell mounds. Although this publication was not available for this Review, an abstract for Simpson (1977) confirms that the publication is a summary of the surveys completed and reported by Bascom et al. (1976) and Mearns and Moore (1976). In addition to the information cited from Simpson (1977), the 1994 MND also reports data that showed that the highest number of kelp bass (*Paralabrax clathratus*) caught per unit effort in California during the 1980s occurred at the Hilda and Hazel Platforms.

Following the removal of the 4H Platforms in 1996, an ROV survey was completed in October 1998, and subsequent SCUBA surveys were completed in November 1998 at the 4H shell mounds. The results of these surveys are described in de Wit (1999). The ROV survey encompassed more than 6 hours of video imagery and 2,025 square meters of bottom habitat. However, as noted by de Wit (1999), low visibility conditions made much of the footage unusable. A total of 678.5 square meters of habitat across the 4H shell mounds is reported in the results based on 16 minutes of edited video footage produced from the ROV survey.[6] Divers are reported in de Wit (1999) as collecting material from the mounds at the Hazel and Hilda Platform sites that were returned to a lab for identification, but it is unclear whether divers surveyed the deeper platform sites at Hope and Heidi.

Results presented in de Wit (1999) provide a breakdown of the total habitat surveyed by the ROV in 1998 into three broad habitat types: sediments on the mounds, shell hash on the mounds, and mixed sedimentary and shell hash habitat. De Wit (1999) reports shell hash habitat as constituting 15% (1,060 square feet [98.5 square meters]) of

6 Based on the summed areas in Tables 3, 5, and 6 of de Wit (1999), excluding natural areas that are understood to not be part of the 4H shell mounds.

all benthic habitat observed on the mounds. Soft sediment habitat made up 31% (2,298 square feet [213.5 square meters]) of the mounds, with the majority of habitat observed (54%; 3,945 square feet [366.5 square meters]) made up of mixed soft and shell hash habitat. It is likely that these proportions provide a good approximation of the ratios of these habitat types because they are likely to be largely independent of the confounding effect of "variable water clarity" that reduced the effective ROV coverage on the platforms.

A second ROV survey of the 4H shell mounds was completed in August 2000 and is reported in de Wit (2001). This survey collected more than 4 hours of video footage (250 minutes) that produced 38 minutes of edited video footage. A total of 1,145 square meters of habitat on the 4H shell mounds is reported in the results.

In parallel to the ROV surveys reported in de Wit (2001), in September 2000, commercial divers collected biological and sediment samples from the shell mounds and adjacent reference locations. Dominant invertebrates were collected by hand and by using baited traps and were sent for laboratory testing for chemical constituents in their tissues. Animals belonging to four species of benthic invertebrates were sent for chemical analysis of their tissue: bat star (*Patiria miniata*), California sea cucumber, rock crab (*Cancer* sp.), and yellow rock crab (*Metacarcinus anthonyi*). Divers also collected sediment samples using hand-operated box core samplers and sent them for testing of chemical constituents (MEC 2002).

In addition to the sampling by MEC Analytical Systems Inc. (MEC) for tissue analysis, University of California, Santa Barbara researchers conducted baited fishing trap sampling at the 4H shell mounds to determine community composition in September through December 2000 and again in 2001(Page et al. 2005a). Commercially important crabs (primarily *Cancer* spp.) and several other benthic invertebrates were collected by baited fishing traps deployed on the 4H shell mounds. The study compared communities on the 4H shell mounds after the platforms had been removed with shell mounds beneath existing platforms and with natural soft-bottom sites. The University of California, Santa Barbara team conducted transect surveys in 2001 at the shallower Hazel and Hilda shell mounds alongside the Gina Platform shell mound and an adjacent soft sea floor habitat site. These data were compared to color photos of the 4H shell mounds from 1976, when the platforms were still in place, to determine how platforms can change community composition through the generation of shell mounds at their base, and how subsequent platform removal might affect communities on the platform shell mounds.

In 2002, laboratory tests of sediment cores collected from the shell mounds indicated significant toxicity to amphipods when exposed to the solid phase of sediments at all four shell mounds, and significant toxicity to mysid shrimp from sediment at three of the four shell mounds (Platforms Hazel, Hilda, and Heidi). When sediments were suspended in the water column, no significant difference in survival was observed when compared to reference sites (AMEC 2002). The species used in these tests are not native to the shell mound environment, but are used for standardized toxicity testing in a laboratory setting. The sediments used in these studies were combined samples, whereby the sediments from the surface down to a maximum of 27 feet were combined prior to testing. Therefore, these tests that included such deep-lying sediment samples may not reflect contaminant levels that would be exposed in the event of a major seismic event.

SAIC (2003a) conducted a test with mussels tethered above the mound surface in 2002 and 2003 to determine bioaccumulation of contaminants from the mounds. Phillips et al. (2006) included the results from that study in their summary of the AMEC (2002) and SAIC (2003a) results. These analyses allowed for consideration of the contaminants and their toxicity within the mounds, but also whether material was spreading from the mounds to surficial sediments, and whether sufficient contaminants were escaping the mounds into the water column so that they could enter the tissue of mussels. The caged mussels placed at each of the shell mounds for 57 to 58 days had greater than 90% survival, and there were no significant differences in survival of mussels placed at the shell mounds and corresponding reference sites. Although all mussel samples exhibited increases in shell length, whole animal weight, and tissue lipid content, in some cases, growth metrics for the shell mound mussels were significantly higher than those for the reference sites. Concentrations of metals, PAHs, and PCBs in tissues of the shell mound mussels were not significantly different from those at reference sites.

SAIC (2003a) also measured mussel survival and growth using shell length, whole-animal wet-weight, and shell weight. Mussel shell length increased significantly across all sites during the study period. Although there were not significant differences between mussel shell growth rates between shallow shell mounds and deep reference sites, mussel shells at the Heidi Platform site had higher growth rates than at the deep reference site. Whole-animal wet-weight was significantly higher at the Hilda site in comparison to the shallow reference site and all other sites, and higher at the Heidi site in comparison to the deep reference site. Shell weights increased significantly for mussels at the Heidi shell mound compared to those at deep reference site, but not for mussels at the Hope shell mound. Tissue weights from mussels were significantly greater at Platforms Hazel and Hilda than the shallow reference sites. Additionally, there was a significant difference in tissue weight between the Heidi and Hope sites in comparison with the deep reference site. The percentage of lipids increased in mussels from all sites during the trial, with the exception of the deep reference site. Lastly, there was no difference in mussel survival across all sites during the study period.

Similar to Page et al. (2005a), Environmental Resources Management also deployed baited traps to estimate densities of fish and invertebrates living on the 4H shell mounds (ERM 2011; Krause et al. 2012). The multi-season fish trapping study was conducted from 2009 through 2010 to understand the use of the shell mounds by fish and invertebrates and to determine whether biotic assemblages differ from surrounding soft-bottom habitats (shallow and deep) and reference hard-bottom habitat (rocky reef) (ERM 2011; Krause et al. 2012). The study deployed 223 baited traps across the shell mounds and reference locations. Varying types of baits were used to attract a broader diversity of fish species. All fishes and invertebrates were identified and their length and/or weight recorded, as appropriate. AMEC Foster Wheeler (2015; Appendix C1) describes a December 2013 study to collect organisms at the 4H shell mound sites. These organisms were sent to a laboratory where they were dissected for tissue chemical analysis. The only metals found to be elevated in the tissues of the invertebrates were barium and copper. Metal levels were similar to those found in the tissues of organisms collected from the shell mounds by AMEC (2002). Further, the study found no indication that organisms were accumulating greater concentrations of metals in 2013 compared to 2002. Therefore, the study concluded that contaminants were currently not being released from the shell mounds to other areas. Concentrations of several PAHs were significantly elevated in bat stars and sea cucumbers at the Heidi and Hope shell mounds compared to the reference site. However, the concentrations of contaminants observed in marine organism tissue samples were recorded as being below human health concern levels if consumed. At one of the shell mounds, PCBs were found to be significantly elevated in rockfish compared to the reference site. Because PCBs increase at higher levels in the food chain, rockfish could have acquired PCBs by feeding on invertebrates with low levels of PCBs. Low levels of PCBs are ubiquitous in Southern California ocean sediments because they occur in ocean sewage discharges and were used in electrical equipment, oils, inks, and dyes until being banned in 1977. PCBs are also present in hydraulic fluids that were historically used on oil platforms. The studies conducted for the shell mounds showed that some contaminants are present in certain species at the shell mounds, although the source of these contaminants was not conclusively and directly tied to the shell mounds (AMEC Foster Wheeler 2015).

In July 2022, Marine Applied Research and Exploration (MARE) completed a survey of the 4H shell mounds using a camera system on a hydrodynamic towed sled known as a BATFish. Transects by the BATFish covered a study area of 12 square miles on and adjacent to the 4H shell mounds and collected more than 5 hours of video footage that produced 1 hour 40 minutes of edited video footage. Each transect was approximately 250 feet long, encompassing both mound and adjacent sea floor habitat to provide for comparisons between the habitat and to survey adjacent features of interest identified in prior hydroacoustic surveys completed by Fugro (2021). Geological habitat on the transects were identified as either rock, mud, or shell hash, and the location and species of fin fish and invertebrates were identified along each transect. Other features recorded from the video transects include oil rig debris and other artificial debris, including crab and lobster pots, steel beams, pipes, large chains, and unidentified debris. Feeding holes and burrows on soft-sediment habitat areas were also noted (Appendix C3).

A follow-up study to the SAIC (2003a) mussel exposure study was conducted for this Review in 2023 (Appendix C2) based on feedback from a scientific peer review coordinated by the Ocean Science Trust (Appendix C4). As in the SAIC (2003a) study, caged mussels were deployed on each of the four shell mounds and two reference locations for approximately 2 months in 2023 before they were collected and sent to laboratories for analysis. Mussels were recovered with 100% survival based on visual inspection, with the exception of one sample from a shallow reference site that was severed from its mooring during deployment and could not be recovered. No statistical difference was observed between the mounds and reference sites in end-of-test lipid levels (an indicator of growth rate) in the 2023 testing. Statistical tests of laboratory results indicated no pattern of increased contaminants in the tissues of mussels recovered from the shell mounds when compared to the reference sites. This is consistent with the findings of the SAIC (2003a) study. The lack of evidence of a pattern of increased contaminant levels in tissues exposed at the shell mounds compared to reference sites in both studies, separated by 20 years, indicates that the mounds are not likely to be leaching material in sufficient quantities to be incorporated into the food web.

Although these surveys occurred at the shell mounds, their short duration limits the capacity to understand potential seasonal or interannual variations of contaminants on and above the shell mounds and how those interact with marine biological resources. Nonetheless, some studies have covered multiple years and seasons (ERM 2011; Krause et al. 2012) and the lack of significant differences found in various studies between the shell mounds and reference sites provides confidence that substantial leaching of contaminants from the mounds is not occurring.

2.2.3 Biological Communities of the Shell Mounds

This section describes the communities that directly inhabit the 4H shell mounds and other significant marine biological species that occur in areas adjacent to the mounds that may be influenced by these sea floor features. The 4H shell mounds primarily support communities of benthic invertebrates and some fishes that associate with hard-substrate sea floor habitat (Goddard and Love 2008). However, the presence of the mounds on the sea floor may also affect species in adjacent soft-bottom sea floor habitats and species that live in or use the water column, such as pelagic fishes (i.e., inhabiting the upper layers of the open sea), seabirds, marine mammals, and sea turtles. This latter group of larger pelagic vertebrates includes many species that may be more vulnerable to negative effects from the continued presence of the mounds than most benthic invertebrates due to their status as threatened populations. Some of these animal species are afforded special legislative protections under conservation plans and policies. Therefore, although not directly related to the ecology of the 4H shell mounds, these species are briefly discussed in this section.

Benthic Invertebrates

Invertebrates currently living on the 4H shell mounds consist of three broad groups: benthic invertebrates that are relatively slow moving, benthic invertebrates that are generally more mobile, and invertebrates that remain attached to hard substrate (sessile invertebrates). Benthic invertebrates attached to shells and other hard substrates were the most frequently and consistently observed group at all four 4H shell mounds in the MARE survey in 2022 (Appendix C3). They consisted of purple, orange, and red gorgonians (*Eugorgia rubens*, *Adelogorgia phyllosclera*, and *Leptogorgia chilensis*, respectively). Gorgonians (family Gorgoniidae) are colonial polyps similar to true corals (order Scleractinia) in that they consist of a hard exoskeleton often formed in a fan-like shape that is produced by a colony of usually hundreds or sometimes thousands of asexually reproducing polyps. The polyps feed by extending their tentacles into the water column, much like anemones and true corals. Unlike true corals, the skeleton of gorgonians is flexible; therefore, these organisms can better withstand forces imposed by currents and swell. Although more common on the sandy sea floor, sea whip (*Halipteris californica*) was also observed on the shell mounds during the MARE survey. Sea whips, consisting of a large colony of filter-feeding polyps that form a single-stranded hard but flexible structure, are closely related to gorgonians. Invertebrates that attach to hard substrate on the mounds, such as oil rig debris, included *Metridium* anemones (most likely *Metridium senile*), strawberry anemone (*Corynactis californica*), brown cup coral (*Paracyathus stearnsi*), and gorgonian coral (*Lophogorgia chilensis*). These organisms were notable on the solid concrete caisson that is a remnant of the Hazel Platform (Appendix C3).

Relatively slow-moving invertebrates are the most diverse group observed at the 4H shell mounds. The most frequently noted slow-moving benthic invertebrates were sea cucumbers, bat stars, giant sea stars (*Pisaster giganteus*), ochre sea stars (*Pisaster ochraceus*), key-hole limpet (*Megathura crenulata*), and chestnut cowrie (*Neobernaya spadicea*). Kellet's whelk (*Kelletia kelletii*) has also been found on the shallower mounds at the Hilda and Hazel sites, although they were absent in surveys of the deeper mounds at the Hope and Heidi sites. Rock crabs and lobsters are faster-moving benthic invertebrates that range over much larger areas as individuals. Species common to the 4H shell mounds included yellow rock crab, red rock crab (*Cancer productus*), and brown rock crab (*Romaleon antennarium*). California spiny lobsters (*Panulirus interruptus*) are considerably less common but have been observed in older surveys since the platforms were removed (Appendix C3).

Adjacent to the mounds, the sea floor is sandy or muddy, and the benthic invertebrate assemblage is very different. The seabed community in these areas includes infaunal and benthic invertebrates. Polychaete worms are abundant in samples of this community. These include filter-feeding worms such as *Trochochaeta franciscanum* and the tube-building worm *Diopatra ornata*. Sea pens (order Pennatulacea) and tube-dwelling anemone (family Cerianthidae, probably *Pachycerianthus* spp.) are also abundant invertebrates on adjacent sandy/muddy sea floor habitat (Appendix C3). This mirrors the account by Carlisle et al. (1964) of the sea floor habitat that occurred immediately prior to construction of Platform Hazel. They describe the sea floor as "consisting of dark gray, silty mud with many sea pens (*Stylatula elongata*) and tube anemones (*Pachycerianthus* spp.)," indicating that very little change has occurred in the dominant constituents of this benthic habitat in the decades since the platforms were established.

Fish trapping conducted in 2009 and 2010 recorded 12 invertebrate species in traps placed on the mounds compared with 7 species from traps on soft-bottom habitats (ERM 2011; Krause et al. 2012).

Fishes

Prior ROV surveys of the shell mounds did not note many fishes compared to the fishes observed in the 2022 MARE survey (Appendix C3). However, this may have been a function of technology advances in ROV surveys of marine environments, particularly camera resolution and the speed at which the ROV in the MARE surveys moved.

However, it is apparent from the most recent survey by MARE in 2022 (Appendix C3), prior surveys of the mounds by de Wit (2001), and others described above that there was a marked decline in fishes after the platforms were removed. Bascom et al. (1976) clearly describes an abundant and diverse assemblage of fishes inhabiting the platforms that are no longer present at the 4H shell mounds. The historical surveys document thousands of fishes, dominated by rockfishes and seaperch, but including many other fishes often found in kelp forest and other highly productive marine habitats in Southern California, such as kelp bass, blacksmith (*Chromis punctipinnis*), lingcod (*Ophiodon elongatus*), pile perch (*Rhacochilus vacca*), swell sharks (*Cephaloscyllium ventriosum*), and painted greenling (*Oxylebius pictus*). Many of these would have occupied areas higher in the water column, within the area of the structure of the rig, as opposed to the low-complexity benthic structure of the mounds. These survey results are consistent with summaries by Love et al. (1999, 2003).

In contrast with the fish community that occupied the 4H Platforms as reported by Bascom et al. (1976) and others, the most recent survey of the 4H shell mounds by MARE (2022) shows that the density of fishes inhabiting the 4H shell mounds has been reduced by nearly three orders of magnitude (Appendix C3). For example, Bascom et al. (1976) estimated that 20,000 fish lived at the Hilda Platform during their surveys in 1975. Assuming a shell mound area of 37,675 square feet (3,500 square meters), that equates to approximately 550 fish per 1,077 square feet (100 square meters). Based on the MARE survey completed in 2022, the average fish density overlying shell hash habitat at all the 4H shell mounds was 0.24 fish per 1,077 square feet (100 square meters) (from 0.7 to 0.42 fish per 100 square meters) (Appendix C3). The most abundant fishes now occurring on the 4H shell mounds are members of the surfperch family (Embiotocidae). Many of these are pink surfperch (*Zalembius rosaceus*), a species typical of soft-sediment and low-relief rubble habitat that is often found in small schools of 5 to 10 individuals (Love 1996). During platform operation, Bascom et al. (1976) noted an abundance of white sea perch (*Phanerodon furcatus*) at the platforms; however, this species is generally associated with vertical structures, such as platforms, piers, and kelp forests; it was mostly observed associated with the 4H Platform legs, and it is unlikely to occur at the 4H shell mounds now that the platforms have been removed. Although many surfperch observed in the video footage were unidentified by MARE, they are unlikely to be white sea perch and are most likely pink surfperch. Barred sand bass (*Paralabrax nebulifer*) was also abundant at the shell mounds relative to other species of fishes observed by MARE (Appendix C3). This is a bottom-associated round fish commonly observed at shell mounds and on other low-relief reefs and sandy sea floor habitats in Southern California. It is often found at the interface between hard substrate and sandy sea floor. Rockfishes and lingcod were observed on the shell mounds by MARE, although in much lower abundance than during the period when the platforms were present (Appendix C3).

Trap surveys by Environmental Resources Management in 2011 provided a similar list of fishes caught on the 4H shell mounds to those of the fishes observed by MARE in 2022, although the relative abundance of fishes was quite different. A total of 21 fish taxa were collected on the 4H shell mounds by Environmental Resources Management trapping survey (ERM 2011) compared to 15 fish taxa observed by MARE in 2022 (Appendix C3). It is possible that short-deployment trap surveys provide a better estimate of the species present around the mounds because they are less likely to miss fast-moving fishes that will swim away from camera systems. However, baited traps may attract certain species of fishes better than others, biasing the sample estimates in favor of those fishes. Long-term trapping surveys may also introduce sampling error because baited traps could attract fishes to the mounds from outside the shell mounds. Fishes caught in the Environmental Resources Management trapping survey included the species noted in the MARE and de Wit surveys described above. However, they also caught a large number of brown rockfish (*Sebastes auriculatus*), calico rockfish (*Sebastes dalli*), bluebanded ronquil (*Rathbunnella hypolecta*), sarcastic fringehead (*Neoclinus blanchardi*), and white croaker (*Genyonemus lineatus*). The high counts of brown and calico rockfishes were notable in the Environmental Resources Management trapping study compared to the few fish (one from each species) observed in the MARE survey. White croakers are more likely to be associated with soft-sediment habitat and may have been attracted to the traps due to the bait.

Protected Species and Habitats

The following section describes several vertebrates and invertebrates that are provided special protections by conservation legislation and policy. These include species protected under the federal Endangered Species Act (ESA), the California Endangered Species Act (CESA), and the Marine Mammal Protection Act. Animals include sea turtles, marine mammals, invertebrates, and fishes. Although no surveys for these species have been conducted at the 4H shell mounds, the species discussed in this section are primarily highly mobile and/or migratory species with large ranges that are likely to occur relatively infrequently at the 4H shell mounds compared with the resident benthic invertebrates and habitat-associated fishes discussed above, and their presence has not been documented in the studies cited above. However, these species are briefly discussed because they are particularly vulnerable to the effects of contaminants leaching from the mounds, entering the food web, and bioaccumulating.

The Magnuson-Stevens Fishery Conservation Act (Magnuson-Stevens Act) provides protection for a selection of habitat types for managed fish species, called Essential Fish Habitat. These are also briefly discussed below in relation to the 4H shell mounds.

Sea Turtles

Four species of marine turtle are endemic to the Southern California Bight region; all species are listed under the ESA: green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), and olive Ridley sea turtle (*Lepidochelys olivacea*). Green sea turtle, the only species listed as threatened under the ESA, is the most common species, but it is unlikely to be affected by the 4H shell mounds in any ecologically meaningful way. Resident populations of green sea turtles occur in San Diego Bay (Madrak et al. 2016); they are also consistently observed at La Jolla Shores headland (Hanna et al. 2021), and a third resident population occurs at the Seal Beach National Wildlife Refuge and in the adjacent San Gabriel River (Crear et al. 2017). Green sea turtles are generally a nearshore sea turtle in Southern California and are highly unlikely to occur regularly near the 4H shell mounds. Furthermore, they feed on algae and seagrasses, which are not found at or adjacent to the 4H shell mounds.

Leatherback sea turtles, which are listed as endangered under the ESA, are a large, highly migratory sea turtle that occur seasonally (in late summer, fall, and early winter) in the eastern Pacific, particularly north-central California around Monterey Bay. Leatherback sea turtles that occur in California nest on beaches in the eastern Pacific (primarily parts of Indonesia, Papua New Guinea, and the Solomon Islands) or in Mexico (NOAA Fisheries and Fish and Wildlife Service 2020). Leatherback sea turtles migrate from nesting areas to California to feed on seasonally abundant jellyfish, their primary food source. Most observations of leatherback turtles in California occur in the Monterey Bay area, which is not in the Southern California Bight region. However, tagging studies of these wide-ranging animals show they occasionally migrate through and forage in offshore waters of the Southern California Bight region (Benson et al. 2011). Although leatherback sea turtles may occur infrequently in waters overlying the shell mounds, leatherback turtles are not a deep-diving species, so they will not come into direct contact with or proximity to the 4H shell mounds. They also range over large areas when foraging. Therefore, the likelihood of an individual animal occurring frequently enough in the shell mounds area to absorb pollutants, to the extent such pollutants are present, in its body is very low. Furthermore, their prey are jellyfish, which are unlikely to be affected by any pollutants bound into the mounds because they are pelagic and are not known to bioaccumulate large quantities of pollutants. If jellyfish occurred at the mounds, it would be only briefly before they drifted away on the current. For these reasons, pollutants from the mounds are unlikely to enter the diet of leatherback sea turtles.

Both loggerhead sea turtles and olive Ridley sea turtles typically have a tropical distribution and are very uncommon in the northern portions of the Southern California Bight region. However, aerial surveys reported in Eguchi et al. (2018) indicate persistent occurrence of juvenile loggerhead sea turtles foraging in waters as far north as San Clemente Island, approximately 100 miles (160 kilometers) south of the 4H shell mounds, and anecdotal accounts of these animals off Palos Verdes have been recorded by scientists from NOAA Fisheries (Seminoff, pers. comm., 2022). Olive Ridley sea turtles have rarely been documented north of the tropical eastern Pacific. It is assumed that accounts of these animals in the Southern California Bight region are likely to be sick or lost animals. Although loggerhead sea turtles are more likely to occur than olive Ridley sea turtles, both of these species are highly unlikely to occur regularly near the 4H shell mounds.

Marine Mammals

At least 19 species of marine mammals have the potential to occur in the waters surrounding the 4H shell mounds. Of these species, seven are listed under the ESA and one is listed under the CESA. These marine mammals, along with their status under the ESA and/or CESA, are listed in Table 2-2.

Table 2-2. Marine Mammals Potentially Occurring in the Vicinity of the 4H Shell Mounds

Common Name	Species Name	ESA Status	CESA Status
Whales			
gray whale	*Eschrichtius robustus*	Endangered[1]	Not listed
humpback whale	*Megaptera novaeangliae*	Endangered Threatened[2]	Not listed
blue whale	*Balaenoptera musculus*	Endangered	Not listed
fin whale	*Balaenoptera physalus*	Endangered	Not listed
Bryde's whale	*Balaenoptera brydei*	Not listed	Not listed
minke whale	*Balaenoptera acustorostrata*	Not listed	Not listed

Table 2-2. Marine Mammals Potentially Occurring in the Vicinity of the 4H Shell Mounds

Common Name	Species Name	ESA Status	CESA Status
Dolphins and Porpoises			
short-beaked common dolphin	*Delphinus delphis delphis*	Not listed	Not listed
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	Not listed	Not listed
Risso's dolphin	*Grampus griseus*	Not listed	Not listed
bottlenose dolphin	*Tursiops truncatus*	Not listed	Not listed
long-beaked common dolphin	*Delphinus delphis bairdii*	Not listed	Not listed
Dall's porpoise	*Phocoenoides dalli dalli*	Not listed	Not listed
killer whale	*Orcinus orca*	Not listed	Not listed
harbor porpoise	*Phocoena phocoena*	Not listed	Not listed
northern right whale dolphin	*Lissodelphis borealis*	Not listed	Not listed
Pinnipeds			
California sea lion	*Zalophus californianus*	Not listed	Not listed
northern elephant seal	*Mirounga angustirostris*	Not listed	Not listed
northern fur-seal	*Callorhinus ursinus*	Not listed	Not listed
Guadalupe fur-seal	*Arctocephalus townsendi*	Threatened	Threatened

Sources: CDFW 2024a; USFWS 2024

Notes: ESA = federal Endangered Species Act; CESA = California Endangered Species Act.

1 Gray whales in California belong to two separate distinct population segments (DPSs). Only gray whales from the Western North Pacific DPS are listed.

2 Humpback whales in California belong to two separate DPSs with different listing statuses.

Most whales are recognized as seasonal migrants in California. This is because most whales migrate to tropical latitudes in the winter season to breed and give birth. Temperate waters, such as in Southern California, are generally feeding areas or part of the migratory route between the tropical breeding and nursery grounds and the more northerly feeding areas. However, many species of whales are observed year-round in Southern California, even though they show seasonal decline in the fall and winter.

Gray whales (*Eschrichtius robustus*) are only migratory in Southern California and do not remain in the region to feed. Southbound gray whale migration peaks around the last week of January through the second week of February, and northbound migration peaks from the middle through the end of March (Schulman-Janiger, pers. comm., 2021).

Humpback whales (*Megaptera novaeangliae*) are the most abundant whales in California. In Southern California they appear in increasing numbers in March through May. Numbers generally decline in Southern California from June through the summer period as they slowly move north to Central and Northern California. Numbers increase again in Southern California in July through December. Blue whales (*Balaenoptera musculus*) are generally most abundant in Southern California from July through October, but are present in the region year-round. Both humpback and blue whales are most abundant in the Channel area, which includes the 4H shell mounds. The southeasterly boundary of a Biologically Important Area[7] for feeding for humpback whales occurs approximately 2 miles southwest of the Hilda Platform shell mound but does not overlap the shell mound sites (Calambokidis et al. 2015). Recently designated critical habitat for humpback whales extends south and west beyond this Biologically Important Area. The boundary of humpback whale critical habitat occurs 0.72 nautical mile southwest of the Hope Platform shell mound but does not overlap the site (86 FR 21082). A Biologically Important Area for blue whales occurs approximately 12.5 nautical miles southwest of the 4H shell mounds (Calambokidis et al. 2015).

Fin whales (*Balaenoptera physalus*) are abundant whales in Southern California. Historically assumed as migratory, increasing evidence suggests that many populations of fin whales around the world do not migrate (Geijer et al. 2016). Acoustic data has provided evidence of year-round occurrence of fin whales in much of California (Oleson et al. 2014), and a recent publication by Falcone et al. (2022) using photo identification of individual fin whales over multiple years provides evidence of a discrete subpopulation of year-round resident fin whales living in inshore waters of the

7 Biologically Important Areas represent places and periods (months or seasons) that are important to cetacean species, stocks, or populations for feeding, migrating, or activities related to reproduction. They may also be defined to encompass the range or core areas of small and resident populations. Biologically Important Areas are compilations of the best available information and have no inherent or direct regulatory power. They have been used by NOAA Fisheries, other federal agencies, and the public to support planning and marine mammal impact assessments, and to inform the development of conservation measures for cetaceans.

Southern California Bight region. These fin whales appear to remain within the region most of the time, with some rare incursions to the Central Coast (San Francisco and Monterey Bay areas). This subpopulation is notably active inshore (within 16 miles [25 kilometers] of the coastline), and has an abundance of observations centered around the Palos Verdes Peninsula. This population appears to have established inshore residency in 2009, although Falcone et al. (2022) postulate that this could also reflect a lack of inshore data prior to this period. They also suggest that the emergence of inshore resident fin whale populations may reflect a recovery of pre-whaling fin whale habits and habitat use. This finding is not yet reflected in current stock status, but has potentially important implications for the management of these animals. If so, this is the first population in the eastern Pacific known to be reestablishing this distribution pattern. As noted in Falcone et al. (2022), the high density of human activities in the Southern California region, including shipping, military training, oil and gas extraction, fishing, and recreational boating, may have further implications for this local resident population. Waters used by these resident Southern California fin whales overlap the 4H shell mounds and adjacent areas, but the benthic fauna occurring at the 4H shell mounds would not provide a food source for fin whales, and they would not be attracted to these sites. Fin whales feed on pelagic marine animals, such as anchovies and krill, that are not expected to interact with the shell mounds.

Bryde's whales (*Balaenoptera brydei*) are a typically tropical and subtropical resident. Their northern range is the Southern California Bight, and they are less commonly observed in the northern reaches of the Southern California region that encompass the 4H shell mounds than in the southern region. Acoustic recordings indicate Bryde's whales are present in Southern California waters from summer through early winter. Sightings and acoustic recordings of Bryde's whales in Southern California waters have increased in the past decade, possibly signaling a northward range expansion (Carretta et al. 2021). At least 15 sightings of Bryde's whales are confirmed in the Southern California region in citizen science data compiled by the Happywhale project. Most of these observations occur between the Palos Verdes Peninsula, Catalina Island, and Newport Beach (Happywhale 2022). Minke whales (*Balaenoptera acustorostrata)* are also relatively rare whales in California, being more commonly observed in the northern latitudes of the Gulf of Alaska and the Bering and Chukchi Seas (Carretta et al. 2021). However, data from the Happywhale project indicate a clear increase in abundance in Southern California beginning in May and extending through October, with a regional peak in August (Happywhale 2022). It is unclear whether this pattern is due to seasonal declines in whale-watching activity over the winter months, but there is a potential that this biases observation frequency in Happywhale data.

Dolphins and porpoises represent the most diverse group of marine mammals that may occur in the waters encompassing and adjacent to the 4H shell mounds. Some species are highly abundant in the Southern California region. Short-beaked common dolphin (*Delphinus delphis delphis*) can form individual social groups that number hundreds of individuals and occasionally form megapods of thousands of individuals. Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) are also abundant in Southern California, forming smaller groups than short-beaked common dolphins, although this species can also form megapods of thousands of animals in the region. They are more common in Southern California in January through March, with a more northerly distribution into Central California or offshore in Southern California in warmer months (Carretta et al. 2021).

Moderately abundant species include Risso's dolphin (*Grampus griseus*), bottlenose dolphin (*Tursiops truncatus*), long-beaked common dolphin (*Delphinus delphis bairdii*), and Dall's porpoise (*Phocoenoides dalli dalli*). Risso's dolphins are commonly seen throughout the U.S. Pacific Coast in California, Washington, and Oregon. Typically, populations shift north after the colder winter months as water temperatures increase in the late spring and summer. Two bottlenose dolphin populations, a coastal (nearshore) population and an offshore population, are recognized as occurring in California, according to Carretta et al. (2021). Long-beaked common dolphins, which are closely related to short-beaked common dolphin, have a more southerly distribution than short-beaked common dolphin and are considerably less abundant. They are not found as far offshore as short-beaked common dolphins, although both species overlap in the waters overlying the 4H shell mounds. Dall's porpoises are observed throughout the year in Southern California and are most frequently observed in the Channel to the north and offshore of the 4H shell mounds. Killer whales (*Orcinus orca*), harbor porpoises (*Phocoena phocoena*), and northern right whale dolphins (*Lissodelphis borealis*) are considerably less commonly observed in Southern California (Carretta et al. 2021).

California sea lion (*Zalophus californianus*) is the most abundant otariid (eared seal) in the California region (Carretta et al. 2021). The species is found along the entire California coastline, often in groups on and around rocky areas, sandy coastal locations, and artificial structures, such as marina docks and buoys. Although they are most commonly observed close to shore, they are also the most frequently observed marine mammal in offshore surveys, a reflection of their high abundance in California (Carretta et al. 2021), and are likely to be highly abundant in waters around the 4H shell mounds.

Northern elephant seals (*Mirounga angustirostris*) are the largest member of the pinnipeds. Adult males may be up to 10 times larger than females. After the breeding season from November through March, most adult males migrate to high latitude feeding areas from the Gulf of Alaska to the western Aleutian Islands. Similarly, most females migrate to feed offshore of Washington and Oregon. However, northern elephant seals are wide-ranging animals and are frequently seen in Southern California year-round. They are deep-diving animals easily capable of targeting fishes and squid on the 4H shell mounds (Carretta et al. 2021).

California is the southern limit of the range of northern fur-seals (*Callorhinus ursinus*). Most of the species breed in Alaskan waters, particularly on the Pribilof Islands, and a small population of northern fur-seals breed on San Miguel and the Farallon Islands in California. The distribution of northern fur-seals south of Point Conception is typically well offshore of the Channel Islands. It is likely that this reflects their temperate water preference because the offshore waters are generally cooler due to the southward-moving California Current, and the inshore waters are generally warmer due to the California Countercurrent, which circulates subtropical waters upcoast from Mexico in the Southern California region (Zeppelin et al. 2019).

Guadalupe fur-seals (*Arctocephalus townsendi*) breed almost exclusively on a few islands off the northwest Pacific coast of Baja California, Mexico. The most numerically abundant breeding colony occurs at Guadalupe Island, and a smaller number of pups are also born at the San Benito Archipelago. Breeding and pupping occur from May through August. When not at the breeding colonies, Guadalupe fur-seals disperse through the offshore waters of Mexico into California and as far north as Oregon and Washington to feed. At sea, Guadalupe fur-seals are solitary and wide ranging. Tag data indicates the species rarely occurs in continental shelf waters (less than 660 feet [200 meters] deep), although they remain within 500 miles (800 kilometers) of the shore, so they are likely very rare at the 4H shell mounds (McCue et al. 2021). However, this species is protected under the ESA and CESA, and may feed on fishes and other pelagic invertebrates that occur at the 4H shell mounds.

Generally, highly mobile prey species, such as fishes and squid, that are the typical targets for these mammals are unlikely to significantly bioaccumulate contaminants that may be present at the 4H shell mounds because of their limited exposure to the area. Further, bioaccumulation studies conducted in 2003 (SAIC 2003a) and 2023 (Appendix C2) did not indicate that even filter feeding mussels placed at the shell mounds are bioaccumulating contaminants at a level above shallow and deep water reference sites.

Other Protected Marine Species

One shark species and two benthic invertebrates listed under the ESA have ranges that overlap the 4H shell mounds. These are listed in Table 2-3. All three species are notably rare in Southern California, and therefore are unlikely to occur at the 4H shell mounds.

Table 2-3. Other Protected Marine Species with Potential to Occur at the 4H Shell Mounds

Common Name	Species Name	ESA Status	CESA Status
scalloped hammerhead shark[1]	*Sphyrna lewini*	Endangered	Not listed
white abalone	*Haliotis sorenseni*	Endangered	Not listed
sunflower sea star	*Pycnopodia helianthoides*	Proposed for listing	Not listed

Notes: ESA = federal Endangered Species Act; CESA = California Endangered Species Act.
1 Scalloped hammerhead sharks in California belong to the Eastern Pacific distinct population segment.

According to Ebert (2003), scalloped hammerhead sharks (*Sphyrna lewini*) are extremely abundant in the Gulf of California but are rarely seen in California waters. Ebert (2003) states that a few scalloped hammerheads have been confirmed as occurring in the waters off of the Southern California region based on accidental gill net and angler catches. They were caught in summer months and are more commonly seen during El Niño years, indicating that these sharks are more likely to occur in the summer in Southern California, when waters are warmest. This pattern of occurrence corresponds with their warm-temperate and tropical distribution pattern. They are sometimes confused with smooth hammerhead sharks (*Sphyrna zygaena*), a more common hammerhead shark in California waters (Ebert 2003). No more recent data are available regarding occurrence of this species.

White abalone (*Haliotis sorenseni*) are herbivorous marine gastropod mollusks (a type of snail) found along the west coast of North America from Point Conception, California, to Punta Abreojos, Baja California. This species is found from 16 to 200 feet (5 to 60 meters) deep, but current remnant populations are most common from 100 to 200 feet (30 to 60 meters) deep. Survey data indicate that the highest densities of white abalone occur from 130 to 165 feet (40 to 50 meters) in depth. It is the deepest-dwelling abalone species in California. Adult white abalone occur in open, low-relief rocky reefs or boulder habitat surrounded by sand. Observations in the field indicate that white abalone prefer the edges of reefs at the sand-rock interface. White abalone associate with flat, moderate-complexity habitats consisting of deformed (faulted or folded) rocks and sand and the presence of brown algae such as *Agarum fimbriatum* and *Laminaria* spp. The species feeds on benthic drift kelp and other algal sources. Suitable habitat is patchy; therefore, it is assumed that the distribution of white abalone is naturally also patchy. This is a very cryptic species that is well camouflaged and remains in cracks and crevices in its natural habitat (NOAA 2018). It is unlikely to be observed by ROV camera surveys, such as the de Wit (1999, 2001) and MARE (Appendix C3) surveys. Their presence is usually determined by detailed diver surveys specifically targeting the species, which have not been conducted on the 4H shell mounds. Although the 4H shell mounds occur within the depth and geographical range of this species, the absence of algae on the mounds suggests that these are very poor white abalone habitat. Combined with the species' rarity, these conditions make it highly unlikely that white abalones occur on the 4H shell mounds.

Sunflower sea stars (*Pycnopodia helianthoides*) are currently under consideration for listing in the ESA by NOAA Fisheries. The sunflower sea star is considered a candidate species under the ESA. Sunflower sea stars occur from the Aleutian Islands, Alaska, to at least the Southern California Bight. The species is more commonly found in waters less than 82 feet (25 meters) deep, although it may range as deep as 985 feet (300 meters). From 2013 to 2017, the population of sunflower sea star was severely depleted by sea star wasting syndrome. The population is believed to have declined more than 90%, and the area it occupies has decreased by more than 50%. The species appeared to be locally extinct at the Channel Islands from 2014 to 2017 (Lowry et al. 2022). Because the Southern California population appears to have experienced such a dramatic decline, it is unlikely this species occurs at the 4H shell mounds. Although close relatives of the sunflower sea star (*Pisaster* spp.) were commonly observed during surveys of the 4H shell mounds (de Wit 2001), sunflower sea stars have not been observed on the mounds. They are highly unlikely to occur at the 4H shell mounds, but the potential for their presence cannot be ruled out.

Essential Fish Habitat

Essential Fish Habitat (EFH) is a protection designation afforded to marine habitats that are beneficial to maintaining and recovering federally managed fishery populations (generally referred to as "stocks" in the fishery management context). EFHs include waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The Pacific Fishery Management Council, a regional fishery management body set up under the Magnuson-Stevens Act, develops fishery management plans for the Pacific Coast region. Four fishery management plans have been developed for the Pacific Coast region of the United States by the Pacific Fishery Management Council (PFMC 2022a, 2022b, 2022c, 2024). EFH for three of the four fishery management plans overlap the 4H shell mounds.

The Pacific Coast Groundfish Fishery Management Plan provides for designated EFH that includes the 4H shell mounds. The Pacific Coast Groundfish Fishery Management Plan encompasses more than 90 species of fishes, including all 70 species of rockfishes, 12 species of flatfishes, 6 species of roundfishes, and 4 species of elasmobranchs. The EFH includes a large proportion of the exclusive economic zone (PFMC 2022a). Although sea floor habitat adjacent to the 4H shell mounds would constitute groundfish EFH, artificial structures are generally excluded from EFH under the Pacific Coast Groundfish Fishery Management Plan, and therefore the mounds themselves would not technically be EFH under the Magnuson-Stevens Act. However, these features still provide habitat for managed species, and should therefore be considered in any consultation with NOAA Fisheries or other federal agencies.

EFH designated in the Highly Migratory Species Fishery Management Plan for dorado (*Coryphaena hippurus*) and common thresher shark (*Alopias vulpinus*) overlaps the 4H shell mounds. Young thresher sharks likely feed on small schooling fishes, such as northern anchovy (*Engraulis mordax*) and Pacific sardine (*Sardinops sagax*), and larger fishes, such as Pacific hake (*Merluccius productus*) and Pacific chub mackerel (*Scomber japonicus*). They are also likely to regularly consume invertebrates, such as market squid (*Doryteuthis opalescens*) and pelagic red crab. The latter can be highly abundant in warm water years. Adult thresher sharks have a similar diet to young sharks, although they are typically more common in deeper waters and may be less common in waters overlying the 4H shell mounds and adjacent areas. Dorado diets are less well documented, but compared to juvenile threshers, they are more likely to feed on smaller fishes, such as northern anchovy and sardines, as well as crustaceans and squids (PFMC 2022b). Adult dorado are also generally farther offshore than the areas around the 4H shell mounds, but may feed on schooling fishes that would occur around the 4H shell mounds, and therefore may be affected by these features.

EFH designated in the Coastal Pelagic Species Fishery Management Plan for four fin-fish species, market squid, and all krill species overlaps the 4H shell mounds. The fin-fish species covered by the Coastal Pelagic Species Fishery Management Plan are Pacific sardine, Pacific chub mackerel, northern anchovy, and Pacific mackerel (*Trachurus symmetricus*). These are pelagic, schooling fishes that inhabit the upper water column, generally above the thermocline (PFMC 2024). Northern anchovy are the smallest of these four fin fishes and form some of the largest schools. However, in some years, sardines can form larger schools than anchovies, particularly in warm-water periods (Chavez et al. 2003). Pacific chub mackerel, jack mackerel (*Trachurus symmetricus*), and Pacific sardines are often found schooling together. Jack mackerel are typically more common on offshore banks in late spring, summer, and early fall than the remainder of the year, with schools often more common over rocky structures than the other coastal pelagic species. Pacific chub mackerel tend to remain closer inshore from July to November, and generally increase in offshore abundance from March to May (PFMC 2024).

Market squid are generally found to occur above the thermocline in pelagic schools. Market squid form large spawning aggregations that are targeted by fishermen. Typically, these aggregations form near shallow semi-protected areas with sandy or muddy bottoms adjacent to submarine canyons. During spawning, eggs are deposited on the sea floor in large masses at depths of 16 to 180 feet (5 to 55 meters). Market squid is one of the largest coastal fisheries in California, with peak catches typically during winter spawning aggregations, although the fishery operates throughout the year (CDFG 2005).

Krill consists of several species in the northeastern Pacific. In the waters of the 4H shell mounds, *Euphausia pacifica* is likely the most abundant species. *Thysanoessa spinifera*, the co-dominant species in the California Current region, has a more northerly distribution than *E. pacifica* (Cimino et al. 2020). Other species that may occur in the region include *Nematoscelis difficilis* and *Nictiphanes simplex* (Fiedler et al. 1998).

All coastal pelagic species produce pelagic larval and/or juvenile forms that inhabit the water column, typically from the surface to a relatively limited depth (e.g., above the thermocline [i.e., the transition layer between warmer, mixed water at the ocean's surface and cooler deep water below]) (Whitney et al. 2021). These pelagic larval forms are passively dispersed on ocean currents and are therefore likely to occur in the plankton overlying the 4H shell mounds; however, they are less likely to occur deeper than the upper third of the water column.

2.2.4 Effects Assessment

The 4H shell mounds can be assessed as "novel ecosystems" —a way of defining ecosystems altered by human activity, where restoration is at best unlikely, and may ultimately be undesirable. The degree to which offshore platforms and their associated components, such as shell mounds, can usefully be considered a novel ecosystem may assist in assessing decommissioning options (Van Elden et al. 2019).

After the removal of the platforms in 1996, it is now apparent that a dramatic loss of marine habitat occurred, resulting in the loss of large, dense populations of fishes and benthic invertebrates that had established on and below the artificial structures of the platforms. Subsequent studies of the marine biological communities characterize a low-relief shell hash community that primarily consists of a few benthic invertebrates and a very small number of benthic-habitat-associated fishes when compared to similar shell mounds beneath intact platforms (de Wit 1999; Bomkamp et. al. 2004).

Presentation of data (cross-sectional areas showing height of the mounds) from hydroacoustic surveys completed by Fugro in 1996, 1999, 2004, 2009, and 2021 do not appear to show any trend in deposition or erosion rates across this period. Estimates of deposition provided by de Wit (1999) indicate 0.08 inches (2 millimeters) of sedimentation per year, which would equate to a change of just 2 inches (5 centimeters), on average, from 1996 to 2021, a measure unlikely to be detectable by hydroacoustic surveys. The remaining low-relief shell hash habitat of the 4H shell mounds is likely to decline in areal cover as sedimentation slowly accumulates on the shell mounds; however, scouring of recent sedimentation over the rugose shell mound structure is challenging to estimate, and may affect sedimentation differently at different thicknesses. De Wit (2001) suggested that scouring rates appear low based on the lack of any erosional depression at the base of the mounds, but did consider that scouring could be more intensive on the western upcurrent slopes of each mound due to storm action. Although the shell mounds continue to provide hard-bottom habitat, the loss of ongoing deposition of new substrate (i.e., shells falling from the former platforms), alongside ongoing sediment accumulation, has decreased the hard-bottom habitat value of these mounds.

If the shell mounds are abandoned in place, they are likely to provide relatively low-quality habitat for decades to come. Habitat value is likely to slowly decline due to the gradual sedimentation of the shell hash, although the low-relief features of the mounds are likely to forever remain a feature of the seascape in this area. Claisse et al. (2015) evaluated the potential effects of partial removal on the biomass and production of the fish communities living near shell mounds off the Southern California coast. Data collection methods included annual visual surveys conducted during daylight hours in the fall from 1995 through 2009 and from 2010 through 2011. The study found that shell mounds under intact platforms are moderately productive fish habitats, similar to or greater than natural rocky reefs in the region at comparable depths. However, Claisse et al. (2015) went on to state that "the complexity and areal extent of these biogenic habitats, and the associated fish biomass and production, will likely be reduced after either partial or complete platform removal."

Fish trapping studies in 2009 and 2010 documented substantial differences in the number of fish and invertebrate species (70% of total species trapped) collected in traps placed over the shell mounds compared with those from surrounding soft-bottom areas (ERM 2011; Krause et al. 2012). The fish assemblages trapped on the mounds were "characteristic of the rocky reef habitat of the Santa Barbara Channel" (ERM 2011; Krause et al. 2012). The study concluded that "shell mounds support a different species assemblage than the surrounding soft-bottom areas and one that is typical of hard-bottom habitat" (Krause et al. 2012). Additionally, the study compared the abundance of organisms, the number of species, and the relative proportion of individuals of a species (i.e., the community structure) captured at each location as metrics of ecological value. Greater abundances of organisms were recorded at the mounds than at soft-bottom reference locations (ERM 2011; Krause et al. 2012). This greater abundance may be a result of fish and invertebrates concentrating to take advantage of available food, shelter, and reproductive opportunities (ERM 2011; Krause et al. 2012). In addition, the shell mounds also appear to support higher fish densities (ERM 2011; Krause et al. 2012). Results of Shannon-Weiner Diversity Index calculations indicate similar conclusions that the mounds serve as a "more valuable ecological resource than the surrounding soft-bottom area" (ERM 2011; Krause et al. 2012). The shell mounds may be viewed as islands providing complex hard-bottom structures, whereas the surrounding soft-bottom habitat is generally featureless (ERM 2011; Krause et al. 2012).

In Meyer-Gutbrod et al.'s (2019) study, surveys using ROVs and submersibles containing surveyors were conducted from 1997 to 2013 to estimate the biomass, density, species composition, and similarity between shell mounds at 22 Southern California platforms. The study found that intact shell mounds host a diverse fish community similar to the platforms themselves, but also have distinctive elements, such as natural hard-bottom assemblages. As noted in Section 2.2.2, the abundance and diversity of fish species at the shell mounds are greater than at soft-bottom reference sites (ERM 2011; Krause et al. 2012).

Several studies have been conducted to determine whether the shell mounds are releasing contaminants into the marine environment. If they are, these contaminants may cause harm to marine life that directly consumes these chemicals, or they may indirectly harm organisms that consume marine life that contains chemical constituents from the 4H shell mounds in their body tissue. In the latter case, some chemicals, such as heavy metals and persistent organic pollutants, can bioaccumulate in higher-trophic-level organisms. Higher-trophic-level organisms often include species that are important to recreational and commercial fisheries, play critical roles in natural ecosystem dynamics (called "keystone species"), or are protected under conservation policy and legislation, such as the ESA, CESA, and Marine Mammal Protection Act. Examples of these species are discussed above.

The studies that examined the potential for contaminant release into surrounding waters or high levels of contamination in associated marine species indicate that it is unlikely the 4H shell mounds are causing harm to marine life (MEC 2002; SAIC 2003a; Phillips et al. 2006; AMEC Foster Wheeler 2015; Appendix C2). The only evidence of potential harm to marine life shown in more recent assessments (AMEC Foster Wheeler 2015) showed that barium, copper, some PAHs, PCBs, and heptachlor epoxide were measured at moderately elevated levels in the tissues of some invertebrates at some of the 4H shell mounds. However, concentrations of contaminants observed in resident marine organism tissue samples were recorded below levels that would represent a human health concern. Also, bioaccumulation of contaminants was not demonstrated in a mussel bag study conducted in 2023 (Appendix C2), nor the similar study conducted 20 years earlier (SAIC 2003a). Further, some contaminants, such as heptachlor epoxide, are not associated with oil and gas development and likely originated from other point or area sources not associated with the 4H shell mounds. Large amounts of PCBs were discharged through sewage outfalls prior to 2003, and they are ubiquitous in Southern California ocean sediments. Resident organisms, such as bat stars, sea cucumbers, and rock crabs, are not prey species for higher-trophic-level organisms, such as marine mammals and sharks. However, it would be impractical to undertake a study to attribute contaminant pathways from the 4H shell mounds to these higher-trophic-level species via their typical prey species for several reasons. First, the prey species that are likely to transfer chemical constituents from the 4H shell mounds are themselves highly mobile, such as pelagic schooling fishes (e.g., northern anchovy, Pacific sardine, jack mackerel). Second, the higher-trophic-level organisms themselves are likely to forage over vast areas. Lastly, although biopsies can detect contaminants in the tissue of animals such as marine mammals, it is not possible to directly attribute contaminants to the 4H shell mounds.

Although no effects were detected by prior studies, scientific studies are unlikely to be able to categorically rule out the leaching of contaminants from the 4H shell mounds. Therefore, Phillips et al. (2006) argue in favor of a weight-of-evidence approach when evaluating this potential effect. Their study showed that organisms directly exposed under controlled conditions (mussel bioassay) to the potential leaching pollutants were not harmed. This conclusion was further supported by the 2023 mussel study that had similar results (Appendix C2), and verified that the mounds had remained stable in the 20 years since the 2003 mussel bag study (SAIC 2003a). Therefore, it is unlikely that the mounds are leaching contaminants. On this weight-of-evidence basis, abandonment of the shell mounds in place would not appear to constitute a risk of contaminant exposure to marine life from gradually leaching contaminants.

However, a major disturbance event at the 4H shell mounds, such as a major earthquake in the vicinity, could result in large movement of mound material or a liquefaction event (refer to Section 2.4) that would cause a sudden and large release of the contaminants known to be bound up in sediments within the mounds. Exposure studies have shown that the highest contaminant concentrations, along with pockets of free oil, are associated with the middle “cuttings” stratum of the mounds that start from 1 to 6 feet below the mound surface. In the bioaccumulation tests, statistically significant levels of barium and PAHs were detected in clam and worm tissues compared to reference tissue levels. The contaminant concentrations caused significant acute toxicity and bioaccumulation of barium and PAHs in test organisms during laboratory exposures (such as AMEC 2002). Environmental monitoring in the Dutch and United Kingdom regions (Bakke et al. 2013) have given a comprehensive picture of the spatial effects of muds and cuttings on sediment macrofauna communities, finding that the areal extent of impact to biota from full exposure of drill cuttings (during a worst-case-scenario seismic event) would potentially be approximately 0.62 square miles (1 square kilometer). However, Bakke et al. (2013) did not find evidence that past and present drill cutting discharges are causing long-lasting or cumulative effects to fauna in their European study area.

Although the potential for bioaccumulation through the food web into higher organisms (e.g., marine mammals, sharks, sea turtles) has not been analyzed at the shell mounds to date, the settling of released contaminants on the sea floor following a significant seismic event could result in an area of sediments with elevated contaminants for some limited distance (approximately 0.62 square miles) (Bakke et al. 2013) around the shell mounds. The elevated pollutants in these sediments might impact marine species in this area directly through consumption of the chemical constituents, resulting in a short-term (potential months to a few years) reduction in the diversity and abundance of benthic organisms and associated fish species. Furthermore, these contaminants could enter the food web and harm higher-trophic-level organisms, such as marine mammals and fishes, as well as humans if they consumed those fishes.

In addition to effects from potential contaminant release following a major disturbance, the fish and invertebrate assemblages could be altered from increased scouring of the shell mounds over time. Climate change is projected to increase the frequency and intensity of swells and surges, which could increase scouring and increase shell exposure. This change in physical condition of the mounds could provide new habitat for fish and invertebrates, potentially increasing diversity and density of taxa. However, this potential change is highly speculative.

Finally, by abandoning the mounds in place, this area would remain closed to trawling activity. This would allow bottom fish and other benthic marine life to avoid trawling's adverse effects on and in the vicinity of each shell mound.

2.3 Commercial Fishing

2.3.1 Commercial Fishing in the Region of the Shell Mounds

As stated in the California Marine Life Management Act Master Plan (CDFW 2018a), California has a rich fishing culture that is an integral part of the history of the state. The commercial fishing industry in California provides an essential and diverse food source, supports the livelihoods of a local workforce, and underpins the character and tradition of many coastal communities. In 2019, commercial fishermen landed 45million pounds of fish in Southern California, valued at $53.5 million in market value (CDFW 2020a).[8] The Southern California fishery includes more than 180 taxa, including fishes, invertebrates, and algae. Many of these fisheries overlap the coastal zone that includes the 4H shell mounds. Within the Southern California fishery, more than 50% of the fishery value comes from three fisheries: spiny lobster, market squid, and spot prawn (*Pandalus platyceros*). Other major fisheries include tunas, urchins, and crabs. Major fin-fish fisheries include sablefish (*Anoplopoma fimbria*), swordfish (*Xiphias gladius*), Pacific mackerel, and California halibut (CDFW 2020a). The discussion below focuses on species that are likely to interact with the shell mounds, or whose fisheries could be disrupted by the continued presence of the 4H shell mounds on the sea floor. Based on these criteria, the discussion below is limited to halibut, spiny lobster and crabs.

California halibut is a commercially important flatfish fishery concentrated from Bodega Bay in Northern California to San Diego in Southern California (CDFG 2004). California halibut stock assessments break California halibut up into two separate stocks, a northern and southern stock. These stocks are separated at Point Conception and bounded by the California borders with Oregon and Mexico. The most recent modeling efforts estimate the California halibut stock in Southern California is at 23.5% of unfished biomass. The current flatfish target set by the Pacific Fishery Management Council is 25% for California halibut, which indicates the fishery may be overfished. However, management recommendations and decisions are awaiting further work to improve the accuracy of the model informing the stock assessment process (CDFW

8 Based on the most recently published annual commercial fishery landings data for the Santa Barbara, Los Angeles, and San Diego port complexes throughout California.

2022). Bottom trawling is the primary commercial fishing method for halibut, but other methods include set gill and trammel nets and hook-and-line (CDFG 2008). Trawling is permitted in federal waters (3 to 200 nautical miles offshore); however, trawling is prohibited in state waters (0 to 3 nautical miles offshore), except for the designated California Halibut Trawl Grounds within state waters (CDFG 2004). California halibut are landed in live condition, and the price per pound for live California halibut is higher in Southern California compared to Northern California (CDFG 2008). Juvenile halibut rely on shallow water embayments as nursery habitat, and migrate from the Southern California bays to the open coast. The size of the California halibut population and halibut fishery may be limited by available nursery habitat due to anthropogenic changes, such as dredging and filling of bays (CDFG 2004).

The spiny lobster fishery is a seasonally limited (open October through February), trap-based commercial fishery and was the most lucrative fishery in Southern California in 2019 at $11.3 million. Commercial California spiny lobster traps are deployed in shallow coastal water of less than 300 feet (91 meters) (CDFW 2019). According to the most recently published review (CDFW 2018b) of the Spiny Lobster Fishery Management Plan for California (CDFW 2016), the northern Channel Islands are considered hotspots for the commercial California spiny lobster fishery. CDFW (2018b) notes, for example, that catch originating from the Channel Islands in the 2016–2017 commercial season was greater than the catch from the entire Southern California coast combined.

Landing of crabs ranked sixth by value in Southern California in 2019. CDFW lists 11 species of crab caught in Southern California; however, two species of crab, red rock crab and yellow rock crab, constituted 82% of the total catch by value in 2019. The third species of rock crab, brown rock crab, contributed a further 3% of the value of the crab fishery in 2019. Other crab species that contributed a relatively high value to the fishery included box crab (*Lopholithodes foraminatus*) and spider (sheep) crab (*Loxorhynchus grandis*). Rock crab is landed commercially throughout the state year-round (there is no closed season). Point Lopez, in Monterey County, divides a northern management region with open access permits from a southern region that has limited entry. Fishermen use traps of varying dimensions, mesh sizes, and number of chambers, and the traps must have a circular hole of a diameter no less than 3.25 inches (8.25 centimeters) for sublegal-sized crabs to escape (crab carapace must be 4.25 inches [10.80 centimeters] wide for legal take). Peak landings in the fishery's history occurred in 2014, with nearly 2.4 million pounds (CDFW 2020b).

2.3.2 Risks to the Fishery from the Shell Mounds

Because the 4H shell mounds occur on the sea floor, groundfish fisheries, such as trawlers, trap, and drift net fisheries, are the most likely to be affected by the mounds. Many commercial fisheries, such as midwater trawlers and hook-and-line fishermen, do not directly interact with the sea floor, and it is highly unlikely that the temporary effects of a contaminant release caused by seismic activity would reduce local stocks enough to affect commercial catches. These fisheries target such a large area that any localized effects to fish populations from even a large release from the 4H shell mounds caused by a large seismic event that destabilizes the overlying shell layer would not result in a substantial effect to the fishery catch. Further, a large release is unlikely based on the low frequency of large seismic events in the region of the 4H shell mounds (refer to Section 2.4), the apparent stability of the mounds, and the lack of evidence of contaminant release (refer to Section 2.2).

Approximately 10 to 20 commercial trawlers fish in the shell mounds area (Fusaro, pers. comm., 2015). It is understood that these trawlers are primarily targeting California halibut and sea cucumbers. Sea cucumbers ranked as the 16th most valued fishery in California in 2019, according to CDFW data, and California halibut is ranked the 8th most valued. Warty sea cucumbers (*Apostichopus parvimensis*) constitute the majority (76%) of the sea cucumber catch value in Southern California. The remainder of the catch is California sea cucumber (*Apostichopus californicus*) (CDFW 2020a). Halibut bottom trawling generally occurs along sandy and muddy sea floor in approximately 20 to 270 feet (6 to 82 meters) of water; sea cucumbers are also caught within this range. CDFW regulations require that trawlers fish more than 1 nautical mile from shore and only between June 16 and March 14 annually. The shell mounds are located in the California Halibut Trawl Grounds,[9] an approximately 128,640-acre zone within a band from 1 to 3 nautical miles offshore from Point Arguello to Point Mugu. Data from 2019 indicated that approximately one-half of the 41 properly permitted vessels fished in the California Halibut Trawl Grounds (CDFW 2024b), and an older study of harvest data showed the trawlers generally avoided scattered hard substrates that compose approximately 14% of the California Halibut Trawl Ground, which likely included the 4H shell mounds (CDFG 2008).

[9] Although the full California Halibut Trawl Grounds area is approximately 128,640 acres, the California Fish and Game Commission has closed portions of the full area to reduce fishing catch since 2008. As of 2022, approximately one-half (64,912 acres) of the full California Halibut Trawl Grounds area remains open (CDFW 2022).

Trawlers have reported that the mounds and the debris scattered around their periphery can damage fishing gear (SAIC 2003b), and there have been several attempts to limit the damage. In 2013 and 2014, Chevron and the Trawlers Association, in coordination with the Liaison Office in Santa Barbara, negotiated an agreement in which Chevron removed the marker buoys and provided GPS equipment to help trawlers locate and avoid the mounds and debris while fishing. This action reduced the trawling exclusion area to approximately 1,000 acres in the vicinity of the shell mounds and resolved the issue to the satisfaction of the Trawlers Association.

Lobster, red rock crab, and brown rock crab trapping occurs primarily in rocky areas, and sheep crabs (*Loxorhynchus grandis*) and yellow rock crabs are generally trapped in sandy areas. Operators may be attempting to trap on the 4H shell mounds—dive surveyors found abandoned lobster and/or crab traps at more than one location in 2014 and 2022 (see Appendix C1, Tissue Concentrations in Resident Organisms at the 4H Shell Mounds, and Appendix C3, Chevron 4H Shell Mounds Environmental Assessment).

2.3.3 Effects Assessment

Leaving the shell mounds in place would continue to block access to approximately 1,000 acres of the approximately 128,640-acre California Halibut Trawl Grounds, according to the Trawler Compensation Agreements. The DGPS units provided to trawlers by Chevron improved trawler access by allowing the vessels and gear to get within approximately 0.125 nautical miles of each mound, thus reducing the exclusion area from almost 3,000 acres to approximately 1,000 acres. The 4H shell mounds are within depth ranges used by crab and lobster trappers and may continue to be of interest to those fisheries, although such interest would likely decline over time as the mounds become increasingly covered by a layer of sediment, which is less-preferred habitat for crabs and lobsters. Industrial, commercial, and recreational underwater infrastructure and debris in the 4H shell mounds' vicinity would remain and block trawler access, but may also continue to attract other commercial fisheries by providing habitat for target species, such as rockfish and crabs (Bomkamp et al. 2004; Krause et al. 2012). Sea cucumbers, crabs, lobsters, and potentially other commercial fisheries throughout the Southern California Bight will likely continue to show mildly elevated levels of metals in their tissues as a result of background ocean pollution levels not associated with the 4H shell mounds. This is supported by mussel bag studies conducted in 2003 and again in 2023, which found no significant difference in bioaccumulation of metals and other contaminants in experimental mussels deployed at the shell mounds when compared to shallow and deep water reference sites (SAIC 2003a; Appendix C2). The mounds do not pose a risk to crab or lobster trap fishermen in their current state because it is unlikely that the levels of heavy metals or other contaminants from species at the shell mounds would cause harm to crabs or lobsters or to other animals, including humans, that may consume these animals. According to MEC (2002), U.S. Food and Drug Administration chronic consumption levels of concern for nickel in crustacean shellfish are 2,400 micrograms per person per day. Based on the dry weight concentration of 1.87 mg/kg detected in yellow rock crab and a 20% solids content to convert dry weight to wet weight, a person would have to consume 14.1 pounds per day (6.42 kilograms per day) of yellow rock crab over a 70-year lifetime to exceed the consumptive limits. This is an improbably large amount of crab; therefore, human consumption risk is considered negligible (MEC 2002).

An earthquake of sufficient magnitude and proximity (as discussed in Section 2.4) could disturb the 4H shell mounds and release materials such as PCBs, petroleum hydrocarbons, and toxic heavy metals such as barium, chromium, lead, and zinc, which may adversely affect the surrounding water quality and fisheries. Refer to Section 2.1 for details on potential effects on marine water quality. In such an event, CDFW and other agencies would assess the damage and determine whether habitat or commercial fisheries should be closed due to metal contamination. The extent of closures and lack of access to fish or habitat could be short or long term, depending on the severity and longevity of the releases. Local and long-distance fish markets may refuse product if fish is contaminated or if contamination is feared. Closures may reduce income for fishing operators and related businesses.

2.4 Geologic and Seismic Hazards

This section describes the regional and local geologic setting of the 4H shell mounds, as well as geologic hazards, such as seismically induced ground shaking and the potential for slope failure or rupture of the shell mounds.

2.4.1 Setting

The Channel is bounded on the north by the Santa Ynez Mountains and on the south by the Channel Islands (Figure 2-1, Regional Geologic and Seismic Environment). The Channel lies in the western part of the Transverse Ranges geomorphic province, which formed as a result of transpression associated with the Big Bend region of the San Andreas Fault, located approximately 40.4 miles (65 kilometers) north of Ventura (Johnson et al. 2017). The east/west orientation of geologic structures in the Channel contrast with the northwest/southeast trend of the offshore structures in the Southern California Borderland Province to the south of the Channel, and the continental margin of the Central California coast to the north (Johnson et al. 2017). A combination of crustal block rotation and transform motion in the vicinity of the Channel have caused the change in structural orientation over this limited offshore area (Johnson et al. 2017).

Sediments supplied to the Santa Barbara Basin mostly are derived from rivers and tributaries along the coast, each of which may have different sediment characteristics. The Santa Clara River contributes the majority of the sediment to the Channel, with the Ventura River, Gaviota Creek, Rincon Creek, and other smaller watersheds contributing lesser amounts (Johnson et al. 2017). Sediment grain-size distribution in the Channel ranges from medium to fine sands to silty sands to silts due to a variety of sediment sources, variable submarine topography, and a complex circulatory pattern. Sediment transport occurs along the Santa Barbara County coastline in a net easterly direction, beginning east of Point Conception.

Over the past 200 years, several major earthquakes have occurred on faults in the Santa Barbara–Ventura Basin region of the Western Transverse Ranges. High rates of uplift along the coastline are juxtaposed with continuing subsidence of the basins due to regional movement on the San Andreas Fault system during the last 20 to 35 million years (Minerals Management Service 2001). Faulting within the Western Transverse Ranges Geomorphic Province occurs within the distributed plate boundary between the North American and Pacific tectonic plates associated with the San Andreas Fault. However, the faults within the Western Transverse Ranges Geomorphic Province are not considered to be part of the San Andreas Fault system (Minerals Management Service 2001).

Based on U.S. Geological Survey data (USGS 2022) assessed by Fugro (Appendix D), no large earthquakes (moment magnitude [M] 6.0 or larger)[10] have been recorded within 10 miles (16 kilometers) of the 4H shell mounds (records available from 1860 to 2022) (Appendix D). However, a 1925 event that had an uncertain epicenter (Santa Barbara vicinity, offshore, or possibly onshore on the More Ranch or Mesa Fault; M 6.8) may have fallen within the 10-mile radius of the 4H shell mounds. Historical large (greater than approximately M 6.0) earthquakes occurred in the region in 1812, 1854, and 1925 (USGS 2022). The 1812 earthquake, which was located approximately 16 miles (26 kilometers) from the 4H shell mounds and was an estimated M 7.1 (Toppozada et al. 1981), likely occurred on an offshore fault south of the Santa Barbara/Carpinteria region, or possibly onshore on the San Cayetano Fault to the east (Dolan and Rockwell 2001) or the Santa Ynez River Fault to the northwest (Sylvester and Darrow 1979). The 1854 event (M 6.0)

10 The Fugro (2022) analysis (Appendix D) uses the term "moderate" to refer to a 6.0 magnitude event, but that is unique to that analysis because it was comparing different model scenarios. Moderate earthquakes do not exceed M 5.9 on the Richter scale.

was centered in the northern margin of the City of Santa Barbara, approximately 13 miles (21 kilometers) from the 4H shell mounds, and apparently caused heavy surf swell to run up the Santa Barbara shoreline (Trask 1864). Other destructive earthquakes impacting the broader region occurred in 1857 (San Andreas Fault, approximately 100 miles [160 kilometers] from the shell mounds; M 8.1) and 1927 (offshore of Point Arguello, approximately 65 miles [105 kilometers] from the shell mounds; M 7.3). The most recent earthquake near the shell mounds of greater than M 5.0 occurred in 1978 approximately 7.5 miles (12 kilometers) south of Santa Barbara (M 5.1). No records are available documenting the conditions of the 4H shell mounds following this 1978 earthquake (USGS 2022).

The U.S. Geological Survey Working Group on California Earthquake Probabilities completed an assessment of the probability of occurrence of large-magnitude earthquakes for *all* of California (Field et al. 2013). The results of this study indicate that for Southern California, the probability of an M 6.7 or larger quake occurring between 2014 and 2043 is 93%, and the average number of years between earthquakes of M 6.7 or higher is 12 years (USGS 2015). This study also indicated that the probability of an M 6.7 or larger earthquake occurring on the offshore faults within approximately 10 miles (16 kilometers) of the shell mounds is approximately 10%, and the probability of an M 6.0 or larger earthquake occurring between 2014 and 2043 is approximately 23%. Many active faults contribute to this aggregate probability, and several have significance with regard to potential earthquake ground shaking at the 4H shell mound sites. Faults that may cause strong ground shaking at the 4H shell mounds include the Red Mountain, Ventura–Pitas Point-North Channel Fault system, Mission Ridge–Arroyo Parida, Oak Ridge, Santa Ynez, Santa Cruz Island, Channel Islands Thrust, Rincon Creek, Santa Rosa Island Faults, and others (Johnson et al. 2017; Appendix D) (Figure 2-1).

The stability of the 4H shell mounds is affected by their topography and profile, their composition, and the likelihood of a significant disturbance, such as the seismic activity noted above. The ocean floor topography in the vicinity of the 4H shell mounds slopes to the southwest at less than 1% slope gradient. The average slopes on the flanks of the shell mounds range from approximately as shallow as 5:1 (5 horizontal to 1 vertical, or approximately 11.4°) to as steep as 3:1 (18°). The Hazel Platform shell mound has side slopes that are relatively uniform, and the mound is nearly symmetrical. At the other three locations, the shapes of the mounds are less uniform. Core samples collected across 16 locations at the 4H shell mounds in 2000 showed that the mounds were generally composed of a 1- to 7-foot-thick (0.3- to 2.1-meter-thick) layer of shell hash and sediments atop a mixture of drilling mud, drill cuttings, and rock chips referred to as "drilling waste" (Appendix D). Native clay sediments underly the drilling mud, cuttings, and rock chips at all four shell mounds (Appendix D).

Strong earthquake motions have the potential to cause failure of the side slopes of the shell mounds and/or to generate cracks, fissures, and liquefaction associated with sediment boils on the upper surfaces and slopes of the mounds. Slope failure could result as poorly consolidated sediments on the outer margins of the mounds, consolidate and move downslope during an earthquake, undercutting the support for the upper slopes and triggering continued upslope migration of the slide. Cracks, fissures, and liquefaction of poorly consolidated sediment within the mound structures could occur as earthquakes cause adjustments and bending motions along the crest of the Rincon Anticline underlying the shell mounds. Slope failure, cracking, and liquefaction at the mounds could result in exposure of the drilling waste at the surface of the mounds (Appendix D).

Geophysical surveys investigating the bathymetry of the shell mounds were performed at the 4H shell mound sites in 1996, 1999, 2004, 2009, and 2021 (Chevron 2005; Fugro 2009; Appendix D) and suggest that the mounds have remained generally stable since the platforms were removed. Pockmarks and depressions are evident in the bathymetry and were likely caused by removing the platform structures and demolition activities in 1996. The data plots from the surveys of each mound show that the topography of the mounds is nearly identical for all the surveys, including those depressions. The repeated surveys also show no evidence of slope failure, even though the 4H shell mounds have been physically disturbed by various events, including platform removal activities (such as explosive cutting of platform pilings and platform jacket removal), two trawl test events, placement of temporary marker buoys, two debris removal events, two vibracore surveys, and minor earthquakes during the 13-year period of the surveys. ROV surveys conducted in 2022 did not find indications of slope failure or exposure of underlying drill muds (Appendix C3).

2.4.2 Effects Assessment

As described above, the surface topography of the 4H shell mounds has remained stable since 1996 under static conditions, but settlement and slumping could occur during strong ground shaking. Review of mapping of active faults by the U.S. Geological Survey and California Geological Survey indicates that there are active faults within 1 mile of the 4H shell mounds (Figure 2-1).

In 2004, Fugro performed an evaluation of the seismic stability of the 4H shell mounds. This initial slope stability evaluation examined two ground-shaking scenarios on two different mound geometries, for a total of four scenarios, to estimate the potential for slope failure at the shell mounds. The four scenarios tested suggested that the shell mounds could settle/slump on the order of inches in response to a moderate earthquake (M 6.0) within 3 miles of the mounds, and several feet in response to a large earthquake (M 6.5) within 0.5 miles of the mounds, depending on the ground acceleration experienced at the mounds (Fugro 2004). Because the 4H shell mounds do not have a uniform composition, shaking of the mounds could result in non-uniform deformation. The Fugro 2004 study found that settling of the mound material in response to an earthquake would likely cause bulging at the base of the mounds. Additionally, seismic events have the potential to induce localized failures on the slopes of the mounds, where a relatively small area of the mound would flow in a manner similar to a surficial mud flow on land. Such a failure could result in the exposure of the underlying drilling waste as the shell hash layer is carried downslope (Fugro 2004).

In 2022, Fugro updated the initial analysis of slope stability and seismic displacement (Appendix D). This updated analysis estimated the seismic displacement at the 4H shell mounds for a range of earthquake magnitudes and displacements, rather than the four distinct scenarios developed for the 2004 analysis. The earthquake epicenter distance analyzed ranged from less than less than 0.5 miles (1 kilometer) to 10 miles (16 kilometers) from the shell mounds. Magnitude ranged from M 6.0 to M 7.5. The resulting anticipated displacements at the 4H shell mounds were plotted for earthquakes within this range of distances and magnitudes. As expected, smaller-magnitude earthquakes closer to the shell mounds were found to cause the same displacement as larger-magnitude earthquakes centered farther from the shell mounds (Appendix D).

The largest plotted displacement at the mounds was 2.3 feet (70 centimeters), which could occur if an M 7.5 earthquake occurred within 0.3 miles (0.5 kilometers) of the 4H shell mounds (Appendix D). This distance is approximately equal to the distance between the mounds and the nearest active fault. At the same distance, an M 6.0 earthquake could result in 8 inches (20 centimeters) of displacement at the mounds. The smallest plotted displacement was 2.4 inches (5 centimeters) (Appendix D). This displacement could occur for a range of earthquake magnitudes (from M 6.0 to M 7.5) at distances of 3.3 miles (6 kilometers) to 10 miles (16 kilometers) from the 4H shell mound sites.

The most recent evaluation of earthquake probabilities (described in Section 2.4.1) indicates that the annual probability for occurrence of an earthquake greater than approximately M 6.0 that could cause deformation of the 4H shell mounds is approximately 0.8% to 1.0% (USGS 2015). Although the annual probability of an earthquake of this magnitude affecting the mounds is low, the probability that the shell mounds would eventually be affected by ground shaking from an earthquake is high (approximately 25% to 80% for exposure times of 30 to 100 years).

Exposure of a portion of a mound from a slope failure in response to a strong seismic event could result in contaminant releases, which, in turn, could cause adverse impacts to marine water quality and biota (see Sections 2.1 and 2.2). The Fugro 2004 study suggested that the failure mode experienced at the shell mounds would impact the surface area that may be exposed as a result of ground shaking. Dynamic failure along the slope resulting from an M 6.5 earthquake could cause lateral displacements that result in 10% surface area exposure. In contrast, at the same magnitude, liquefaction and lateral spreading of the mound structures could result in a 20% surface exposure, and a debris flow at the mounds could result in 50% exposure of the surface area (Fugro 2004). Although predicting precisely how a seismic event would affect the shell mounds is impractical, ground shaking has the potential to undermine the integrity of the unconsolidated debris overlain by a capping shell hash and result in disturbance of the shell mound materials, including potential slumping, sloughing, settlement, and rupture.

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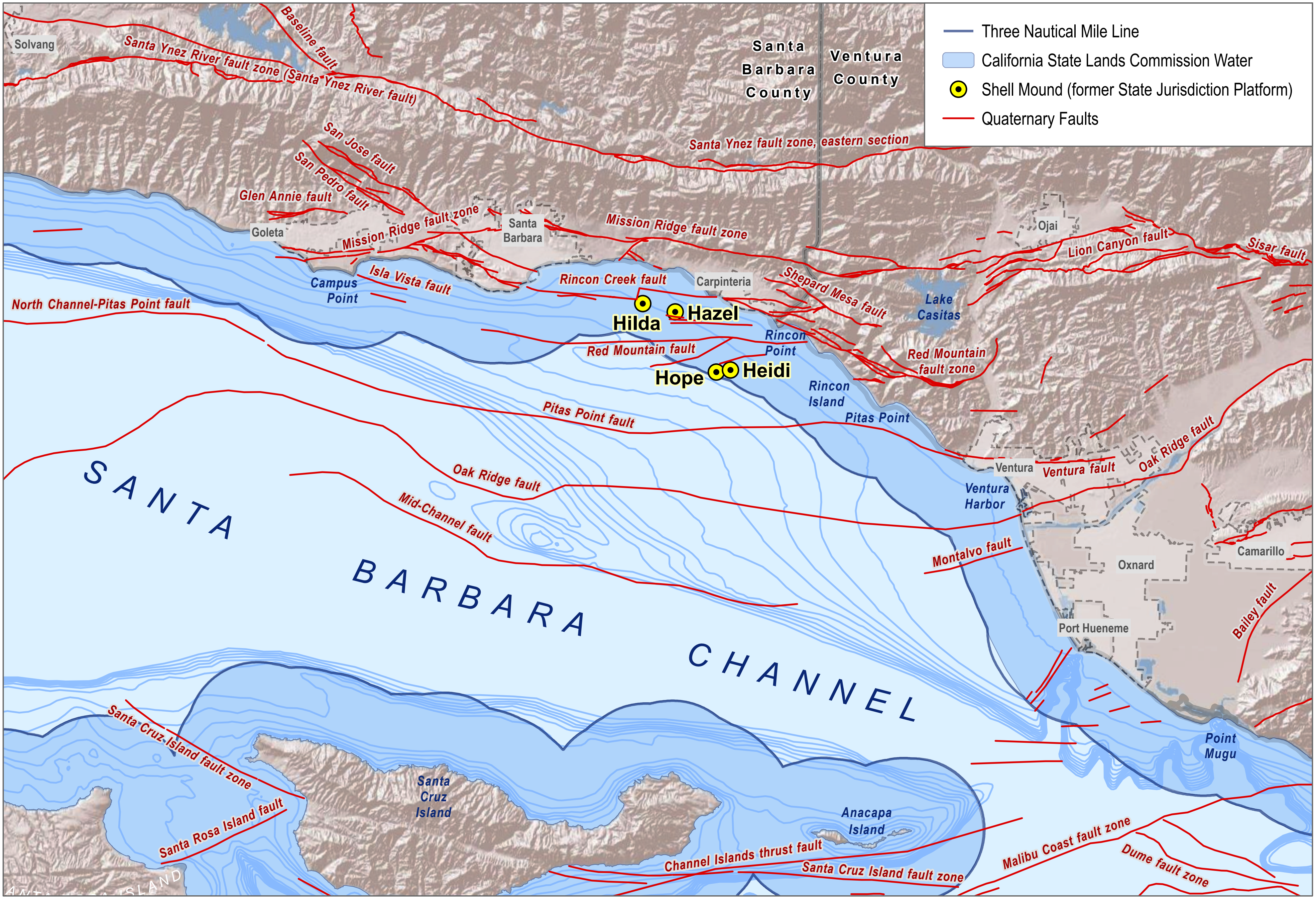

SOURCE: County of Santa Barbara, USGS California Quaternary Faults Offshore, USGS California Geologic Faults Onshore

FIGURE 2-1

Regional Geologic and Seismic Environment

DUDEK 0 2.5 5 Miles

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2.5 Other Issue Areas

2.5.1 Air Quality and Greenhouse Gases

The 4H shell mounds lie within the Santa Barbara County portion of the South Central Coast Air Basin. The Santa Barbara County Air Pollution Control District (District) regulates stationary sources of air pollution in the County, develops guidelines to determine the significance of air quality impacts, and develops plans to bring the County into attainment of the California Ambient Air Quality Standards and National Ambient Air Quality Standards. The District developed the 2013 Clean Air Plan to update the attainment planning process (District 2015). Additionally, the District developed an ozone plan in 2016 and updated it in 2019 (District 2019). The District uses the District Rules and Regulations to implement its air quality plans and regulate emissions from stationary sources of air pollution in the County. The County portion of the South Central Coast Air Basin attains all ambient air quality standards except the state ozone and coarse particulate matter (PM_{10}; particulate matter with a diameter of 10 microns or less) standards.

In April 2015, the District adopted updated guidelines for greenhouse gas (GHG) impacts. The District's GHG threshold is defined in terms of carbon dioxide equivalent, a metric that accounts for the emissions from various GHGs based on their global warming potential. If annual emissions of GHGs exceed these threshold levels, a proposed project would result in a cumulatively considerable contribution of GHG emissions and a cumulatively significant adverse environmental impact. A proposed stationary source project would not have a significant GHG impact if operation of the project would do any of the following:

- Emit less than the screening significance level of 10,000 metric tons per year carbon dioxide equivalent.
- Show compliance with an approved GHG emission reduction plan or GHG mitigation program that avoids or substantially reduces GHG emissions (sources subject to the Assembly Bill 32 Cap-and-Trade requirements pursuant to Title 17, Article 5 [California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms] would meet the criteria).
- Show consistency with the Assembly Bill 32 Scoping Plan GHG emission reduction goals by reducing project emissions 15.3% below business-as-usual levels.

Abandonment of the 4H shell mounds in place would not result in additional emissions over the short term that would affect air quality or GHG emissions. Over the long term, an accidental release of contaminants potentially caused by a major seismic event could indirectly impact air quality as authorities and Chevron use vessels to survey the area in response to the release. Because most released contaminated sediments would settle to the ocean floor, such increases in air pollutant and GHG emissions (e.g., oxides of nitrogen, sulfur dioxide, PM_{10}, and fine particulate matter [$PM_{2.5}$; particulate matter with a diameter of 2.5 microns or less]) due to survey activities would likely be of short duration. However, in the event of a major release, monitoring and testing associated vessels' air and GHG emissions, or even potential cleanup activities, could result in notable but short-term increases in emissions. The prevailing winds in this area are from the west and northwest, which would transport those pollutants along the coastline rather than directly toward land.

Because the presence of the 4H shell mounds would prevent trawling and associated disturbance of the sea floor, mound abandonment may reduce the potential for release of GHGs entrained in the sediment (Sala et al. 2021; Hiddink et al. 2023). The magnitude of effects from trawling on sediment GHG emissions is unsettled science, but it is clear that there is some effect from these activities.

2.5.2 Coastal Processes and Sea Level Rise

The shell mounds lie within the central part of the Santa Barbara littoral cell. Sediment in the littoral cell moves from west to east from Point Arguello in the northwest to Hueneme and Mugu Canyons in the southeast. Alongshore transport rates for the littoral cell are approximated by the 75-year Santa Barbara Harbor and the 44-year Ventura Harbor dredge records, which show mean annual rates of 8 million and 18 million cubic feet of sand removed per year, respectively (Elias et al. 2009). Coarser sediments move down the coast along shorelines, and finer sediments move offshore. Wave energy is generally considered the dominant sediment transport agent to depths of 30 to 100 feet (2 to 30 meters); for comparison, the shell mounds lie in 100 to 140 feet (30 to 43 meters) of water. Sand makes up 5% to 60% of the sediments in depths less than 130 feet (40 meters). At depths greater than approximately 130 feet (40 meters), the percentages of silt and clay increase (Appendix A1).

All four shell mound sites are in a low-energy sedimentation/depositional ocean environment. Ocean currents are generally weak at the 4H shell mound sites, and sedimentation rates are in the range of 0.04 to 0.08 inches (0.1 to 0.2 centimeters) per year. Video footage from numerous historical and recent ROV surveys (Appendix C3), as well as diver surveys, corroborates the conclusion that the shell mounds are in an area of sedimentation. No scouring has been observed on or around the shell mounds. The multibeam surveys performed at the shell mounds indicate that there is no bathymetric depression, or "moat," around the mounds, as would be expected if significant scouring were taking place. Local scouring hypothetically could occur on the western, upcurrent side of the mounds during storm events; however, survey evidence indicates that net sediment accumulation is taking place (Chevron 2005).

Climate change is causing sea level rise through two mechanisms: by melting ice on land, which transfers water to the oceans, and by warming the temperature of ocean water, which causes it to expand. According to website data provided by NOAA Fisheries (NOAA 2022), the mean sea level trend for Santa Barbara, based on monthly mean sea level data from 1973 to 2021, is 0.041 inches (0.104 centimeters) per year with a 95% confidence interval of ±0.036 inches (0.091 centimeters) per year, which is equivalent to a change of 4.1 feet (1.3 meters) in 100 years. The California Ocean Protection Council updated the State of California Sea Level Rise Guidance in 2018 to provide a synthesis of the best available science on sea level rise projections and rates. The Los Angeles tide gauge was used for the projected sea level rise scenario for the lease areas (Ocean Protection Council 2018), as listed in Table 2-4.

Table 2-4. Projected Sea Level Rise for Los Angeles

Year	Projected Sea Level Rise in Feet
2030	0.7
2040	1.2
2050	1.8
2100	6.7

Source: Ocean Protection Council 2018, Table 28.
Note: Projections are relative to a 1991 to 2009 baseline.

Abandonment of the 4H shell mounds in place would not affect ongoing littoral transport, wave action, or other coastal processes. Sediment would continue to accumulate on the shell mounds at a rate of 0.04 to 0.08 inches (0.10 to 0.20 centimeters) per year.

The shell mounds currently lie under 100 to 140 feet (30 to 43 meters) of water. Because the shell mounds are inundated, abandoning them in place would not be impacted by sea level rise.

2.5.3 Cultural, Tribal Cultural, and Paleontological Resources

Documentation of submerged cultural resources in the vicinity of the 4H shell mounds has primarily been of shipwrecks. An inventory of more than 140 shipwrecks dating from 1853 to 2008 has been documented for the Channel Islands National Marine Sanctuary (Sanctuary) and includes Chinese junks, Russian and Mexican sailing ships, American coastal traders, and Gold Rush-era steamships. Of these wrecks, 30 have known locations (Sanctuary 2010). The listed shipwrecks include fishing boats, barges, yachts, cargo carriers, passenger ships, freighters, and target ships. Reasons for their demise have included mechanical failure, fire, collision, grounding, or capsizing. The most common reasons for shipwrecks were either running aground on natural hazards, such as prominent rocks, or colliding in harbors during stormy weather. Shipwrecks are common along much of the Southern California coastline, but are especially concentrated in the Goleta, Santa Barbara, and Ventura areas in the general region of the 4H shell mounds. Aircraft wrecks have also been documented within the Sanctuary, and there are likely others outside the Sanctuary in the Channel (Sanctuary 2022).

In 2004, the California Historic Resources Information Center and the shipwreck database maintained by the SLC were consulted (SLC 2018). Cultural resources data maintained by the Sanctuary was also reviewed (Chevron 2005). Previous investigations found no cultural resources, including shipwrecks, historic structures or buildings, or prehistoric resources, within a 1-mile (1.6-kilometer) radius of the 4H shell mounds (Appendix A1; Chevron 2005). The likelihood that unrecorded shipwrecks are located within the area is very small. The shell mounds area is outside the Traffic Separation Scheme lanes used by large vessels transiting the Channel; however, numerous small recreational boats (e.g., sailboats, motorboats) have frequented this offshore region. Unrecorded sinkings may have occurred, but it is unlikely that most would be more than 50 years old.

Although there are no known underwater archaeological or tribal cultural resources in the vicinity of the 4H shell mounds, two types of tribal cultural resources may occur within the water depths in the Project area: (1) in situ prehistoric remains that predate the Holocene marine transgression (prior to AD 700) and that are situated on relict, submerged landforms, either mantled with unconsolidated marine sediments or exposed on bedrock outcrops; and (2) remains deposited subsequent to the Holocene marine transgression and situated on the sea floor or within unconsolidated recent sediments. These remains would consist primarily of isolated prehistoric and historic artifacts (e.g., stone tools). However, due to previous bottom disturbance from the original construction of the oil platforms, it is highly unlikely that unrecorded, intact, submerged prehistoric or historic remains, including tribal cultural resources, exist within the area.

No disturbance of the sea floor would occur if the 4H shell mounds were abandoned in place, which would eliminate the potential for discovery or disturbance of undocumented submarine cultural, tribal cultural, or paleontological resources. Therefore, no impacts to cultural, tribal cultural, or paleontological resources would occur.

2.5.4 Environmental Justice

The 4H shell mound sites are located between approximately 1.5 and 2.6 nautical miles offshore of Santa Barbara County, distant from any onshore human population areas.

Abandonment of the shell mounds in place would not result in disproportionately high or adverse health or environmental effects on minority or low-income populations because there are no nearby populations, and no disturbance of the shell mounds would occur. Over the long term, a potential release of contaminants caused by a major seismic event could indirectly impact minority or low-income populations if authorities closed offshore waters, and potentially area beaches, in response to a release of contaminants. Most released contaminated sediments would settle to the ocean floor; as such, closure of beaches and associated impacts to minority and low-income populations would likely be brief, if they occur at all. Although the shell mounds are within 5 miles (8 kilometers) of several likely sensitive receptors (e.g., schools, daycare centers), the high levels of dispersion and mixing associated with the offshore environment would ensure that no effects to sensitive receptors are caused by any vessel traffic required for monitoring in the event of a seismic event. There is no evidence that the 4H shell mounds area is used for subsistence fishing. Nonetheless, closure of waters surrounding a potentially damaged mound to recreational boating and fishing could be extended while authorities attempt to determine the extent of contamination and any required cleanup.

2.5.5 Navigation, Transportation, and Traffic

The 4H shell mound sites are within the Channel, approximately 1.5 to 2.6 nautical miles offshore of Santa Barbara County. The sites are characterized by open coastal waters bounded generally by the Channel Islands and nearshore coastal areas along the California mainland.

The Channel is the primary offshore vessel corridor in the vicinity of the 4H shell mound sites and is heavily traveled, particularly by northbound and southbound vessels entering and leaving the Port of Los Angeles and the Port of Long Beach. The Channel is 63 miles (101 kilometers) long and increases gradually in width from 11 miles

(18 kilometers) at the eastern end to 23 miles (37 kilometers) at the western end (NOAA 2024). Most California coastwise vessel traffic passes through the Channel on the way to major ports on the U.S. West Coast. However, since the California Air Resources Board implemented rules regarding use of low-sulfur fuels in state waters in 2009, a substantial increase in large vessel traffic south of the Channel Islands has occurred, potentially reducing the effects of increased regional shipping activity within the Channel (Betz et al. 2011). Vessel transportation in the Channel includes military, research, recreational, and commercial vessels, such as tankers, container ships, bulk carriers, cruise ships, tugs and tows, commercial fishing boats, and oil and gas tankers.

Offshore traffic flow of large cargo ships and tanker vessels is controlled by the U.S. Coast Guard, and smaller vessels are controlled by local jurisdictions/harbor patrols. These flow controls are designed and implemented to ensure safety and to minimize congestion in harbors and ports of entry (NOAA 2024).

The shell mounds lie in 100 to 140 feet (30 to 43 meters) of water, and therefore do not interfere with navigation. In addition, the temporary marker buoys that once marked the locations of the mounds for commercial fishermen (see discussion in Section 1.5) have been removed according to SLC directives and no longer impede navigation. Because the 4H shell mounds are located entirely offshore, onshore transportation and traffic would not be affected. Although there is no particular reason for a vessel to visit the shell mound sites, it is possible that vessels could set anchor on or near the mounds. The mounds themselves do not pose a risk for anchor entanglement or loss because they are composed of loose shell hash and sediments; however, the area on and surrounding the mounds has been documented to retain various types of debris from well production and subsequent activities. These debris types include anchor chains (likely from the marker buoys installed at the site) and remnant debris from when the platforms were in active production and/or decommissioning and removal (Appendix C3). At the Hazel Platform shell mound, the large caissons extend above the sea floor and above the level of the mounds in some areas, although most of the Hazel Platform caissons are buried. Any sea floor debris poses a risk of anchor snagging. Refer to Section 2.1.2 regarding the potential for anchors to disturb the shell hash overlying the drill muds and cause effects to water quality.

2.5.6 Noise

The 4H shell mounds are approximately 1.5 to 2.6 nautical miles offshore of Santa Barbara County, where the only noise is from natural sources, such as wind and wave action, and from passing vessels. Based on noise measurements conducted in 2006 for the Venoco Paredon EIR,[11] ambient noise levels on the bluffs at the shoreline where wave noise is audible can be expected to range from approximately 50 to 60 A-weighted decibels, depending on wind and wave conditions (City of Carpinteria 2007). Directly on the beach, where surf sounds are not blocked by the topography, ambient noise levels were in the range of approximately 65 to 70 A-weighted decibels (City of Carpinteria 2007). Offshore from the beach, ambient noise levels may be lower except during high wind or wave events.

No disturbance of the 4H shell mounds or sea floor would occur if the shell mounds were abandoned in place. The only time noise would be generated by abandonment of the 4H shell mounds would be if vessels mobilized to the site after a seismic event to conduct monitoring. The vessels would be present for a relatively short duration (likely less than 2 weeks) and would generate relatively low levels of noise given the existing sound environment of vessel traffic within the Channel. Therefore, abandonment of the shell mounds in place would not result in substantial additional noise.

2.5.7 Public Safety and Hazards

The wells of the 4H Platforms were shut in prior to September 1992. All the platforms, except for remnants of the four caissons at the Hazel Platform site, were removed to below the mudline in 1996. The closed wells remain beneath the mounds at an approximate depth of 5 feet (1.5 meters) below the natural mudline. The shell mound sites have remained unused and largely intact since 1996. The shell mounds appear relatively resistant to disturbance by natural processes, fishing activities, and scientific studies that have occurred since the platforms were removed.

Effects related to potential releases of mound contaminants to the water column are described in Section 2.1, and effects on marine biological resources that could be consumed by humans are described in Section 2.2.

No evidence that contaminants are leaching from the mounds has been detected (see Sections 2.1 and 2.2). Analyses of chemistry, toxicity, and bioaccumulation data did not indicate consistent differences between shell mound and reference site invertebrates and fish organisms with respect to the magnitude of known shell-mound-related contaminants that have the greatest potential for bioaccumulation. Additionally, concentrations of contaminants observed in resident marine organism tissue samples were recorded below levels that would represent a human health concern.

[11] The referenced EIR is unrelated to the 4H shell mounds and is referenced solely for ambient noise measurements.

Prior to the agreement between Chevron and the Liaison Office and the completion of the Trawler Compensation Agreements, the primary potential hazard to human safety associated with the shell mounds and Hazel Platform caissons was the tendency for trawl nets to become entangled in debris on the mounds or on the remnant platform legs at the Hazel Platform site (see Section 1.4). Although remnant debris at the site could still cause entanglement of trawl nets, this hazard to commercial fishing operations is no longer an issue due to completed mitigation (see Section 1.5 and Section 2.3).

Other than the potential for contaminant release due to a major and proximate seismic event (see Section 2.4), abandonment of the shell mounds in place would not create a hazard or affect public safety. Over the long term, an accidental release of contaminants caused by a major seismic event could indirectly impact public health through contamination of offshore waters and marine species consumed by the public. Because most releases of contaminated sediments would settle to the ocean floor and disperse, contamination of offshore waters is likely to be of short duration, although some limited potential exists for public consumption of contaminated fish and invertebrate species that are caught through recreational and commercial fishing. Although authorities would likely close the waters surrounding a potentially damaged mound to recreational and commercial fishing, an unknown potential exists for marine species inhabiting or passing through contaminated waters to be consumed by the public. However, sustained consumption of contaminated catch is unlikely, reducing the potential long-term consequences to public health.

2.5.8 Recreation, Public Access, and Land Use

The shell mound sites are 1.5 to 2.6 nautical miles offshore of Santa Barbara County. The closest small-craft harbors are in the City of Santa Barbara (approximately 9.2 nautical miles to the west) and in the City of Ventura (approximately 14 nautical miles to the east). Both support full-service marinas offering fishing and diving charters, whale watching and island cruises, and public boat ramps. Both Santa Barbara and Ventura Harbors provide service to Channel Islands National Park, with one or more boats departing daily for the islands (Channel Islands Harbor 2024; Santa Barbara Harbor 2024). Additionally, Channel Islands Harbor in Oxnard, located 6.8 nautical miles southeast of Ventura Harbor, provides transport to the Channel Islands, sport and commercial fishing dock space, and 11 marinas (Channel Islands Harbor 2024). Recreational boaters periodically traverse the general area surrounding the 4H shell mounds; however, because of the distance from the nearest harbor, the area does not support a heavy concentration of boating activity.

In the vicinity of the shell mounds, boat-based anglers fish for rockfish during the regulated season, which is open from March 1 to December 1, and for scorpionfish during the scorpionfish season, which is open from January 1 to August 1. Sand bass and croakers are fished year-round (CDFW 2024b).

Prior to their removal, the 4H Platforms were relatively productive areas for kelp bass and rockfish recreational catches (de Wit 2001). After the platforms were removed, McCrea and Diamond (cited in de Wit 2001) reported that the shell mounds had only limited recreational fishing value. Private boaters and commercial charters occasionally visited the mounds to fish for croakers, sand bass, and scorpionfish. A few rockfish and salmon were also caught. More recent studies and surveys corroborate the earlier reports. Page et al. (2005b) concluded that the shell mounds support fewer and smaller invertebrates than mounds underneath existing platforms. In 2014, dive surveyors observed hard-bottom invertebrates and rockfish in lower numbers than those observed at a natural hard-bottom reference location (AMEC Foster Wheeler 2015).

Whale watching excursions depart Santa Barbara Harbor year-round and traverse the coastal waters in the general Project area; however, whales are not commonly seen in the vicinity of the shell mounds. The abundance of whales is much greater farther offshore and at the Channel Islands. Trips to Channel Islands National Park are regularly conducted December to April (during gray whale migration) and periodically during summer (for blue and humpback whales in the western part of the Channel). The shell mounds area is not a whale-watching destination.

The shell mounds are not a destination for recreational diving. The depth of the shell mounds (approximately 96 to 137 feet [29 to 42 meters] below surface) limits their accessibility to diving, and these sites consist of mud and shells that do not support an especially productive or diverse biological community that would be attractive to divers.

In the event that monitoring is needed following a seismic event, any barriers to access, use, or recreation would be temporary and would not substantially affect public access. Over the long term, an accidental release of contaminants potentially caused by a major seismic event could indirectly impact recreational use of offshore waters, as authorities could close the vicinity of the shell mounds to fishing or other recreation in response to a release of contaminants. However, because the 4H shell mounds are located well offshore and because most of the released contaminated sediments would settle to the ocean floor, impacts to nearshore recreation, including beach closures, are not expected in response to a seismic event and potential associated release of contaminants. Closure of the waters surrounding a potentially damaged mound to recreational boating and fishing would last until authorities determine the extent of contamination and any required cleanup. However, as noted above, the shell mounds are not a destination for recreational activities, and any effects would be minor.

2.5.9 Scenic Resources

The 4H shell mounds are located within the Channel, approximately 1.5 to 2.6 nautical miles offshore of Santa Barbara County. The site is characterized as open coastal waters surrounded by the Channel Islands and nearshore coastal areas along the California mainland. The site vicinity includes several offshore oil platforms.

If the shell mounds were above water, their locations are close enough to be partially visible from surrounding public viewpoints, including from vessels traveling in the Channel, mainland coastal areas, and Santa Cruz Island. However, their deep underwater location (approximately 96 to 137 feet [29 to 42 meters]in depth) means they are not visible at the surface. If the shell mounds remain in place, the only time that scenic resources could be affected would be if vessels mobilized to the site after a seismic event to conduct monitoring. The vessels would be present for a relatively short duration (likely less than 2 weeks), which would cause a minimal effect on scenic resources given the existing visual environment of vessel traffic within the Channel.

3 Comparison of Effects with Full Removal of the Shell Mounds

Table 3-1 provides a summary of effects from retention of the 4H shell mounds compared to full removal of the mounds. Refer to Appendix B for a detailed analysis of effects from mound removal.

Table 3-1. Effects of Retention of the Shell Mounds versus Full Removal

Affected Resource	Shell Mounds Left in Place	Shell Mounds Fully Removed via Dredging
Commercial Fishing	**Near-term:** Abandonment of the shell mounds in place would not constitute a risk of contaminant exposure in the marine environment under existing conditions unless the outer cover of the shell mounds is disturbed by a catastrophic event, such as a major earthquake.	**Near-term:** The process of dredging the 4H shell mounds would expose substantial amounts of sediment contaminated with various drill mud chemicals. The California Department of Fish and Wildlife and other agencies would assess the damage and determine if habitat or commercial fisheries should be closed due to metal contamination.
	Long-term: Abandonment of the shell mounds in place would not constitute a risk of contaminant exposure in the marine environment under existing conditions unless the outer covers of the shell mounds gradually deteriorate as a consequence of ocean acidification and warming, or are disturbed by a catastrophic event, such as a major earthquake.	**Long-term:** Metals and various chemicals contained in the drill muds and cuttings that are disturbed but not captured by the removal process would either disperse or react in the water column and settle to the sea floor. Some chemicals would degrade or be modified over time, but those that are buried within the sediment may persist. An increase in sea floor available for trawling, specifically 6.4 nautical square miles of halibut trawling area, would be available to commercial fishermen, approximately 20% of the available trawling area within Fish Block 652 (de Wit 2001).

Table 3-1. Effects of Retention of the Shell Mounds versus Full Removal

Affected Resource	Shell Mounds Left in Place	Shell Mounds Fully Removed via Dredging
Marine Water Quality	**Near-term:** Adverse effects from mound contaminants escaping from the intact mounds would be minimal. Over the near term, the potential for a large disturbance that would expose buried drill muds is relatively low; therefore, the potential impact to water quality from retaining the mounds is also low.	**Near-term:** The process of dredging the 4H shell mounds would expose substantial amounts of sediment contaminated with various drill mud chemicals. These would be suspended and resuspended in the water column continuously during dredging operations, both at the sea floor and in the water column as the dredge is brought to the surface. This continual suspension of sediments would increase exposure time to the water column and allow for additional spread to the vicinity, up to 0.6 miles (1 kilometer) from the mounds. Modeling of estimated contaminant concentrations at the dredge site and 328 feet (100 meters) away indicates that chromium, copper, lead, zinc, PAHs, and PCBs could exceed one or more of the acute or chronic California Ocean Plan or U.S. Environmental Protection Agency water quality criteria (SAIC 2003b).
	Long-term: The shell mounds would continue to provide a potential future source of impact to marine water quality, primarily in the event of a large disturbance that exposes a substantial area of the drill muds to the water column. During such an event, contamination would likely be localized and not long lasting because contaminants would disperse	**Long-term:** Most contaminated sediments within the mounds would be removed, leaving only the remnants lost to the vicinity during dredging operations. Future seismic events would not have the potential to trigger adverse effects on water quality from disturbance of the mounds.

Table 3-1. Effects of Retention of the Shell Mounds versus Full Removal

Affected Resource	Shell Mounds Left in Place	Shell Mounds Fully Removed via Dredging
	from the shell mounds and settle to the sea floor. The settling of released contaminants on the sea floor could result in an area of sediments with elevated contaminant levels for some limited distance around the shell mounds.	
Marine Biological Resources	**Near-term:** The shell mounds would continue to provide relatively low-quality habitat for reef-associated organisms, but greater overall habitat value than surrounding soft-bottom habitat. No effects would occur in the near term when compared to baseline conditions.	**Near-term:** Populations of sessile invertebrates would suffer 100% mortality, and fishes that successfully emigrated from the site would most likely then be subjected to the high levels of fishing mortality present throughout the Southern California Bight. Noise effects on marine mammals could result from dredging activity and vessel movements, and demolition of Platform Hazel caissons could cause potential damage or loss to mammals, fish, birds, and invertebrates.
	Long-term: Habitat value of the mounds would likely continue to slowly decline over time due to settling, sedimentation, and loss of hard-bottom structure, eventually approaching the habitat value of surrounding soft-bottom substrates. The timing of that decline is difficult to predict. The mounds would continue to provide a potential source of contaminant release upon disturbance (e.g., seismic, trawling) to surrounding waters and organisms occupying the	**Long-term:** Dispersal of contaminated sediments could result in longer-term bioaccumulation in benthic organisms, such as crabs. This is especially true for metals, which would not degrade over time. Mound removal would result in loss of habitat for fish and invertebrates.

Table 3-1. Effects of Retention of the Shell Mounds versus Full Removal

Affected Resource	Shell Mounds Left in Place	Shell Mounds Fully Removed via Dredging
	mounds, as well as potential for bioaccumulation of contaminants in species that feed on mound residents.	
Geologic and Seismic Hazards	**Near-term:** The shell mounds appear to be stable but could possibly be disturbed by major ground shaking. Absent a major seismic or storm event, the shell mounds represent relatively stable geologic features that are unlikely to shift or collapse, with a low average annual potential for slumping or collapse and associated release of embedded contaminants.	**Near-term:** Removal would eliminate near-term risks of mound collapse or disturbance from a seismic event. The onshore disposal site would not be vulnerable to effects from seismic disturbance because those effects are specific to marine water quality and the marine biological communities on the mounds.
	Long-term: Chances of a major seismic event and associated potential for release of contaminated materials with secondary impacts to water quality and marine biota would increase over time. In the event of a major seismic event near the mounds, minimal to substantial volumes of contaminated sediments may be temporarily released into the water column, with associated potential to impact marine organisms living on and around the shell mounds for an indeterminate period (see Section 2.1, Marine Water Quality, and Section 2.2, Marine Biological Resources).	**Long-term:** Removal would eliminate long-term risks of mound collapse or disturbance from a seismic event. The onshore disposal site would not be vulnerable to effects from seismic disturbance because those effects are specific to marine water quality and the marine biological communities on the mounds.

Table 3-1. Effects of Retention of the Shell Mounds versus Full Removal

Affected Resource	Shell Mounds Left in Place	Shell Mounds Fully Removed via Dredging
Other Issue Areas	**Near-term:** Impacts to other issue areas would remain either nonexistent (coastal processes and sea level rise; cultural, tribal cultural, and paleontological resources; environmental justice; noise; scenic resources) or minor (air quality and greenhouse gases; recreation, public access, and land use; navigation, transportation, and public safety and hazards).	**Near-term:** Removal of mound materials would cause substantial emissions of air quality pollutants and greenhouse gases from the dredging operations and from marine- and land-based transport to the onshore disposal site. These activities would also cause adverse effects to scenic resources while dredging vessels are located above the mounds and potential disturbance to navigation patterns and recreational access during dredging and transport, for a period of up to 15 months. Finally, the transport of contaminated sediments through ports, such as the Port of Los Angeles or Long Beach, could result in environmental justice impacts, as could the land-based transport to remote hazardous waste disposal facilities.
	Long-term: Impacts to other issue areas would remain as described for the near term.	**Long-term:** After removal, no additional impacts to other issue areas would be expected.

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4 Preparation Sources

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Appendix A1

Adopted Mitigated Negative Declaration

MINUTE ITEM
This Calendar Item No. 54
was approved as Minute Item
No. 54 by the State Lands
Commission by a vote of 3
to 0 at its 8/3/94
meeting.

CALENDAR ITEM

54

A 35

S 18

08/03/94 PRC 1824
W 40654 PRC 3150
Johnson
Gonzalez
Walker

ADOPT MITIGATED NEGATIVE DECLARATION AND APPROVE THE ABANDONMENT AND REMOVAL OF FOUR OFFSHORE OIL PLATFORMS, SANTA BARBARA COUNTY

LESSEE:

Chevron U.S.A. Inc.
Attn: Mr. G. W. Gray
P. O. Box 6917
Ventura, California 93006

AREA, TYPE LAND AND LOCATION:

Oil drilling and production Platforms Hazel and Hilda, located on State oil and gas lease PRC 1824, and Platforms Hope and Heidi on State oil and gas lease PRC 3150 are located on State tide and submerged lands in the eastern portion of the Santa Barbara Channel, Santa Barbara County (Exhibit"A").

BACKGROUND:

Platform Hazel was installed in 1958 and Platform Hilda in 1960. Platforms Hope and Heidi were constructed on lease PRC 3150 in 1965. During the life of the four platforms, production totaled approximately 62.3 million barrels of crude oil and 132.8 million cubic feet of natural gas. All of the platforms were shut-in in 1992.

Chevron plans to abandon and remove Platforms Hope, Heidi, Hilda and Hazel and abandon associated oil and gas pipelines in the manner and under conditions specified in the proposed Mitigated Negative Declaration ND 652, Sch. No. 94051016 (Exhibit "B") and the list of Project Stipulations (Exhibit "C").

In summary, a contractor hired by Chevron, after conducting a seafloor survey of the site to locate subsurface debris and establish anchor and mooring sites for the project removal equipment, will dismantle the platforms in several distinct procedures including decommissioning of the auxiliary and emergency equipment, sectioning of the platform decks for removal by a derrick barge and cutting of the pilings and conductors to allow for removal of the platform jackets. Mechanical cutting methods will be used for the legs of Platform Hazel and explosive cutting for the piles and conductors of the other three platforms.

In an associated but separate activity, pipelines between Platform Hope and the shoreline will be repositioned and left to service production from Platforms Grace and Gail in Federal waters which previously produced to Platform Hope and then onto shore. The remaining pipelines from Hazel, Heidi and Hilda will be cleaned by flushing and running a "pig" through the lines to remove all hydrocarbons, filled with grout or other inert substances, and abandoned in place. All platform materials will be taken by barge to the Port of Long Beach/Los Angeles for onshore salvage and disposal. The final step in abandonment will be a cleanup of any debris from the removal operations or debris which was located during the initial site surveys.

Chevron U.S.A., Inc. remains the State's lessee on the affected leases, PRC 1824 and PRC 3150.

STATUTORY AND OTHER REFERENCES:

A. P.R.C.: Div. 6, Parts 1 and 2; Div. 13.

B. Cal. Code Regs.: Title 3, Div. 3; Title 14, Div. 6.

AB 884:

08/11/94

OTHER PERTINENT INFORMATION:

1. Pursuant to the Commission's delegation of authority and the State CEQA Guidelines (14 Cal. Code Regs. 15025), the staff has prepared a Proposed Mitigated Negative Declaration identified as EIR ND 652, State Clearinghouse No. 94051016. The Proposed Negative Declaration was prepared and circulated for public review pursuant to the provisions of CEQA.

   During the public comment period, staff received letters from the federal Minerals Management Service (MMS), the California Coastal Commission (CCC), the Santa Barbara County Air Pollution Control District (APCD), and the Energy Division, County of Santa Barbara Resource Management

Department. The major concerns of each agency and staff's responses are summarized below. Staff's detailed responses to each comment received have been furnished to the Commission and each commentor.

Minerals Management Service
The MMS expressed its concern that the placement and use of the derrick barge for the removal of Platform Hope not adversely impact the pipelines that will be rerouted around Platform Hope and remain in place to service Platforms Grace and Gail in the federal OCS. Stipulation 3 in Exhibit "C" has been added to require the placement of the derrick barge on the west side of Platform Hope, i.e., the side opposite the pipelines.

California Coastal Commission
The CCC's comments focused primarily on the issue of abandonment of facilities, both pipelines and platform components, in place versus their removal. Of primary concern was any potential interference with commercial fishing activities that might be restored to the area subsequent to the removal of the platforms. The CCC also suggested that the observers that are proposed, among other purposes, to ensure that no marine mammals are present within a defined zone of potential impact during the use of explosives in the removal procedures be "independent" of Chevron or its contractors.

Staff provided the CCC additional information regarding the considerations that were used to elect to abandon certain facilities and remove others. In addition, Stipulations 2 (independent observers), 4 (test trawls at each former platform location), 5 (underwater surveys of abandoned facilities) and 6 (removal of abandoned facilities at the Commission's discretion) in Exhibit "C" are proposed in further response to the CCC's concerns.

Santa Barbara County Air Pollution Control District
The APCD recommended in their letter of May 24, 1994, that an environmental impact report (EIR) be prepared in deference to the proposed Mitigated Negative Declaration (MND). The District also indicated that the proposed ...abandonment and removal of the platforms constitute a construction activity" for which air emission offsets would be required if pollutant levels were above stated levels.

In a subsequent letter of May 27, 1994, the District indicated that a mitigated negative declaration was appropriate and listed measures that would reduce the identified emission levels. In its response to the District, staff indicated that such measures were specified in the Commission's environmental documentation. On further review, staff determined, on the basis of the information contained in the proposed MND and the District's rules governing "construction" activities, that the regulated emissions associated with the project are below the threshold above which offsets would be necessary.

However, in a letter of July 20, 1994, the District reiterated its position that offsets were required in addition to the measures specified in their letter of May 27. Staff sought additional clarification from the District and were advised that the District now regards the proposed activity as a "new source" rather than a "construction" activity as previously indicated. Under such classification, emissions are evaluated under different threshold criteria.

In sum, while the issues have been better defined and focused, the extent and requirements of Chevron's authorization from the District will require additional discussions between the parties.

Energy Division, County of Santa Barbara
As an "interested agency", the County, through the staff of the Energy Division recommended that an EIR be prepared for the project on the basis of potential air quality impacts (see preceding discussion) and potential impacts to marine resources, i.e., in conjunction with an oil spill and the use of explosives. Staff believes that sufficient information and analyses exist within the proposed MND to mitigate the impacts identified.

The County's comments also addressed issues raised by the CCC as above described. In addition to the stipulations described with respect to the CCC, Stipulation 1 is incorporated in response to the County's specific recommendations.

Based upon the Initial Study, the Proposed Mitigated Negative Declaration, and the comments received in response thereto, and the stipulations incorporated therein, there is no substantial evidence that the project will have a significant effect on the environment. (14 Cal. Code Regs. 15074(b))

A copy of the environmental document is attached as Exhibit "B".

2. This activity involves lands identified as possessing significant environmental values pursuant to P.R.C. 6370 et seq. Based upon the staff's consultation with the Department of Fish and Game and through the CEQA process, it is the staff's opinion that the project, as proposed, is consistent with the use classification.

EXHIBITS:
- A. Location Map
- B. Negative Declaration
- C. Stipulations
- D. Mitigation Monitoring Plan

IT IS RECOMMENDED THAT THE COMMISSION:

1. CERTIFY THAT A PROPOSED NEGATIVE DECLARATION, ND 652, STATE CLEARINGHOUSE NO. 94051016, WAS PREPARED FOR THIS PROJECT PURSUANT TO THE PROVISIONS OF THE CEQA AND THAT THE COMMISSION HAS REVIEWED AND CONSIDERED THE INFORMATION CONTAINED THEREIN AND THE COMMENTS RECEIVED IN RESPONSE THERETO.

2. ADOPT THE MITIGATED NEGATIVE DECLARATION AND DETERMINE THAT THE PROJECT, AS APPROVED, WILL NOT HAVE A SIGNIFICANT EFFECT ON THE ENVIRONMENT.

3. ADOPT THE STIPULATIONS TO THE PROJECT AS CONTAINED IN EXHIBIT "C", ATTACHED HERETO.

4. ADOPT THE MITIGATION MONITORING PLAN, AS CONTAINED IN EXHIBIT "D" ATTACHED HERETO.

5. FIND THAT THIS ACTIVITY IS CONSISTENT WITH THE USE CLASSIFICATION DESIGNATED FOR THE LAND PURSUANT TO P.R.C. 6370 ET. SEQ.

6. APPROVE, IN THE MANNER DESCRIBED IN THE DOCUMENTATION CONTAINED IN EXHIBITS "B" AND "C", THE REMOVAL, WITH STIPULATIONS, OF PLATFORMS HAZEL, HILDA, HOPE AND HEIDI FROM STATE OIL AND GAS LEASES PRC 1824 AND 3150 TOGETHER WITH THE ABANDONMENT OF THE ASSOCIATED OIL AND GAS PIPELINES WITH DISPOSAL OF THE PLATFORM STRUCTURE MATERIAL AT THE ONSHORE SITE AS DETAILED IN THE ATTACHED EXHIBIT "B".

7. AUTHORIZE STAFF TO TAKE ALL ACTIONS NECESSARY TO IMPLEMENT THIS PROJECT CONSISTENT WITH: 1) THE COMMISSION'S RULES AND REGULATIONS; 2) SOUND ENGINEERING PRACTICES; AND 3) MAXIMUM FEASIBLE PROTECTION OF THE ENVIRONMENT.

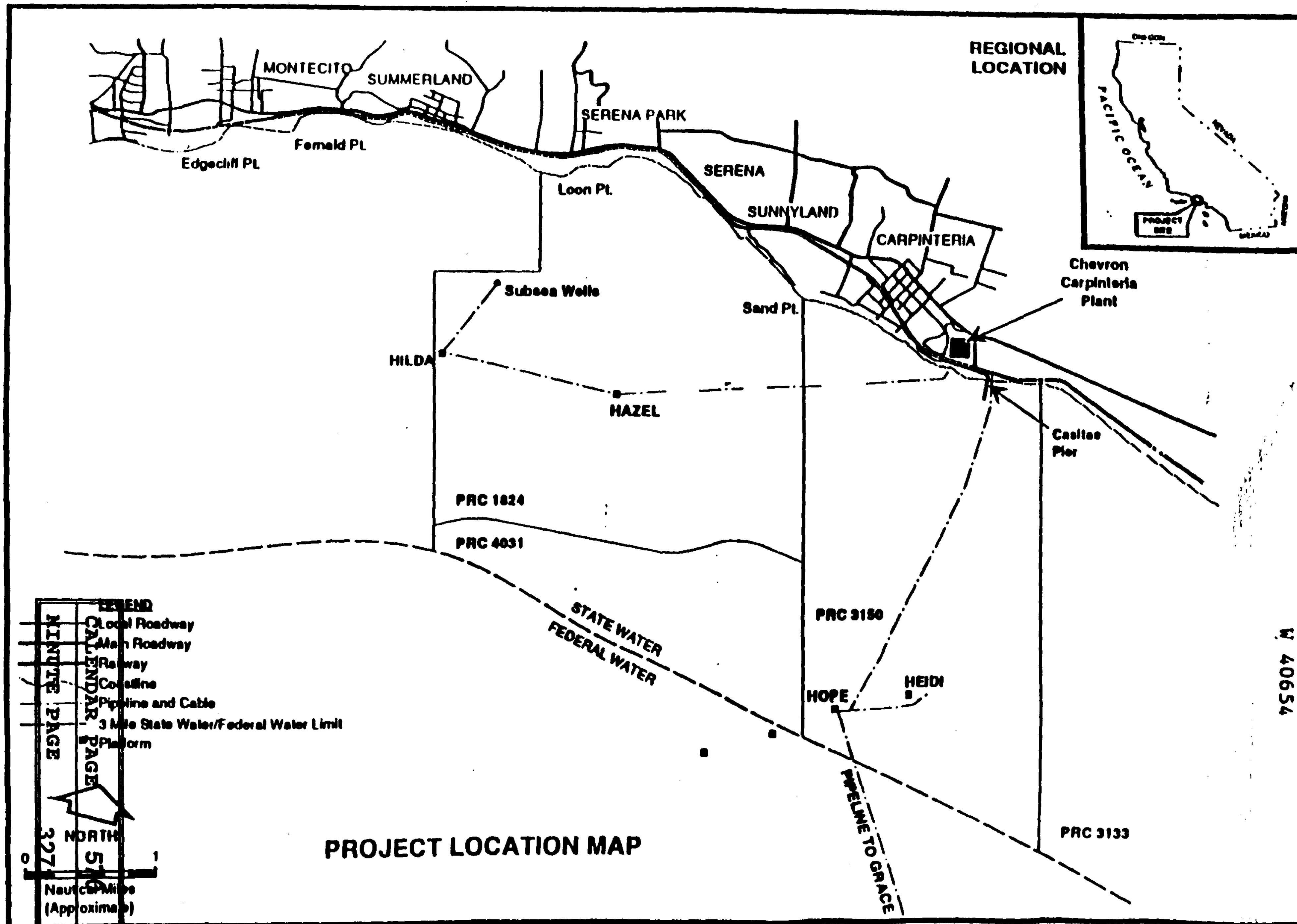

FIGURE 1.2-1

EXHIBIT A

W 40654

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CALENDAR PAGE

STATE OF CALIFORNIA

PETE WILSON, Gov

STATE LANDS COMMISSION

LEO T. McCARTHY, Lieutenant Governor
GRAY DAVIS, Controller
THOMAS W. HAYES, Director of Finance

EXECUTIVE OFFIC
1807 - 13th Street
Sacramento, CA 95

CHARLES WA
Executive Officer

EXHIBIT B

May 9, 1994
File: W 40654
ND 652
SCH No. 94051016

NOTICE OF PUBLIC REVIEW OF A PROPOSED NEGATIVE DECLARATION
(SECTION 15073 CCR)

A Negative Declaration has been prepared pursuant to the requirements of the California Environmental Quality Act (Section 21000 et seq., Public Resources Code), the State CEQA guidelines (Section 15000 et seq., Title 14, California Code Regulations), and the State Lands Commission Regulations (Section 2901 et seq., Title 2, California Code Regulations) for a project currently being processed by the staff of the State Lands Commission.

This document is being circulated under a shortened review, pursuant to Public Resources Code, Section 21091(d)(2), and is attached for your review. Comments should be addressed to the State Lands Commission office shown above with attention to the undersigned. All comments must be received by May 31, 1994.

Should you have any questions or need additional information, please call the undersigned at (916) 322-0530.

Goodyear K. Walker

GOODYEAR K. WALKER (4)
Division of Environmental
Planning & Management

Attachment

STATE LANDS COMMISSION

LEO T. McCARTHY, Lieutenant Governor
GRAY DAVIS, Controller
THOMAS W. HAYES, Director of Finance

EXECUTIVE OFFICE
1807 - 13th Street
Sacramento, CA 958

CHARLES WARREN
Executive Officer

PROPOSED NEGATIVE DECLARATION

File: W 40654
ND 652
SCH No. 94051016

Project Title:	Removal of Offshore Oil Platforms Heidi, Hilda, Hope & Hazel
Project Proponent:	Chevron U.S.A., Inc.
Project Location:	Santa Barbara Channel, offshore Santa Barbara County.
Project Description:	Four offshore oil platforms will be removed and barged to Long Beach Harbor for dismantling.
Contact Person:	Goodyear K. Walker Telephone: (916) 322-0530

This document is prepared pursuant to the requirements of the California Environmental Quality Act (Section 21000 et seq., Public Resources Code), the State CEQA Guidelines (Section 15000 et seq., Title 14, California Code Regulations), and the State Lands Commission regulations (Section 2901 et seq., Title 2, California Code Regulations).

Based upon the attached Initial Study, it has been found that:

/__/ that project will not have a significant effect on the environment.

/ X / mitigation measures included in the project will avoid potentially significant effects.

CONTENTS

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LIST OF TABLES

LIST OF FIGURES

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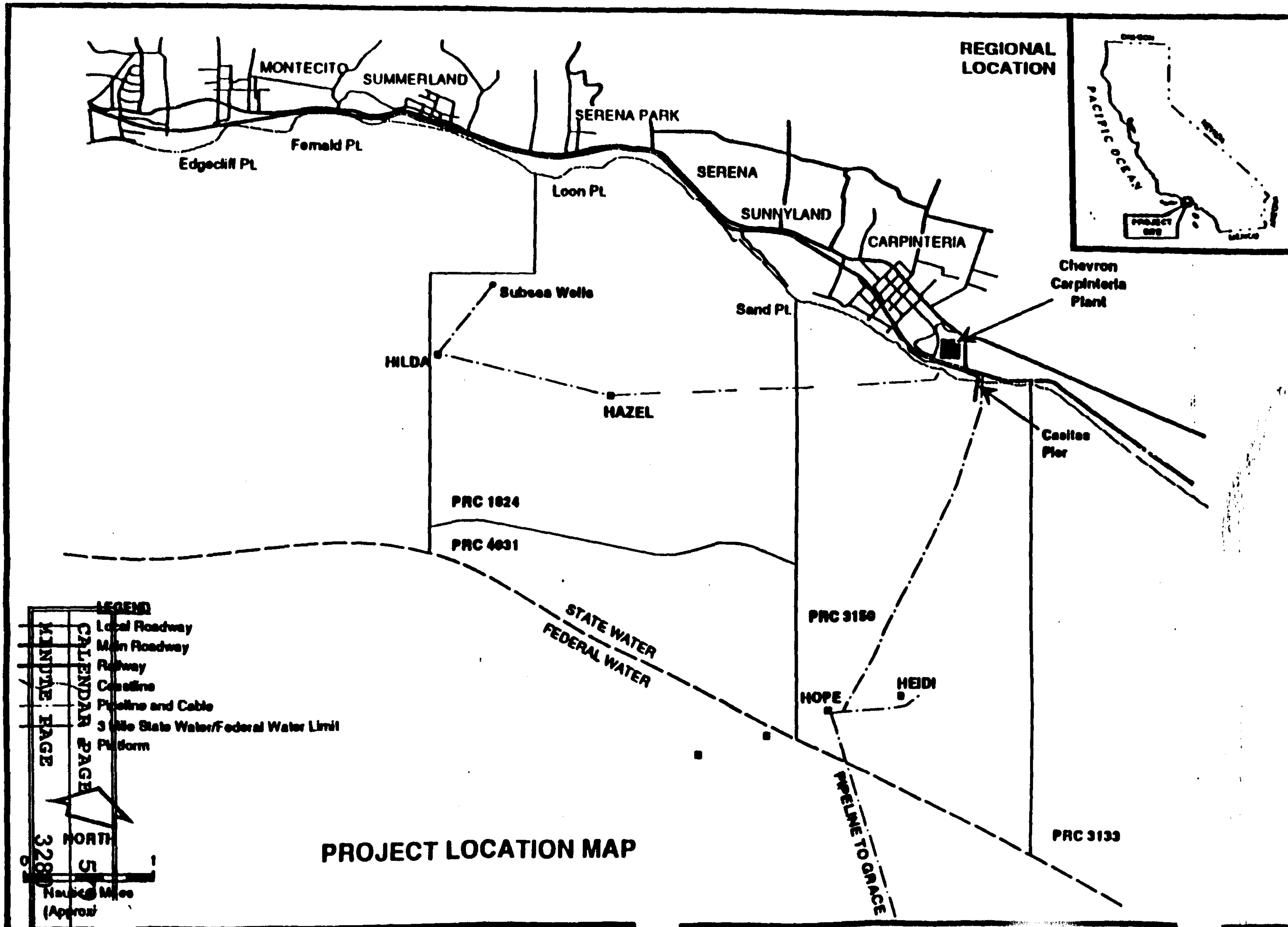

REGIONAL LOCATION
PACIFIC OCEAN
PROJECT SITE
MONTECITO
SUMMERLAND
SERENA PARK
Edgecliff Pt.
Fernald Pt.
Loon Pt.
SERENA
SUNNYLAND
CARPINTERIA
Sand Pt.
Chevron Carpinteria Plant
Casitas Pier
Subsea Wells
HILDA
HAZEL
PRC 1824
PRC 4031
PRC 3150
PRC 3133
STATE WATER
FEDERAL WATER
HOPE
HEIDI
PIPELINE TO GRACE
LEGEND
Local Roadway
Main Roadway
Railway
Coastline
Pipeline and Cable
3 Mile State Water/Federal Water Limit
Platform
NORTH
0
1
Nautical Miles (Approx)
PROJECT LOCATION MAP

FIGURE 1.2-1

1.0 PROJECT OVERVIEW

1.1 PROJECT PROPONENT

Chevron U.S.A. Production Company

1.2 PROJECT LOCATION

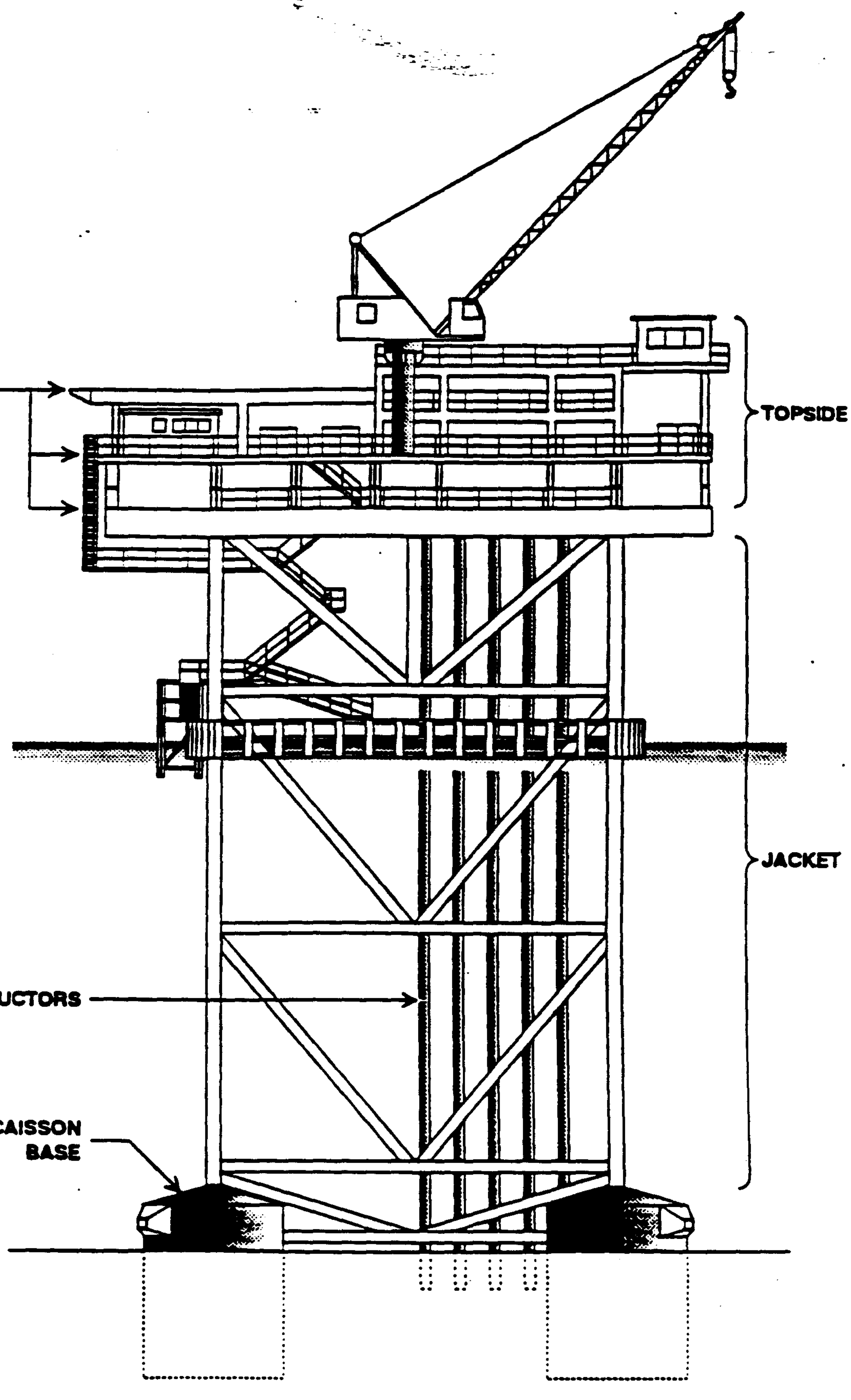
Platforms Hazel and Hilda (State Lease PRC 1824) and Platforms Hope and Heidi (State Lease PRC 3150) are located on State tidelands and submerged lands in the eastern portion of the Santa Barbara Channel, California (see Figure 1.2-1). Two of these platforms, Hope and Heidi, are within a legislative grant to Santa Barbara county, although all rights concerning oil and gas extraction were reserved to the State under the terms of the grant.

1.3 PROJECT BACKGROUND

The production of oil and gas reserves by Chevron within State Leases PRC 1824 and 3150 began in 1958 with the completion of Platform Hazel (see Figure 1.3-1). Construction of Platform Hilda was completed in 1960, Hope in 1965, and Heidi in 1965 (see Figure 1.3-2). The oil production from these offshore facilities is transported by subsea pipelines to Chevron's mainland separation, treatment, and processing facility located within the City of Carpinteria (see Figure 1.2-1). During the life of the four platforms, production has totaled approximately 62.3 million barrels of crude oil and 132.8 million cubic feet of natural gas.

All of the wells on these platforms were shut-in prior to September 1992. After the wells were shut in on each platform, the majority of the oil and gas processing equipment was drained and cleaned. Equipment left in service on the platforms includes wastewater handling facilities, air compressors, saltwater pumps, emergency power generators, navigation lights, fog horns, cathodic protection rectifiers, Platform Hope's vapor recovery compressor, and the pipelines carrying OCS oil and gas via Hope to the Carpinteria Plant. Subsea pipelines between Heidi and Hope, Hope and the Carpinteria Plant, Hilda and Hazel, and Hazel and the Carpinteria Plant have been left operational to handle rainwater and wastewater. The low pressure gas pipeline between Heidi and Hope has been left in service in order to bleed down Heidi's well casings to Hope's vapor recovery compressor.

Operations personnel conduct daily walk-throughs of each platform to ensure the proper operation of the equipment that is left in service. A remote alarm system allows personnel at the Carpinteria Plant to monitor critical alarms and functions on each platform.



PLATFORM HAZEL
PROFILE

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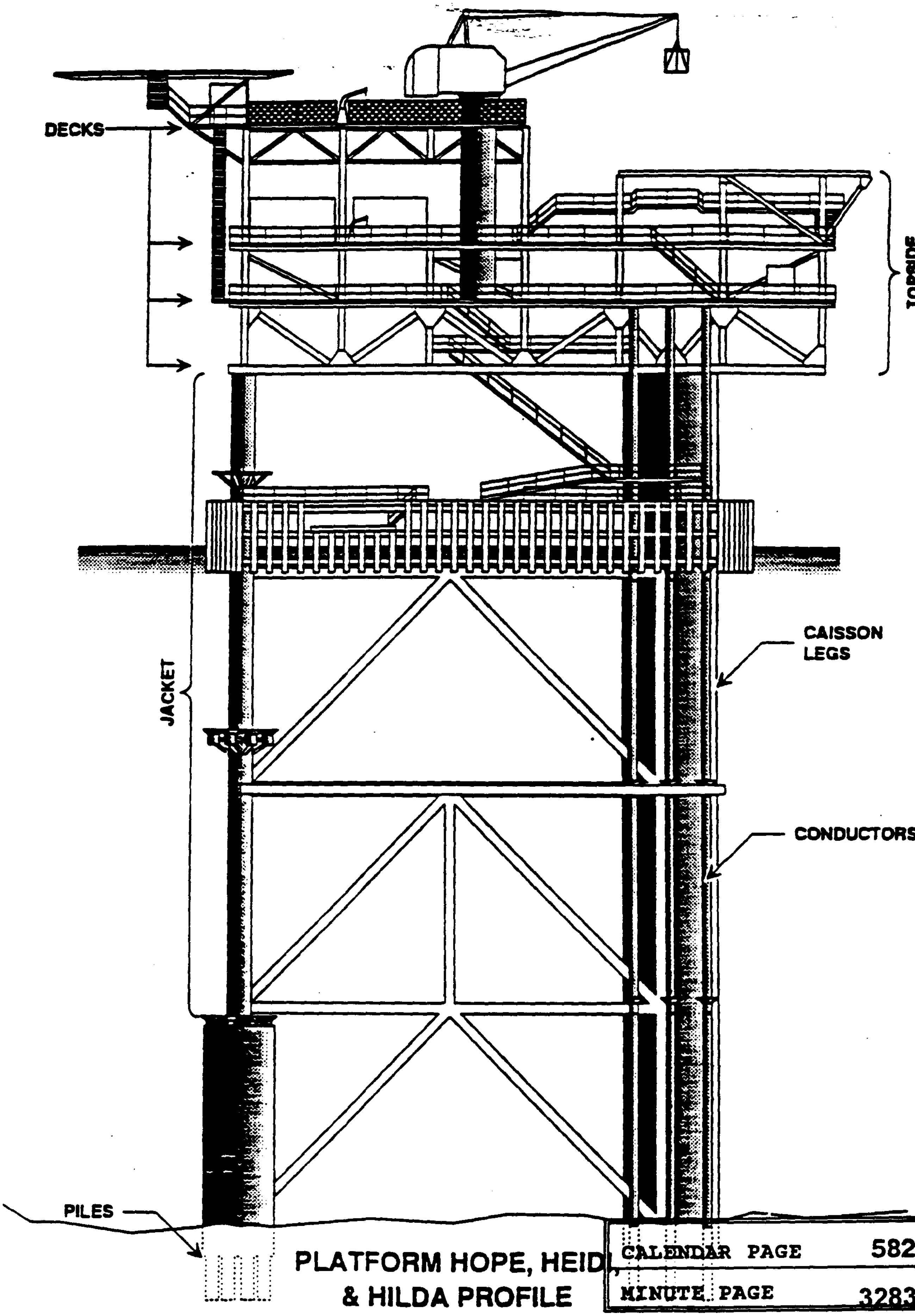
FIGURE 1.3-1



PLATFORM HOPE, HEIDI, & HILDA PROFILE

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FIGURE 1.3-2

The wells on each platform will be abandoned using procedures and equipment that have been described in Well Plugging and Abandonment Plans submitted and approved by the State Lands Commission and the Department of Oil and Gas. The abandonment rig will be used to cut and recover well conductors located outside the platform legs on all platforms. Decommissioned piping and equipment that can be handled by the existing cranes on the platforms will be cut loose from the platform by work crews and loaded onto the crew boat that services the platforms. The equipment will be transported to Chevron's Casitas Pier where it will be off-loaded and stored temporarily at the Carpinteria Plant site. Most of this equipment will be transported to an appropriate facility and scrapped. Some equipment may be reused by Chevron or sold.

1.4 PROJECT OBJECTIVES

Chevron petroleum production facilities located on State Leases PRC 1824 and 3150 can no longer be feasibly operated due to the near depletion of the petroleum resource, and economic costs associated with continuing operations. The dismantling of these facilities by Chevron is being proposed in accordance with the lease stipulations regarding the removal of facilities and restoration of the project site following the completion of oil and gas production operations.

1.5 PROJECT SUMMARY

Chevron proposes to permanently abandon and remove Platforms Hope, Heidi, Hilda, Hazel, and associated oil and gas pipelines. Such activities will result in some short-term impacts associated with removal equipment and vessel operations. Removal and abandonment procedures are further discussed below.

1.5.1 Platform Removal Procedures

Prior to initiating project abandonment operations, preliminary seafloor surveys will be conducted within a 1,000-foot radius of the platforms. The survey work will be conducted using side-scan sonar to identify the location of subsurface debris and to establish potential anchor and mooring sites for project abandonment equipment. Additionally, all sensitive bottom features, including pipelines, rocky outcrops, and kelp beds will be noted during the survey. These areas will be noted on applicable navigation charts and no anchors will be placed in the sensitive areas.

Dismantling of the project platforms will require several distinct procedures including decommissioning of auxiliary and emergency equipment, removal of the platform decks or topsides, the cutting of the platform pilings and conductors, and the disposal of the platform jackets. Figures 1.3-1 and 1.3-2 illustrate the general location of platform pilings, jackets, and decks or topsides.

Initially, cutting torches and welding equipment will be brought to the platforms to complete the decommissioning of the platform auxiliary and emergency equipment. This phase will not require the use of support equipment until the final removal of heavy equipment is to begin. At this time, several support vessels will be brought to the project site including a derrick barge, material barges, tug boats, crew boats, and diving support vessels. The materials barges are expected to be stored on separate moorings near the platforms and tended by a tug boat. Furthermore, during this phase any residual fluids collected during the final cleaning operations will be drained into appropriate containers on a work boat and transported to shore for appropriate treatment or disposal.

Removal of the decks or topsides will include the sectioning of the platform into pieces that provide adequate structural support and are light enough to be removed by the derrick barge. The sizes and weights of decking pieces will be determined by the capacity of the derrick barge to be utilized and the configuration of deck packages. Upon the installation of structural padeyes and rigging preparations, topside deck pieces will be attached to lift slings and a crane hook aboard the derrick barge, and final cuts made to allow the pieces to be lifted aboard the vessel. The deck sections will then be transferred to the material barges and eventually transported to the Los Angeles/Long Beach Harbor to be scrapped.

The final platform removal operation includes the removal of the platforms' jackets. In general, Platforms Hope, Heidi and Hilda have similar configurations with two large caisson legs originally used to float the jackets into place. Platform Hazel, however, contains cement filled caissons bases and will require a different removal technique than that used for the other three platforms.

Before the removal of platform jackets, it will be necessary to cut the pilings that anchor the platforms, and the conductors that were not removed during platform well abandonment. The cutting of the piling and conductors will be performed from inside the caisson legs and skirt pile guides and involve the use of several pieces of specialized equipment. Cutting operations will be performed from a barge and workboats utilizing explosives on three of the platforms, and from the platform decks utilizing mechanical cutting methods on Platform Hazel.

Removal of the Hope, Heidi, and Hilda jackets will occur from the top downward to maximize safety. In addition, the bottom horizontal elevation will be left in place to maintain stability between the 54-inch caisson legs. Each lift is expected to be pulled up and stacked on the materials barge for storage and eventual transport to the mainland. Once the final piece of jacket has been cut away and removed, all that will remain is the caisson legs, the bottom horizontal elevation, and the caisson bases. Final cuts will then be made on the caisson legs to separate them from the rest of the structure, leaving the bracing between the legs intact.

A derrick barge will then adjust position and a tug will attach a tow bridle to the caisson legs. Pumping will be commenced from a utility vessel to dewater the legs and achieve moderate positive buoyancy. Upon achieving buoyancy, the tug will initiate pulling operations to free the legs from the bottom. Additional pulling forces may be applied by winches on the derrick barge to achieve the breakout force required. The legs will be freed and pumping operations will continue from the utility vessel while the tug tows the legs to a secure location. Upon completion of pumping operations, the legs will be attached to a temporary mooring and towing preparations completed. At this time, the legs may be separated before towing by cutting the connecting bracing and conductor guides alongside the derrick barge.

The smaller caisson bases would be removed one at a time using the derrick barge crane. Once the caisson bases reach the surface, drain holes will be cut into the bases to allow the water to drain as the load is held at the surface. Once drained, the caissons bases would be placed on the materials barge for storage and transport.

Platform Hazel's jacket will be removed from the top downward to maximize safety. Each lift will be stacked on a materials barge for storage and transport. Currently, the bottom horizontal elevation of the platform is below the existing mudline, along with the grouted 27-foot-diameter caisson bases. The bottom horizontal and caisson bases will therefore be left buried in place to minimize bottom disturbance. Platform Hazel legs will be removed to 1 foot below the existing mudline. Once the cutting of the legs has occurred, the removal operations required for this platform would be similar to that described above for Platforms Hope, Heidi, and Hilda.

1.5.2 Pipeline Abandonment

Abandonment operations will include the flushing and pigging of all oil and gas pipelines. Flushing will continue until no visible hydrocarbons are observed. A seep tent shall be used if any lines can not be successfully flushed and plugged. The pipelines will be separated from the platforms, capped, and the ends jetted down below mudline. Pipeline spool pieces connecting the pipeline to the platforms risers will be recovered and blind flanges installed on each pipeline end. Some excavation may be required to expose the pipeline flanges, leaving a trench to be used for burial of the capped pipeline ends. It is expected that the disturbance to the seafloor will be moderate and natural bottom contours are expected to be restored by current and tidal energy. Also during this period the power cables running between the platforms and shore will be cut, the ends jetted down, and covered with natural sediment.

Pipelines between Platform Hope and the shoreline will be left in service. In the past these pipelines serviced Platforms Hope and Heidi and are currently servicing Platforms Grace and Gail, located in federal waters. As proposed, Platforms Grace and Gail will continue to produce through these pipelines, which include a 10-inch oil (SACS), 12-inch oil (Gail/Grace), and 10-inch gas (Combined Streams).

The pipelines between Platform Hazel and the shoreline will be abandoned in place. These pipelines include an 8-inch out of service oil line, 6-inch gas, and 6-inch oil. The offshore ends of these pipelines will be separated from the platform, capped, and jetted below mudline as described above. The nearshore sections of these pipelines will be filled with grout from the top of the bluff to approximately 800 feet offshore.

The pipelines between platforms Heidi and Hope include a 10-inch gas lift, 10-inch gas, and 10-inch oil. These lines will be abandoned in place as described above. The pipelines between Platforms Hilda and Hazel include an 8-inch out of service oil line, 6-inch gas, and 6-inch oil. These lines will be abandoned in place as described above.

1.5.3 Seafloor Cleanup and Restoration

The final phase of the offshore abandonment project will involve the removal of debris located during the preabandonment surveys and any additional material dropped during removal of the platforms. The debris recovery will be performed over a 1,000-foot radius from the platforms with divers gathering and loading items onto a work boat. During the post-abandonment survey, all anchor scar locations will be logged and final survey maps submitted for commission review.

2.0 PROJECT DESCRIPTION

2.1 PRE-ABANDONMENT DEBRIS SURVEY

A pre-abandonment debris survey will document the quantity and location of suspected debris targets before the removal of the platform structure. This survey will also be used to identify pipelines and hard bottom areas to be avoided during work vessel anchoring operations. This survey will be performed with side scan sonar within a 1,000-foot radius of the platforms in accordance with State Lands Commission (SLC) guidelines.

2.1.1 Equipment

The survey will be performed using a 500-khz side scan sonar system such as the Klien 595 or equivalent. The survey will be conducted from a support vessel with a length of at least 50 feet. Positioning will be provided by a navigation system with 3-meter accuracy. Underwater positioning of the towfish will be based on slant range calculations.

2.1.2 Procedures

Survey lines will be run at 50-meter spacing in lines running East to West and North to South. Coverage will be interrupted by the structure, but the overlapping survey lines will complete coverage within 100 feet of the jacket on all sides. Tow speed will be between 3 and 5 knots.

2.1.3 Data Reduction

The data will be reduced to a suspected target listing showing position, size, and shape of the target.

2.1.4 Debris Recovery

Due to the potential for some small pieces of the platform topsides or jacket to fall during transfer to the materials barge, all debris will be recovered after the removal of the platform structure.

2.2 JACKET DEMOLITION PREPARATIONS

2.2.1 Equipment Spread

This work will be performed from a diving support vessel of about 165-foot Length Overall (LOA), or from a derrick barge. The vessel will be equipped with deep air surface supplied diving equipment, 10,000 psi hydroblasters, and underwater burning gear.

2.2.2 Preliminary Inspection

A remotely operated vehicle (ROV) may be used to plan the details of demolition operations and verify conditions upon which prior planning has been based. The information gathered could include debris locations on the structure, lift sling rigging locations and obstacles, and hull penetrations on caisson legs.

2.2.3 Cleaning

Divers with hydroblasting equipment will remove the marine growth from the legs and subsea bracing of each platform where cuts will be made.

2.2.4 Pre-rigging

Installation of some heavy lift slings may be performed to prepare for the first few lifts.

2.3 TOPSIDE REMOVAL

2.3.1 General

Prior to mobilization of the derrick barge and support vessels, a work crew with cutting torches and welding equipment will be brought to the platform. The workers will complete the decommissioning of the platform equipment.

2.3.2 Equipment

The initial stages of this work may be performed from the platform without derrick barge support. The derrick barge with a dedicated tug boat will be brought in when the first heavy lifts are ready to be performed (see Figure 2.3-1). This work may run concurrently with the jacket demolition preparations described in Section 2.5. Materials barges from 180-foot LOA to

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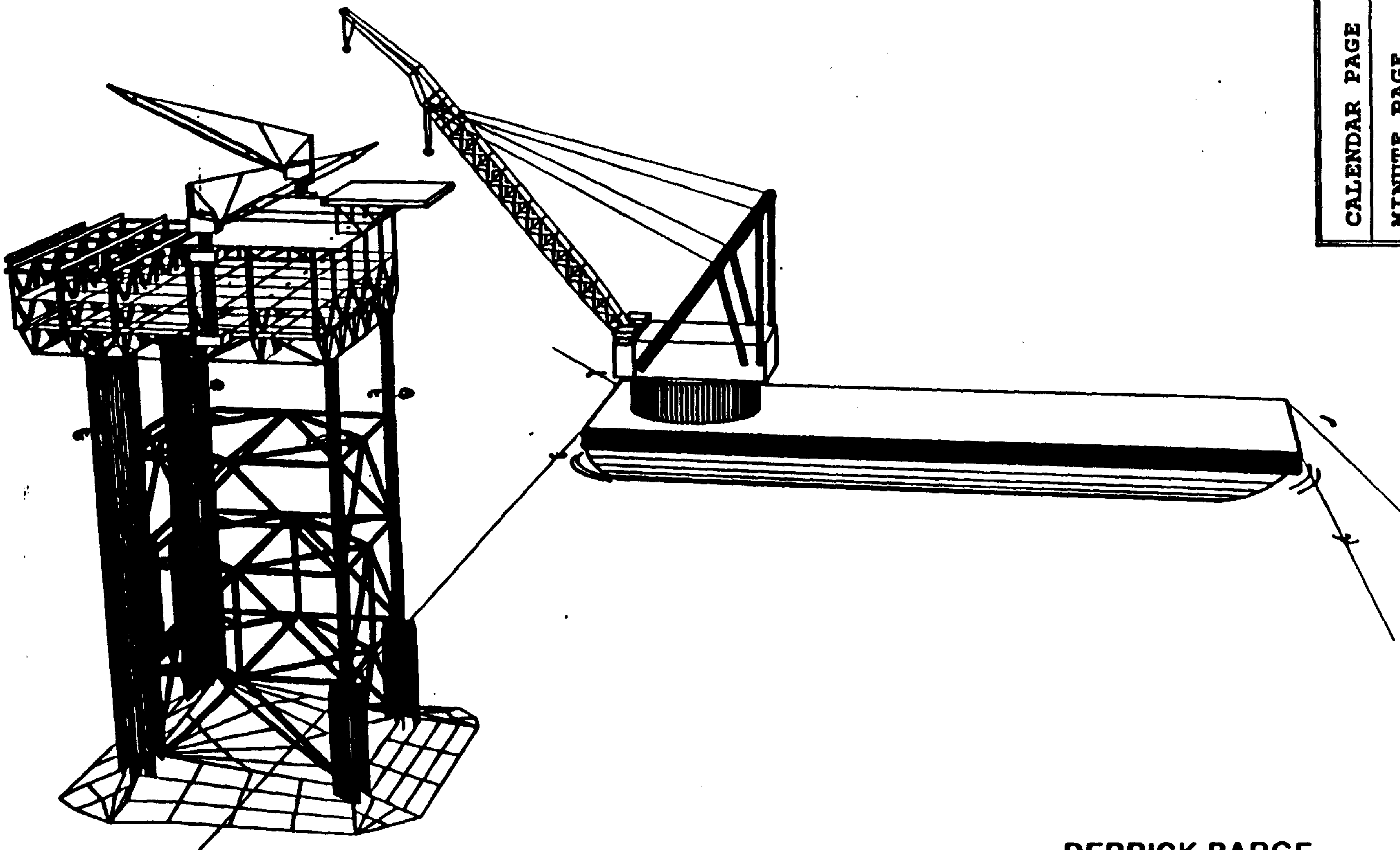


SOURCE: International Diving Services

DERRICK BARGE
TYPICAL CONFIGURATION
(500 TON SHOWN)
PLATFORMS HOPE, HEIDI
AND HILDA

FIGURE 2.3-1

400-foot LOA will be utilized to receive the deck packages off-loaded. These barges may be stored on separate moorings near the structure and will always be tended by at least one tugboat in the area. Additional vessels, such as crew boats and a diving support vessel, will be used as required.

2.3.3 Cleaning of Tanks

Tanks and piping that have already been drained of operating fluids. They will be cleaned and prepared for removal. Fluids collected during the cleaning operations will be drained into appropriate containers on a work boat and transported to shore for appropriate treatment or disposal. The total volumes involved will total less than one barrel.

2.3.4 Removal of Small Items

The demolition crew will remove any small equipment items or loose material that will hinder the removal of large packages from the structure. The platform cranes or portable cranes may be used to assist in these operations.

2.3.5 Sectioning Decks

Decks will be cut into sections using oxy-acetylene torches, leaving adequate structural support until the rigging is in place for each lift.

2.3.6 Preparation of Rigging

The cutting of access holes and installation of structural padeyes for heavy lifts at specified locations will be a part of the rigging preparations. Certain lifts may be around members without the use of padeyes, as determined by the removal contractor. Heavy lift slings will be installed for the derrick barge crane.

2.3.7 Heavy Lifts

2.3.7.1 Lift Size

The size of the lifts will be determined by the capacity of the derrick barge crane used and the configuration of the deck packages. Many deck packages will be separated and removed in their original installation configuration.

2.3.7.2 Installation of Lift Rigging

The platform rigging crew will attach the lift slings to the crane hook and the crane will lift the slings to take out most of the slack.

2.3.7.3 Final Structural Cuts

The rigging crew will make final cuts to allow the package to be lifted.

2.3.7.4 Derrick Barge Position

The lifts will be made from the derrick barge, which will be anchored on a 4-point moor, positioned alongside the structure. The barge may actually make lifts while positioned on any side of the structure, depending upon its lift capacity and configuration. As described in Section 3.4, Mooring Operations, no heavy lifts will be made over the Gail/Grace pipelines while they are in service during the removal of the platforms.

2.3.7.5 Dynamic Load Preparations

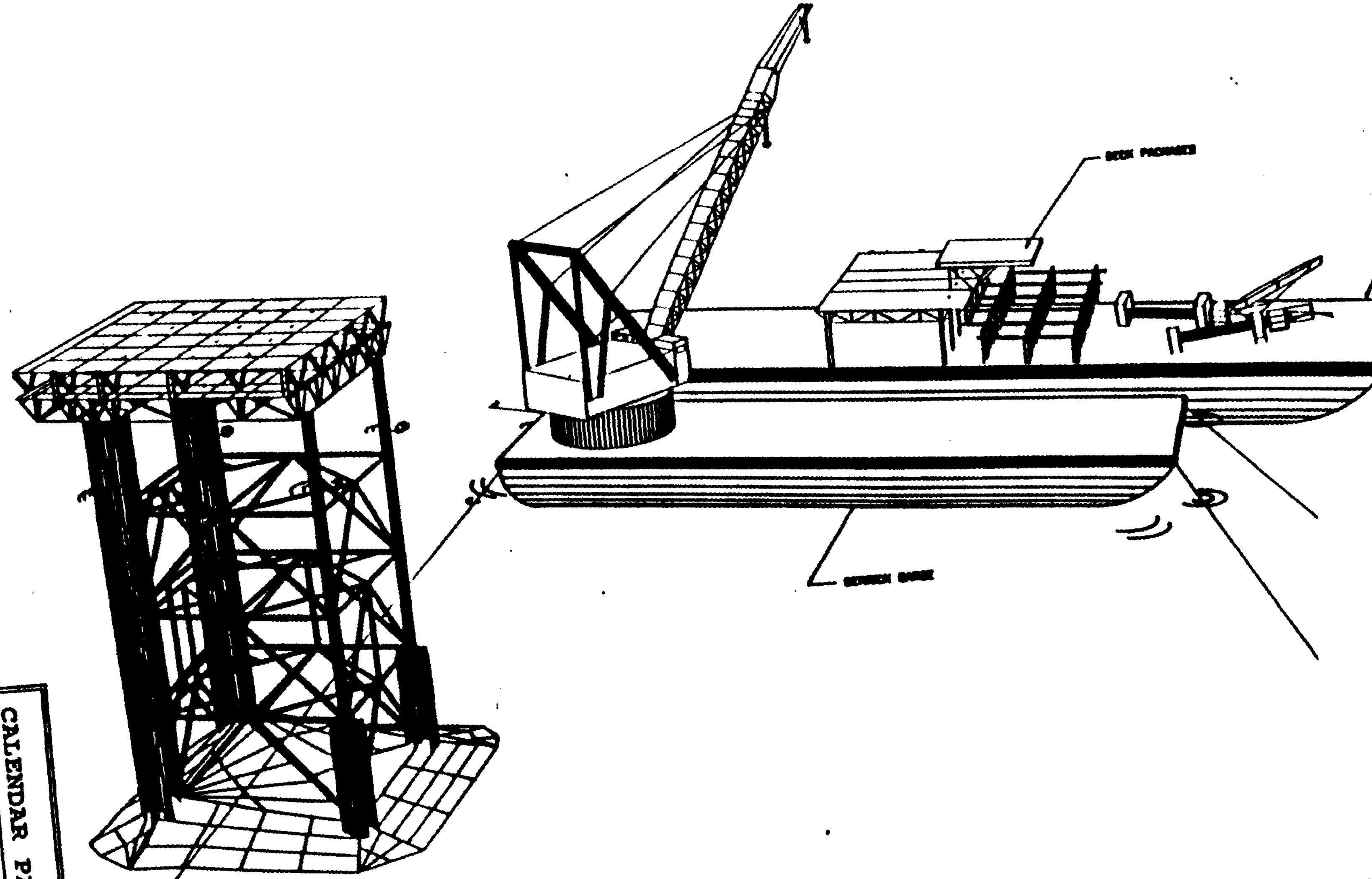
The crane lifts will be somewhat dynamic, due to the barge motion in the swell. Therefore, temporary guides will be installed where necessary to permit the load to be set back down accurately on the platform in the event a lift must be aborted.

2.3.7.6 Off-Loading on Materials Barges

A materials barge will be maneuvered with tug boats alongside the derrick barge, to receive each load. Deck packages will be stacked on the materials barge to maximize space (see Figures 2.3-1 and 2.3-2). The materials barges will be towed to the Los Angeles/Long Beach Harbor when completely loaded, and when the onshore staging area is prepared to receive them.

2.3.8 Remote Mooring

Remote moorings will be used to anchor materials barges before and after loading. These moorings will consist of a 30,000-pound anchor, 2-3/4 inch chain ground leg, dip section, and riser, with a West Coast Buoy.



DECK PACKAGE REMOVAL PLATFORMS HOPE, HEIDI AND HILDA

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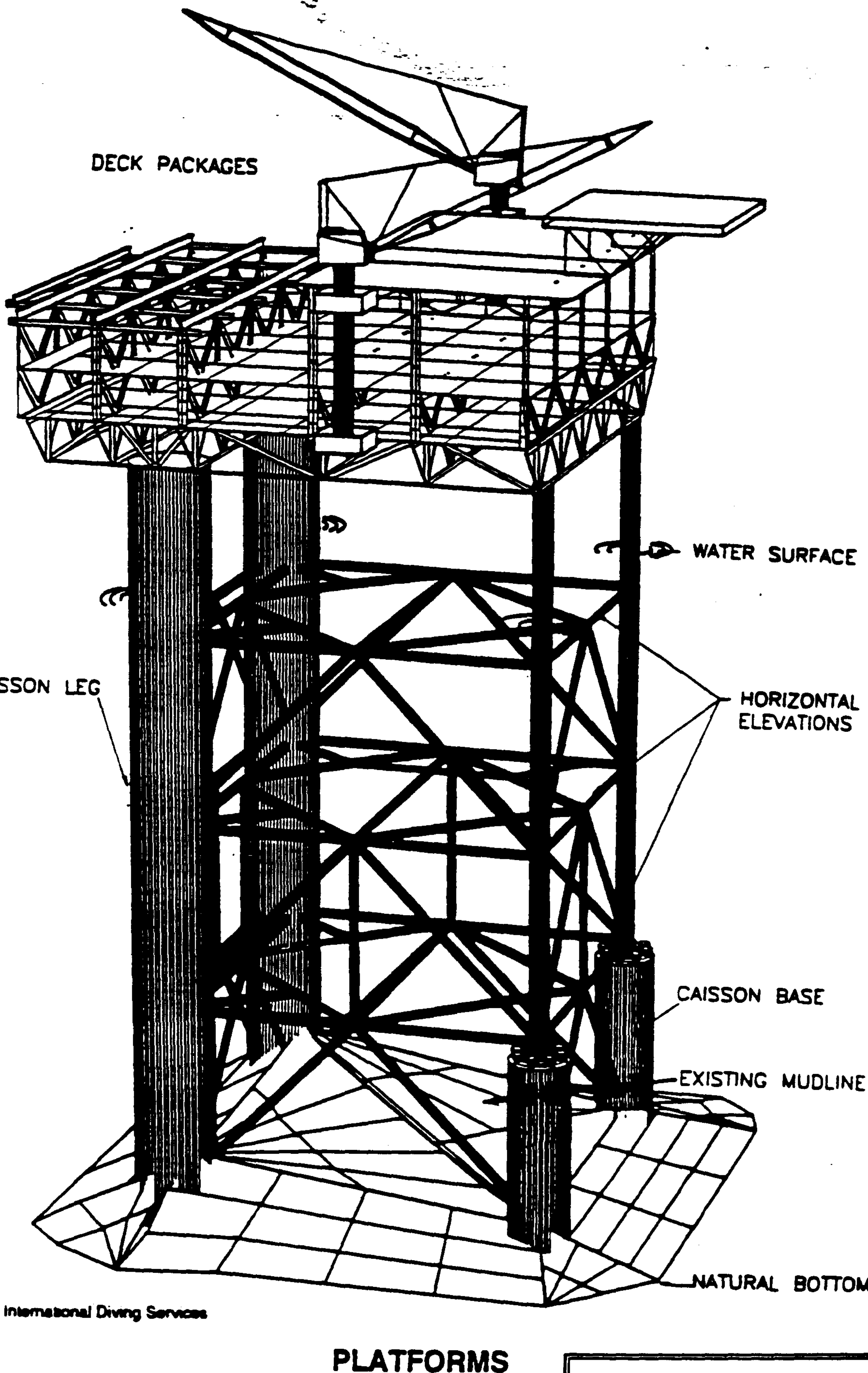
2.4 PILE AND CONDUCTOR CUTTING OPERATIONS

2.4.1 General

A similar method will be used to remove the platform piles and conductors on Platforms Hope, Heidi, and Hilda. Platform Hazel is of a different construction, and it's removal is discussed in Section 2.5.5. Before the platform jackets can be removed, it will be necessary to cut the pilings which anchor the platforms, and any well conductors that were not removed with the well abandonment rig (Figures 2.4-1 and 2.4-2). The cutting of piling and conductors inside the caisson legs and skirt pile guides will involve the use of specialized equipment and techniques. Abandonment criteria for the proposed project fall under the jurisdiction of the State Lands Commission. The California Code of Regulations, Title 14, Division 2, Chapter 4, Section 1745.8 states, "All casing and anchor piling shall be cut and removed from not more that 5 feet below the ocean floor." It should be noted that explosives will be located at least 8 feet below natural mudline. The cut points on Platform Hazel have been selected to avoid significant disturbance to the seafloor associated with removing the caisson basses.

2.4.2 Cutting Method

The use of explosives is the planned method of cutting the platform piles and conductors. The heavy lifts required to remove the jacket structures must be made with a high level of confidence that the piling and conductors anchoring the structure to the seafloor have been completely severed. Several methods were considered for the cutting tasks, including explosive charges and mechanical cutting. The use of explosives has been the dominant method of cutting piles in the Gulf of Mexico where such experience is greatest. The use of explosive charges lowered into piles has been proven as the most reliable method of making complete cuts. Since the piles and conductors will be cut beneath the platform legs and below the mudline, there will be no way to verify that complete cuts have been made in all the piles which anchor a platform leg until a derrick barge begins to lift the leg from the seafloor. If an incomplete cut is discovered at this point, there would be serious safety and logistical concerns associated with aborting the lift and redeploying the cutting equipment in the pile. For this reason, it is critical that a cutting method with a high likelihood of making a complete cut on the first attempt be employed. In the Gulf of Mexico platform removals, explosives have proven to be much more reliable in making complete cuts than mechanical cutters. The poor reliability of mechanical cutters was also noted during the removal of Texaco's Platforms Helen and Herman where the use of casing cutters resulted in problems associated with incomplete cuts. Therefore, explosives represent the most effective means of cutting the piles. The ability to verify that a complete cut has been made by mechanical cutters is difficult. Should incomplete cuts occur, there will be an increased potential for aborted lifts and their associated safety problems.



SOURCE: International Diving Services

PLATFORMS
HOPE, HEIDI, AND HILDA
ELEVATIONS

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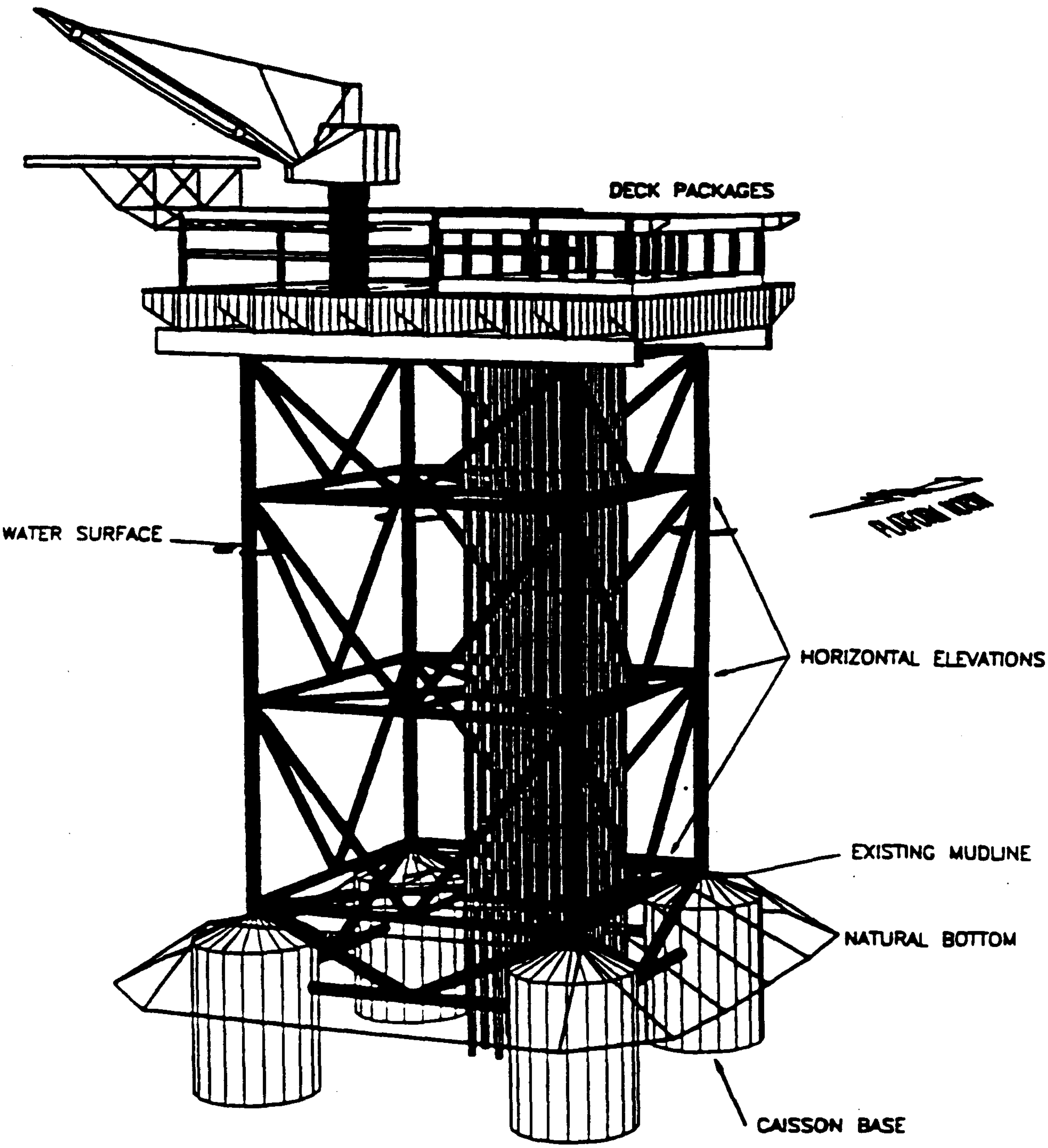
FIGURE 2.4-1



SOURCE: International Diving Services

PLATFORM HAZEL ELEVATIONS

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FIGURE 2.4-2

A key difference between explosives vs. mechanical cutting operations is the timing in which cutting operations occur. Explosive cuts will be made after the platform topsides have been removed and cutting operations can be conducted from work barges and vessels. Mechanical cutting operations require a stable base and the platform decks would be left in place to position equipment. This exposes the platform to a long time period in which the piles and conductors have been cut and topside removal operations would be completed after cutting. Mechanical cutting operations are expected to take 3 to 4 weeks per platform to complete. Once the cuts are completed, it will take 1 month to remove the platform jacket. This represents an exposure window of 2 months between the beginning of pile cutting to the end of the platform removal. Since explosive cutting would only take 3 or 4 days per platform to complete, the exposure window would only be one month. Once the pile cutting begins, the platform's ability to withstand horizontal loading is reduced. The exposed platform may shift or become damaged during extreme weather conditions or a seismic event. Such unstable conditions would significantly complicate removal operations and result in unsafe working conditions for dismantling crews. Therefore, the use of explosives is the planned method of making the conductor and pile cuts.

2.4.3 Timing of Cutting Operations

The cutting of anchor piling below the jacket legs will leave the structure free-standing. The use of explosives allows the cutting operation to be completed quickly, after the topsides have been removed, and with a shorter time period between initial cutting of piles and jacket removal.

2.4.4 Verification of Pile Internal Clearance and Jetting of Pile

2.4.4.1 Pile Internal Clearance

The piling located in the skirt pile guides has been open to the sea. Verification must be made to ensure that the inside of the pile is clear several feet below the planned cut location. Divers will be used to sound the pile using a gauge lowered on a line at the top of the pile.

2.4.4.2 Pile Jetting

If the pile is not clear, jetting may be performed to provide this clearance. Pile jetting would be performed with a 10,000 psi hydroblaster, in conjunction with a low pressure/high volume jet pump.

2.4.5 Cutting Methodology Using Explosives

2.4.5.1 Internal Cut

The piling and conductors to be cut will be accessed internally to complete the cut. An explosive charge will be lowered from the production deck elevation to a point approximately 3 feet below natural mudline (15 to 25 feet below the existing mudline). As such, all explosive cuts would occur within the piles or conductors and no open water detonations would occur. This will confine the explosive impacts to below the base of the platform legs and below the existing mudline (see Figure 2.4-1).

2.4.5.2 Explosive Charges

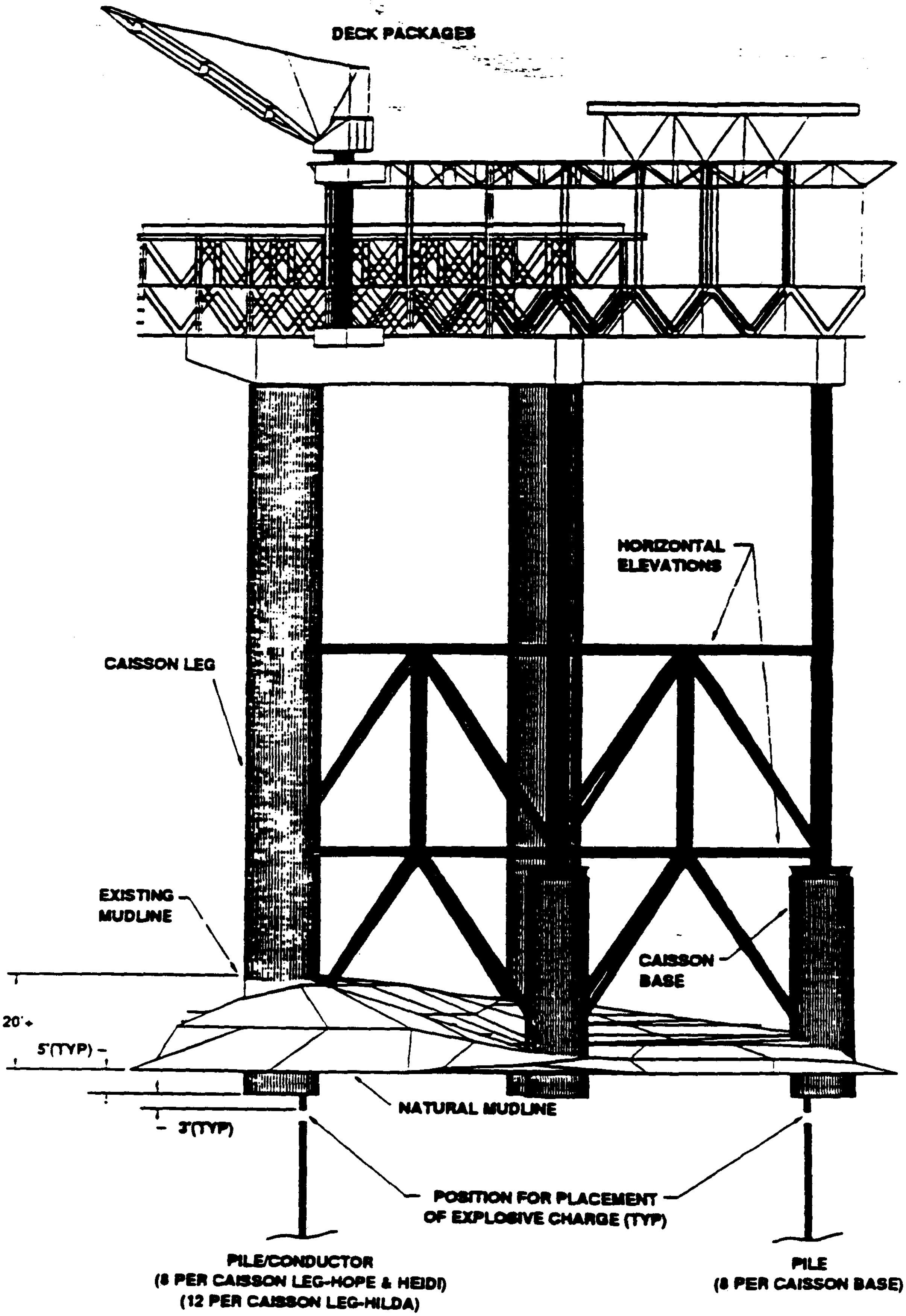
The explosive charges will be cylindrical in shape, and will be lowered down hole with a concrete weight above the charge. The concrete will provide a tamping effect when the charge is detonated. The charge will be designed in accordance with the "collision charge" principle, to detonate from the top and bottom ends simultaneously, creating an outward cutting force when the explosions meet in the center of the charge (see Figure 2.4-3 for placement of charge location, and Figure 1.4-1 in the Discussion of Environmental Impacts for a graphic depiction of this process). The explosive proposed is nitromethane, a binary explosive which consists of two liquids, neither of which is individually classed as an explosive. This allows for simpler and safer transportation and storage of the material. No hazardous substances will be released to the ocean following detonation of the explosive charges. Chemicals used in the explosive charges will become inert gasses following detonation.

2.4.5.3 Explosive Charge Size

There will be 32 to 40 individual charges each containing between 25 and 45 pounds, depending on the material to be cut, of explosive material detonated per platform .

2.4.5.4 Staggered Charges

The detonation of charges will be staggered to limit the water shock forces to the magnitude of one charge at a time.



HOPE, HEIDI, AND HILDA ABANDONMENT
PLACEMENT OF EXPLOSIVE CHARGES
FOR CONDUCTOR/PILE CUTTING OPERATIONS

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SOURCE: International Diving Services

FIGURE 2.4-3

2.4.5.5 Duration of Cutting Operations Using Explosives

It is estimated that cutting operations will be performed for approximately 3 to 4 days per platform.

2.4.6 Mechanical Cutting Methodologies

As an alternative to explosives, two mechanical cutting methodologies have been evaluated for this work. The first is a casing cutter using a cutting tool on a rotating drill string, and the second is abrasive cutting using a grit entrained high pressure water jet system. In addition, embrittlement techniques were reviewed but not evaluated further due to logistical constraints.

2.4.6.1 Casing Cutter

This method is similar to methods used in normal drilling operations for cutting casing and well conductors for abandonment. In a platform removal application, a portable system would be used without the drilling rig. The system is comprised of a power swivel, drill string, and cutting tool, which are lowered downhole by the platform crane or a portable crane. The casing cutter has a three blade carbide cutter that is lowered into the well in the retracted configuration to the cut location. The blade opens when hydraulic (water) pressure is applied to the bit, and the power swivel turns the assembly on the platform drill deck.

2.4.6.2 Abrasive Cutter

This method incorporates a high pressure water jet with a grit entrainment system to force particles (i.e., copper slag) into the cut at pressures up to 10,000 psi. The cutter nozzle is fitted on a robotic assembly that is lowered down the well conductor or pile. The assembly rotates the cutter nozzle around the circumference of the conductor to be cut. Cutting rates are adjusted based on the wall thickness and number of strings to be cut.

These mechanical cutting methods have not proven to be highly reliable in actual field experience and require a stable work platform (i.e., platform decks).

2.4.6.3 Embrittlement Technique

The embrittlement technique (extreme cold being applied to the structural member followed by a physical blow. The blow results in the crackling and separation at impact point). Such a method may be effective on exposed members, but would be extremely difficult to conduct in the confined piles and conductors below mudline; therefore this method is not considered practical.

2.5 JACKET REMOVAL

2.5.1 General

After the topside decks have been removed, a dive crew will be used to cut the jacket into liftable sections. Structural members of the platform jacket will be cut by divers with oxy-arc torches.

2.5.2 Aids To Navigation

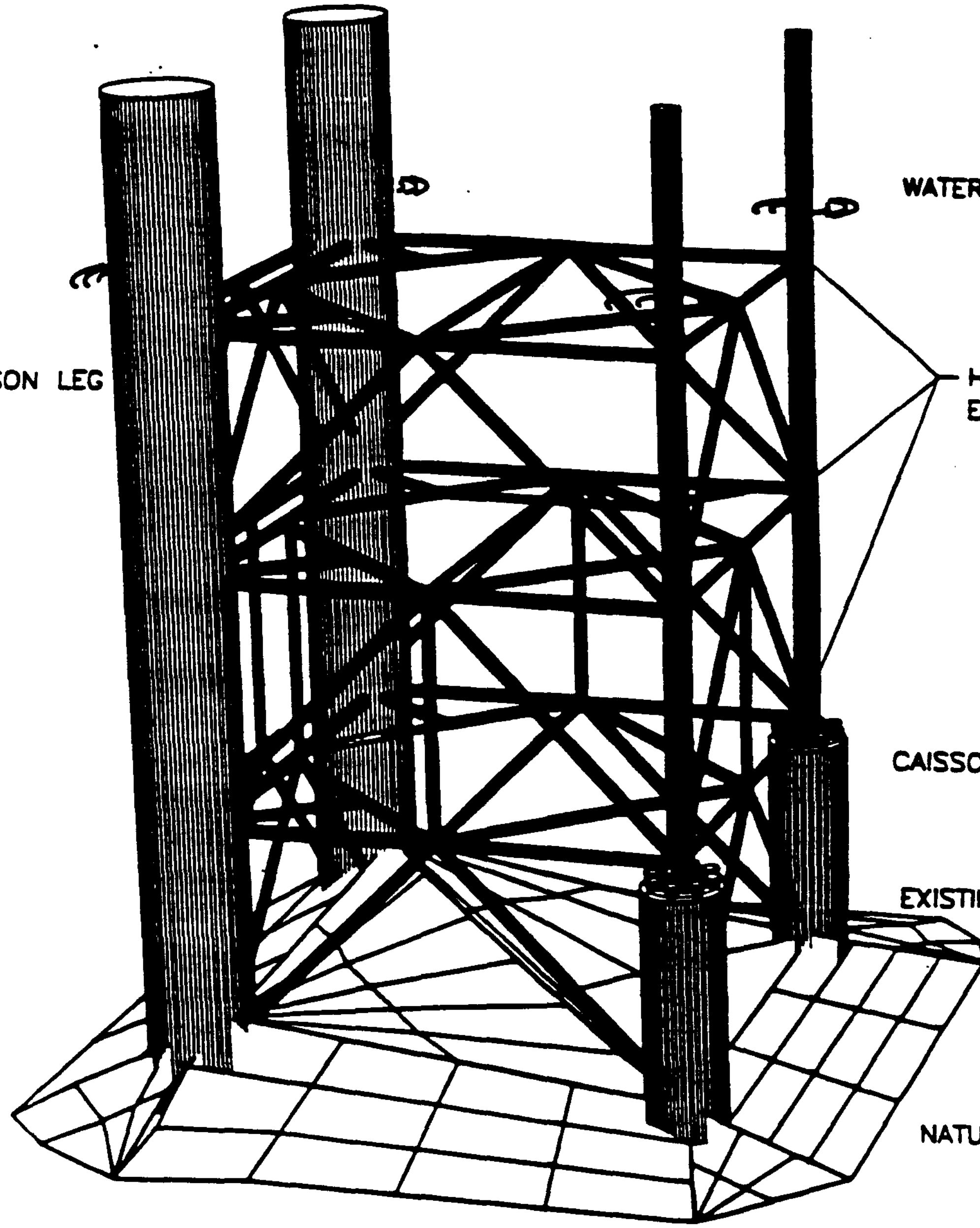
The existing aids to navigation on the platform (lights) will be maintained during the topsides removal and during the jacket removal. These lights will be relocated on the legs after the decks are removed to provide identification at night, if the barge is required to move off location.

2.5.3 Equipment

The derrick barge and tug boat used for topsides removal will be used to remove the jacket. Materials barges from 180-foot LOA to 400-foot LOA will be used to receive the jacket sections lifted. These barges may be stored on separate moorings near the structure and will always be tended by at least one tugboat in the area. Additional vessels, such as crew boats and a diving support vessel, will be used as required.

2.5.4 Removal Plan for Platforms Hope, Heidi, and Hilda

Platforms Hope, Heidi, and Hilda all have similar structural configurations, including two large caisson legs originally used to float the jacket to the project site. Once at the platform installation site, these legs were flooded and sunken in place (see Figure 2.5-1). The reverse of this process will be used to remove the structure. Many details of the jacket removal plan will depend on the equipment used by the demolition contractor selected for this work. A likely sequence of events is described as follows:



SOURCE: International Diving Services

PLATFORMS
HOPE, HEIDI, AND HILDA
WITH DECK PACKAGES REMOVED

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FIGURE 2.5-1

2.5.4.1 Upper Bracing Removal

The jacket will be removed from the top down to maximize diver safety. Each lift will be stacked on a materials barge for storage and transport. The bottom horizontal elevation will be left in place to maintain some stability between the legs (see Figure 2.5-2).

2.5.4.2 54-Inch Leg Removal

The 54-inch-diameter legs will be removed down to the caisson bases at the bottom horizontal elevation. Each lift will be stacked on a materials barge for storage and transport. This will leave the large caisson legs, the bottom horizontal elevation, and the caisson bases intact.

2.5.4.3 Caisson Leg Removal

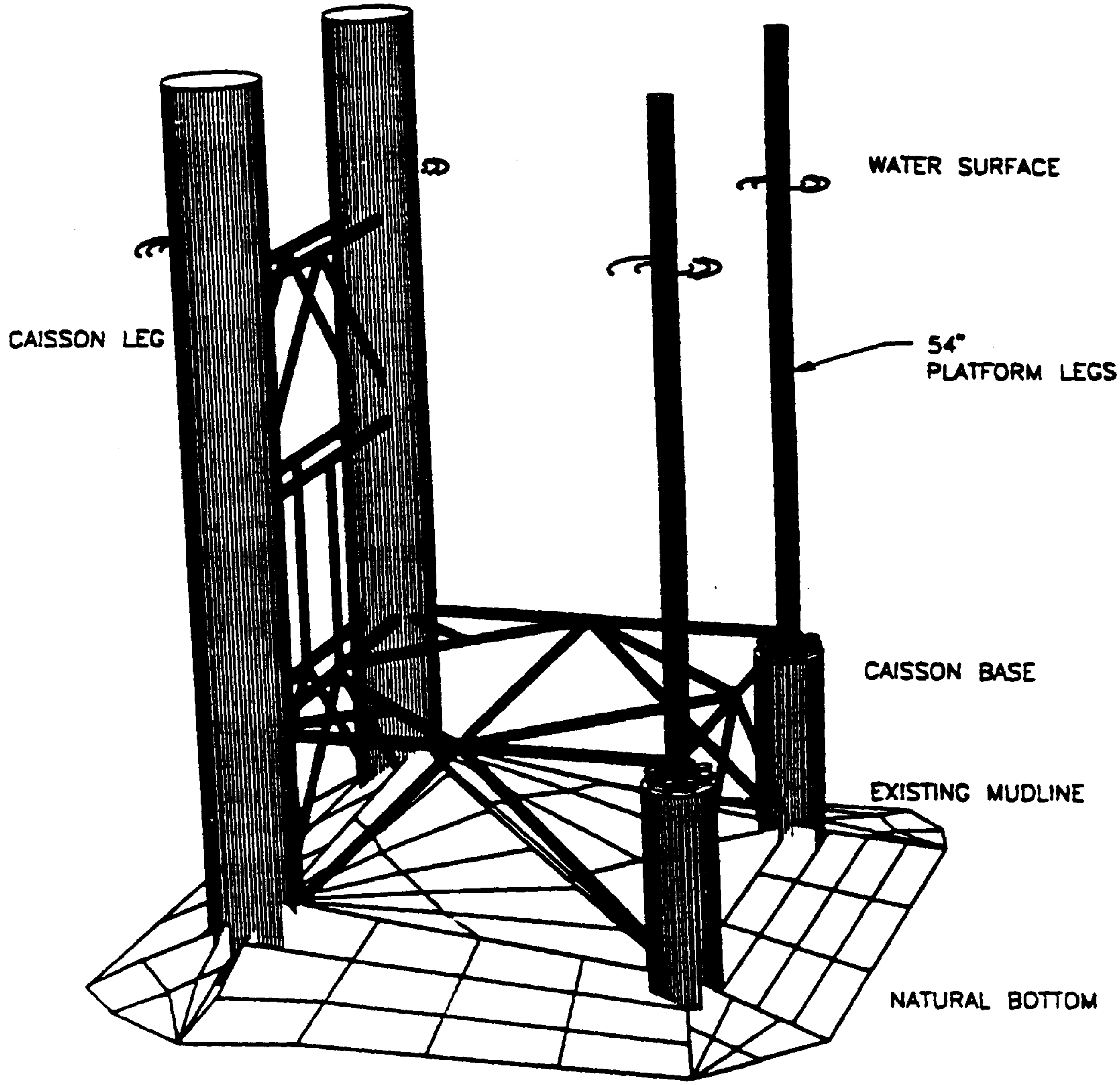
Final cuts utilizing torches will be made on the bottom horizontal bracing to separate the large caisson legs from the rest of the structure. No explosives would be used for this procedure. All bracing between the two caisson legs will be left intact. The derrick barge will adjust position, and a tug will attach a tow bridle to the caisson legs (see Figure 2.5-3). Pumping will be commenced from a utility vessel to deballast a portion of the legs to achieve moderate positive buoyancy. Upon achieving positive buoyancy, the tug will initiate pulling operations to free the caisson legs from the bottom. Additional pulling forces may be applied by winches on the derrick barge to achieve the breakout force required. The legs will be freed, and pumping operations will continue from the utility vessel while the tug tows the legs to a secure location. Upon completion of pumping operations the legs will be moored to a temporary mooring until towing preparations have been completed (see Figure 2.5-4). The legs may be separated before towing by cutting and recovery of connecting bracing and conductor guides alongside the derrick barge.

2.5.4.4 Bottom Bracing Removal

The bottom bracing will be cut and loaded on the materials barge.

2.5.4.5 Caisson Base Removal

The caisson bases for the 54-inch legs will be removed one at a time. Drain holes will be cut in the caissons to allow water to drain as the load is held at the surface. The caisson bases will be placed on the materials barge for transport and disposal (see Figure 2.5-5).



SOURCE: International Diving Services

PLATFORMS
HOPE, HEIDI, AND HILDA
WITH UPPER BRACING REMOVED

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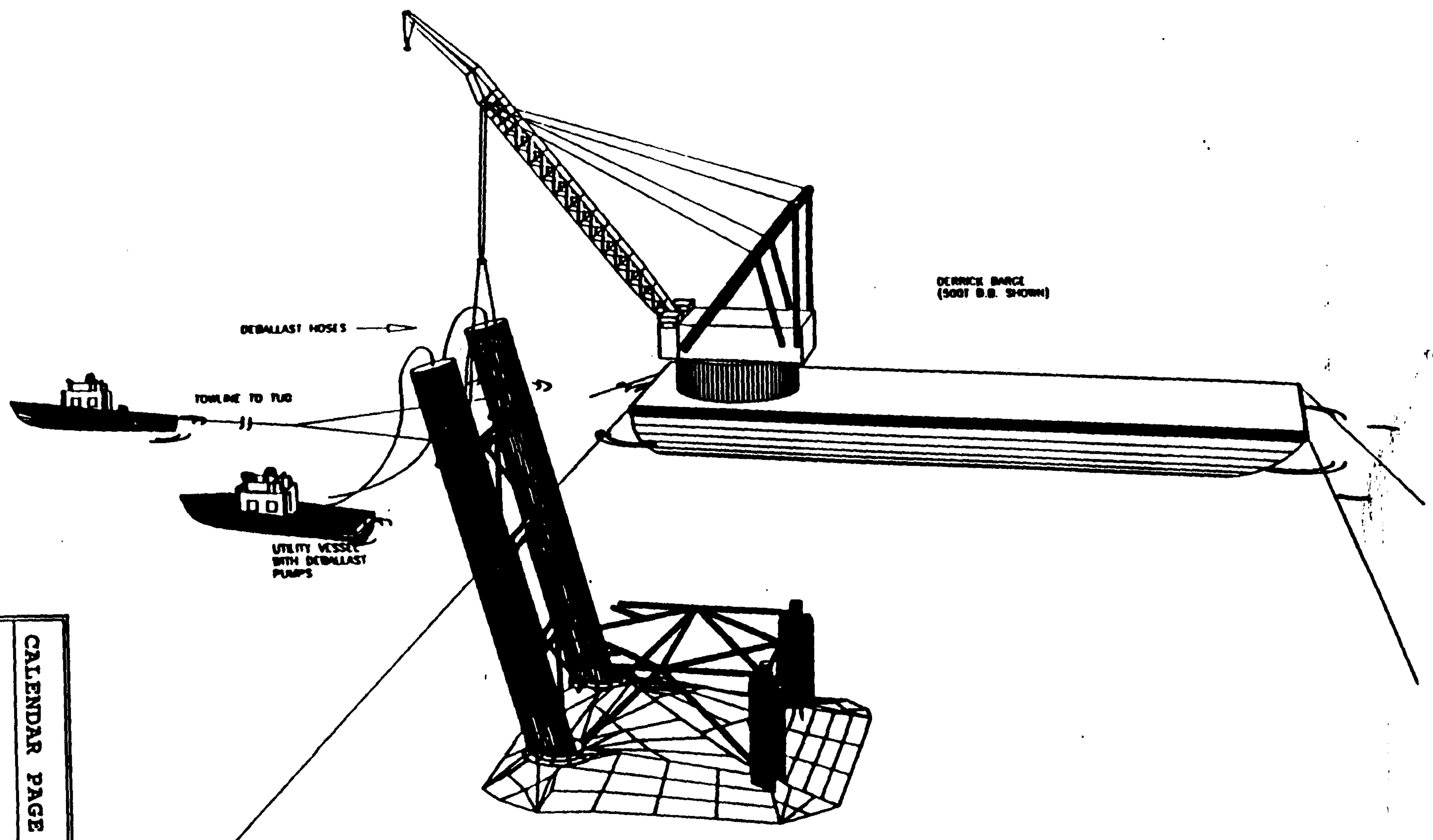
FIGURE 2.5-2

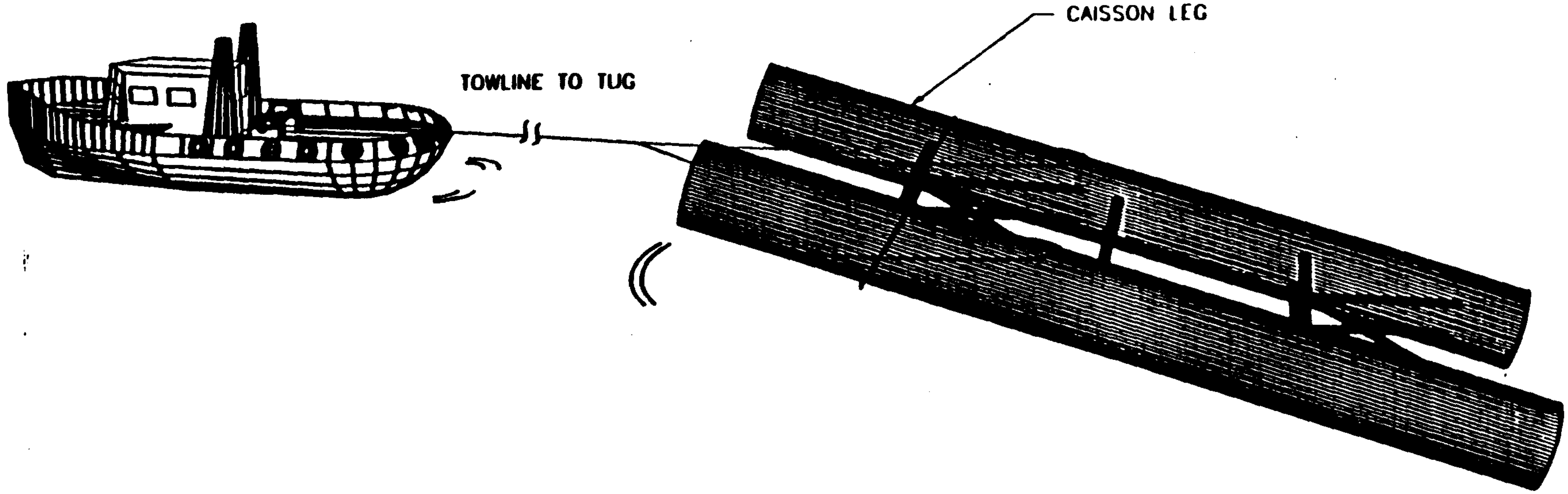


DERRICK BARGE REMOVES CAISSON LEGS PLATFORMS HOPE, HEIDI AND HILDA

SOURCE: Diving Services

CALENDAR PAGE 604

MINUTE PAGE



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CAISSON LEGS UNDER TOW
DURING FINAL DEBALLASTING
PLATFORMS HOPE,
HEIDI AND HILDA

SOURCE: International Diving Services

FIGURE 2.5-4

2.5.5 Removal Plan for Platform Hazel

Platform Hazel is a gravity-based structure which utilizes four caisson bases to anchor the jacket structure. These four caisson bases were used to float the jacket to the project site. Once at the platform installation site, these caissons were flooded, sunk in place, and filled with sand and cement.

2.5.5.1 Upper Bracing Removal

The jacket will be removed from the top down to maximize diver safety (see Figures 2.5-6 and 2.5-7). The 36-inch-diameter vertical legs will be removed down to the caisson bases. Each lift will be stacked on a materials barge for storage and transport. This will leave the grouted caisson bases and the bottom horizontal elevation and some vertical diagonal braces buried in place. The legs will be removed at 1 foot below existing mudline, to meet with State Lands Commission abandonment procedures. Explosive cuts will not be made on Platform Hazel. The platform jacket legs will be cut with oxy-acetylene torches near the top of the caisson base which is located just below the existing mudline.

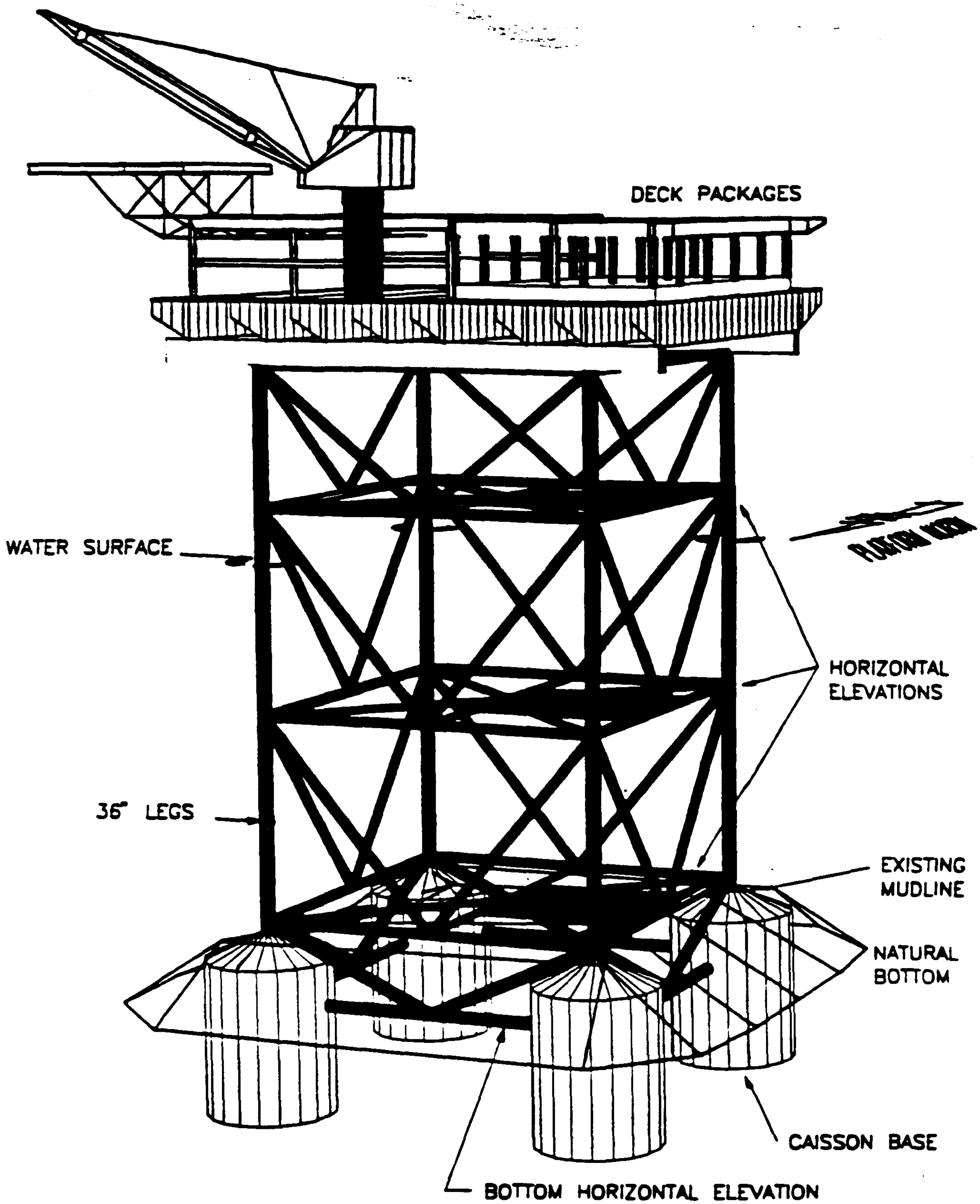
2.5.5.2 Caisson Base Abandonment

The caisson bases for the 36-inch legs will be left in place, along with the connecting tubular braces, all of which are buried. The existing mudline at the platform is now above the top of the caissons (see Figure 2.5-8).

Depth of burial of Platform Hazel's caisson bases and cross members varies across the platform base. Surveys indicate that the disposal pile and associated marine growth reach approximately 26 feet above the natural mudline. Abandonment operations will remove the platform legs to the top of the caisson base or at least 1 foot below mudline, whichever is higher. A post-abandonment survey of the site will confirm the condition of the remaining mound. Should any part of the platform, caissons, or cross members be exposed, Chevron will remove any exposed structural components.

2.5.6 Debris Recovery

The debris on bottom will be recovered by divers after the final heavy lifts have been made. Further debris location will be performed using Mesotech 971 Color Scanning Sonar or equivalent, operated from an ROV or held by a diver. The debris recovery will be performed over a 1,000-foot radius from the platform. Targets located during the pre-abandonment debris



SOURCE: International Diving Services

WELL CONDUCTORS REMOVED
PLATFORM HAZEL

CALENDAR PAGE	607
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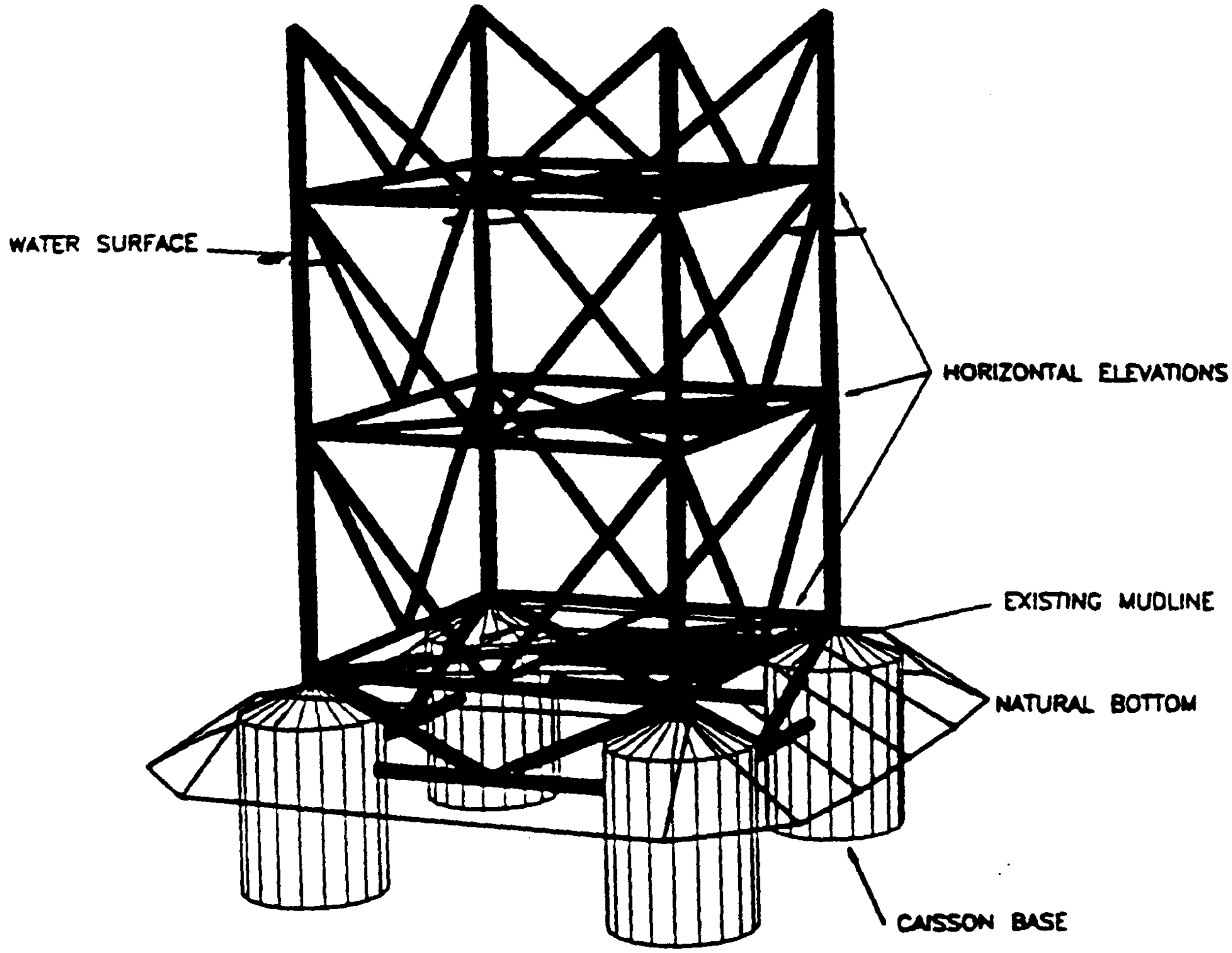
FIGURE 2.5-6



SOURCE: International Diving Services

DECK PACKAGES REMOVED
PLATFORM HAZEL

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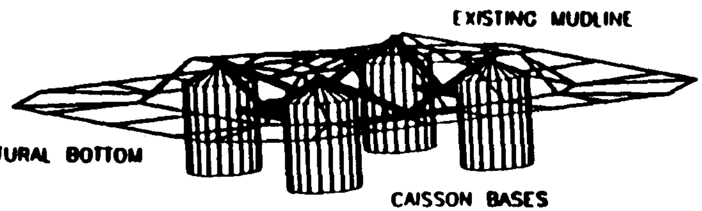
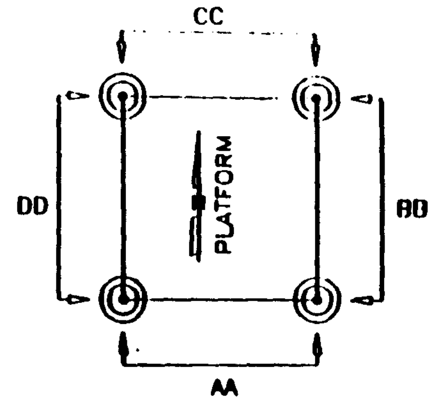
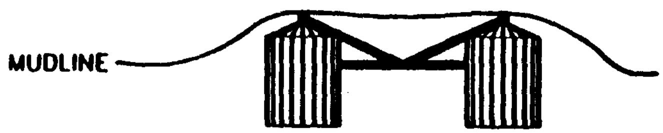
FIGURE 2.5-7



THREE DIMENSIONAL VIEW





VIEW BB
EAST ELEVATION

VIEW DD
WEST ELEVATION

NOTE:
CAISSON BASES ABANDONED IN PLACE. LEGS WILL BE CUT FLUSH WITH TOP OF CAISSON BASE OR ONE FOOT BELOW EXISTING MUDLINE (WHICHEVER IS HIGHER). VERTICAL DIAGONAL BRACES WILL BE CUT OFF, IF NECESSARY IN LIKE MANNER.

VIEW AA
SOUTH ELEVATION

VIEW CC
NORTH ELEVATION

MINUTE PAGE 3310
CALENDAR PAGE 609

CAISSON BASES ABANDONED IN PLACE PLATFORM HA

SOURCE: ... Diving Services

survey will be verified and identified using an ROV or divers, with the assistance of a satellite surface navigation system integrated to an acoustic tracking system. Targets that are verified as debris will be recovered by divers with assistance from a surface crane onboard the diving support vessel. At the same time the anchor scars left by the derrick barges will be examined and leveled if necessary.

2.6 PIPELINE ABANDONMENT

2.6.1 General

The platform decommissioning operations will include the flushing and pigging of all pipelines as discussed in Section 2.6.2 below. Such operations will be conducted prior to platform structure removals. These pipelines were originally installed on the sea bottom; however, natural sediment deposition has resulted in the burial of most of the pipelines. To avoid disturbance to the natural bottom, the pipelines will be abandoned in place. Annual ROV surveys conducted by Chevron between the years 1986 and 1991 have been reviewed to determine the burial state of the lines. The annual surveys confirmed that all offshore portions of the lines between Platforms Hilda and Hazel and between Hazel and the shoreline are buried approximately 200 feet from the platforms and remain buried through the surf zone. Visual surveys of nearshore regions have also confirmed complete burial of the Hazel pipelines. The pipelines between platforms Heidi and Hope are intermittently exposed but they are completely buried for the majority of their route.

Actual depth of burial cannot be determined from the ROV surveys. Removal of exposed segments of pipeline would result in impacts associated with cutting the segments and burial of the pipeline ends. Bottom disturbance in such a case could be a potentially significant environmental impact, depending on depth of burial, sediments in place, and benthic communities present. Abandonment in place of the entire length also provides bottom stability for the whole pipeline.

The pipelines will be separated from the platform riser, capped, and the ends jetted down below mudline. No pipelines will be cut or opened until testing of flushed seawater confirms removal of residual hydrocarbons to acceptable levels.

2.6.2 Flushing and Pigging of Pipelines

The existing shipping pumps on the platforms will be used to pump a minimum of two pipeline volumes of seawater and two scraper pigs or oversize poly-pigs to remove hydrocarbons remaining on the interior walls of the pipelines. Additional seawater will be pumped, as necessary, until no visual hydrocarbons are present in the flush water.

Flush water will be pumped to the Carpinteria plant, treated through the oil/water separators, and discharged in accordance with the plant's NPDES permit. Water quality analysis will be conducted on the flushed water as required by the permit.

2.6.3 Removal of Spool Pieces and Pull Sleds

After the pipelines have been flushed, they will be disconnected from the platform risers at the seafloor and capped. Where possible, the pipelines will be disconnected at existing subsea flanges at the seafloor and a blind flange will be installed to cap the line. If an existing subsea flange is not available, the pipeline will be cut at the seafloor using an oxy-arc torch. The pipeline stub will be capped using a cylindrical sleeve with a plate seal welded to one end. The open end of the sleeve will be placed over the end of the pipe stub and three contact bolts will secure the sleeve to the pipe. The annulus between the sleeve and the pipe will be sealed with an epoxy sealing compound.

The pipe spool piece between the pipeline cut location and the platform riser will be disconnected from the riser and recovered. The pipeline risers will be recovered with the platform jackets.

2.6.4 Burial of Pipeline Ends

The pipeline ends will be jetted in 1 foot below mudline using a high volume diver-held hand jet, and the excavation will be backfilled in a similar manner. The pipeline pull sleds will be left in place if the pipelines are below mudline prior to cutting. If the pipelines are exposed at the cut location, the pull sled will be removed to facilitate burial of the pipeline end.

2.6.5 Nearshore Pipeline Abandonment

2.6.5.1 Platform Hope to Shore

Two of the three pipelines running from Platform Hope to shore will continue to transport OCS oil and gas after Hope has been removed, and their abandonment is not included in this project. The third pipeline will be out of service but will remain in place. The nearshore abandonment of this pipeline will be performed in conjunction with the pipelines which are being left in service. The platforms currently serviced by these pipelines include Hope, Heidi, Grace, and Gail. Platforms Grace and Gail will continue to transport through two of these pipelines, which reach landfall to the east of Casitas Pier and are listed as follows:

10-inch SACS oil/water
10-inch Oil Gail/Grace
10-inch Gas (Combined Streams)

Prior to Platform Hope jacket removal, the 10-inch Gail/Grace oil and the 10-inch gas pipelines will be rerouted 150 feet east of the structure. The proposed pipeline rerouting is being processed as a separate project and will be evaluated under the auspices of the California Coastal Commission in conjunction with the County of Santa Barbara and other responsible agencies.

2.6.5.2 Platform Hazel to Shore

The three pipelines servicing Hilda and Hazel and running to shore will be abandoned in place to minimize environmental impacts associated with removal operations. As such, no disruption of the beach or bluff face will occur. Over an approximately 30-year period, the Hazel-to-shore pipelines have remained buried during numerous severe storms. Monitoring of the pipeline landfall has confirmed that the pipelines have remained buried and future exposure by natural forces is unlikely. In addition, abandonment in place poses no significant risk or hazard and, thus, represents the environmentally superior alternative to the disruption caused by removing the lines across the beach. The pipelines to be abandoned are as follows:

8-inch (Out of Service)
6-inch gas
6-inch oil and water

a. **Pipelines Grouted 800 feet Offshore from Bluff.** Upon completion of the flushing and pigging operations, the nearshore segment of the three pipelines will be grouted. Each line will be grouted in a separate operation from a portable cement unit located onshore. A pig will be inserted into the pipelines at the valve box on the bluff and grout will be introduced and pumped until the pig is at a point where the water depth offshore is -15 feet MLLW (approximately 800 feet) from the bluff. This measurement will be based on volumetric calculations. As previously stated, the pipeline is completely buried from the bluff through the surf zone. Abandonment in place with internal grouting avoids the impacts associated with exposing and removing the pipeline in the surf zone and beach.

2.6.6 Offshore Pipeline Abandonment

2.6.6.1 Platform Heidi to Hope Pipelines

The Heidi to Hope pipelines are comprised of the following lines:

10-inch Gas Lift
10-inch Gas
10-inch Oil and water

These lines will be abandoned in place as described in items 2.6-1 through 2.6-4 above.

2.6.6.2 Platform Hilda to Hazel Pipelines

The Hilda to Hazel pipelines consist of the following lines:

8-inch Out of Service
6-inch Gas
6-inch Oil and water

These lines will be abandoned in place as described in items 2.6-1 through 2.6-4 above.

2.6.6.3 Pipelines to Subsea Wells

Abandonment of the subsea wells located shoreward of Platform Hilda will be conducted as a separate project and evaluated under separate permitting and environmental review. The pipelines between these wells and platform Hilda will be abandoned in place prior to the platform removal as described in items 2.6.2 through 2.6.4 above. The pipelines associated with the subsea wells are as follows:

4-inch Flowline - Pool
4-inch Flowline - Gauge
2-inch Gas Lift
1-inch Hydraulic

2.7 POWER CABLE ABANDONMENT

2.7.1 General

Electrical power supply to each platform is currently provided by subsea cable. Since their installation, these cables have been buried by natural sediment deposition. To avoid disturbance to the natural bottom, these cables will be abandoned in place, except in the case of the shore end of the cable to Platform Hope. The power cables will be cut at the base of each platform and the ends will be jetted down into the bottom.

2.7.2 Cable Cutting

The power cable will be excavated where it enters the mudline using diver-held air lifts. The cable will be cut one foot below mudline with an oxy-arc torch or a mechanical cutter.

2.7.3 Cable End Burial

The cable end will be jetted down an additional foot and covered with natural sediment. A hand jet will be used to backfill around the exposed cable end.

2.7.4 Nearshore Abandonment of Hazel Power Cable

The power cable to Platform Hazel comes ashore at Loon Point in Summerland where it terminates in a switchgear box on the top of the bluff. This cable was buried several feet in the nearshore area when it was installed. To avoid disturbance to the beach and bluff, the cable will be abandoned in place. The cable will be severed at the switchgear box and the cable end will be reburied.

2.7.5 Nearshore Abandonment of Hope Power Cable

The power cable to Platform Hope comes ashore at the end of Casitas Pier. This cable was not trenched originally, and lies near the mudline, where it is possible that it could be exposed in the future. The cable will be severed at the junction box at the end of the pier and at a subsea point 800 feet offshore from the bluff, where it becomes buried deep enough to prevent exposure. The cable between the end of the pier and the subsea cut will be recovered and the end of the cable will be jetted down as described in item 2.7.3.

2.8 SITE CLEARANCE VERIFICATION

2.8.1 General

Verification of site clearance will be performed as part of the final debris recovery operation.

2.8.2 Side Scan Sonar Survey

The survey will be performed using a 500-khz side scan sonar system such as the Klien 595 or equivalent. The survey will be supported from a support vessel with a length of at least 50 feet. Positioning will be provided by a navigation system with 3-meter accuracy. Underwater positioning will be based on slant range calculations.

2.8.3 Procedures

Survey lines will be run at 50-meter spacing in lines running East to West and North to South. Coverage will be with overlapping survey lines with complete coverage of the platform site. Tow speed will be between 3 and 5 knots.

2.8.4 Data Reduction

The data will be reduced in the field and suspect targets will be listed and plotted for target verification survey.

2.8.5 Target Verification

The suspect targets located with side scan sonar will be visually surveyed with an ROV and Mesotech 971 Color Scanning Sonar or equivalent. Suspect targets which are identified as debris will be plotted for recovery operations.

2.8.6 Debris Recovery

The debris located will be recovered by divers to complete the site clearance verification. Pre- and post-abandonment surveys will be conducted within a 1,000-foot radius of the platforms. Test trawls will also be conducted in the area. No trawls are proposed along the pipeline route, as the Department of Fish and Game states that this is a "no trawl" area. It should also be noted that most of the trawl fishermen in the area have already been supplied rollers for their trawl gear by Chevron to mitigate potential gear impacts from oil and gas pipelines.

2.9 PLATFORM DISPOSAL

2.9.1 General

The platform materials will be taken to the Port of Long Beach/Los Angeles for onshore disposal. The possibility for creating an artificial reef with the jacket materials has been investigated, but the current policy of California's Department of Fish and Game is not to create such reefs from scrap material.

2.9.2 Caisson Legs

The caisson legs will be towed to the scrapping site floating by their own buoyancy. The large size and weight of the legs will make it feasible to use drydock facilities for scrapping.

2.9.3 Other Materials

Various steel scrapping facilities have been identified in the Ports of Los Angeles and Long Beach that have the necessary equipment and permits in place to process the abandoned platforms. The facility that is actually used will depend on its storage capacity, steel processing rate, and availability at the time the platforms are removed. It is possible that more than one facility will be used to process the platforms. The steel processing rate for one of these facilities is 160 tons/day. At this rate, scrapping all of the platform steel would take 16 weeks. Information on the scrapping facility that is selected will be provided when available. Offloading will be performed with the derrick barge or land-based crane, depending on the size of the lifts and reach requirements.

2.9.4 Disposal of Materials that Cannot Be Scrapped

Approximately 13,000 tons of material will be generated from the abandonment project and sent to a scrapping facility. This total includes 2,200 tons of material that will be landfilled, such as cemented pipe strings. The remainder of the material is steel which is suitable for scrapping. The platforms will contain no hazardous materials at the time they are removed.

2.9.5 Vessel Traffic Routes

All vessel traffic associated with the project will stay within designated vessel traffic routes established for shore to platform and inter-platform travel. Materials barges will stay within designated shipping lanes when travelling from the project area to the Port of Long Beach/Los Angeles. It is anticipated that towing will take 40 hours per platform.

3.0 CRITICAL OPERATIONS AND CURTAILMENT PLAN

3.1 INCLEMENT WEATHER CONDITIONS

The final determination for shut down of operations due to inclement weather will be made by the barge superintendent, or vessel captain, in conjunction with the removal contractor project manager. Conditions warranting shut down include heavy swell and high winds, but shut down will also be influenced by the swell period, and the direction of wind and swell. The particular vessels affected and their size will also affect the capability to continue work in marginal conditions. As a general rule, sea states of over 8 feet, and winds in excess of 35 knots may cause a shut down. Some operations which are less weather sensitive may continue, as directed by the removal contractor.

3.2 DYNAMIC LIFTS

The removal of major sections of the platform deck packages by a derrick barge will involve some movement from the barge in the swell. Without preparations, this movement could make it difficult to safely reset the package if the lift is aborted. Any lift where safe resetting of the package may be difficult will be engineered with guides installed to control the package movement horizontally for approximately 2 feet of vertical movement. To prevent damage to the oil and gas pipelines from Platform Grace, no heavy lifts will be made over the pipelines service during the removal of Platform Hope.

3.3 DEPLOYMENT OF DIVERS

Divers may be deployed from the platform, barges, tugs, or other support vessels during the project. The diving supervisor will have radio communication with all other vessels on the project to coordinate traffic in the divers' area. The diving supervisor shall approve vessel traffic in the divers' work zone. All diving operations will be performed in accordance with U.S. Coast Guard regulations.

3.4 MOORING OPERATIONS

The process of setting anchors for barges and workboats will be performed as follows:

- Prior to the platform removal project, the position of any active pipelines and hardbottom features in the area will be verified by the pre-abandonment debris survey. The pipeline and hardbottom area locations will be plotted on the positioning system used by the anchor handling vessels which will deploy the anchors in preselected locations that are away from active pipelines and hardbottom areas. This procedure should eliminate any risk of damaging the pipeline and sensitive hardbottom areas with an anchor.

- Anchors will be transported near the water surface by a tug, holding the crown wire, and a crown buoy. All anchors shall be deployed and recovered by a tending vessel using a pendant line to lower and raise the anchors vertically.
- The anchor location will be identified by a survey system with 3-meter accuracy.
- The tug will lower the anchor to the seafloor in the surveyed position, followed by tensioning from the barge.
- The crown buoy position will be monitored during tensioning to verify that the anchor remains in an approved location.
- Periodic checks of the crown buoy position will be made.

3.5 USE OF EXPLOSIVES

The use of explosives will be conducted in accordance with all laws and regulations regarding such activity.

- A licensed State of California blasting supervisor will direct the work, and will coordinate the clearance of the site prior to making a shot.
- Explosives will be stored in a safe manner and in well-marked containers. Nitromethane, which will be used as the main charge, is not classed as an explosive when stored prior to mixing.

4.0 OIL SPILL CONTINGENCY

The proposed execution plan has been designed to ensure the safe and effective removal of the four state waters platforms. Prior to removal of the platform structures and abandonment of subsea pipelines, all oil handling facilities will be drained and flushed of residual hydrocarbons. All wells on the platforms will have been plugged and abandoned in compliance with California State Lands Commission and Division of Oil and Gas requirements.

Despite these precautions, the potential for a small operational spill still exists for the proposed operations. Such spills would most likely be associated with diesel fuel transfers or accidental releases. The following section provides an overview of the initial procedures and equipment which will be available in the event of an oil or diesel spill at the project site. Such procedures and equipment have been designed to handle the most likely spill events. Should the spill exceed the capacity of the onsite equipment and personnel, additional resources are available through Chevron's local oil spill response organization and Clean Seas Oil Spill Cooperative. Procedures and equipment for major and minor spill events are outlined in Chevron's Oil Spill Contingency Plan (OSCP) for State Leases. This section provides only a summary of the comprehensive procedures and equipment outlined in the OSCP.

4.1 NOTIFICATION

An important step in the response procedure is notification of others of the incident. Notification is essential to activate the response organizations, alert company management, obtain assistance and cooperation of agencies, mobilize resources and comply with local, state, and federal regulations.

The order of notification is based on the premise that those parties who can mobilize and provide assistance in controlling or minimizing the impacts of an incident be notified first. The notification process encompasses the following categories:

- Company Notification
- Agency Notification
- Response Team Activation
- Third Party Notification
- Notification of Other Interested Parties
- Notification of Families of Team Members
- Periodic Progress Updates and Reports
- Accidents and Casualties Notifications

Figure 4.1-1 illustrates a typical sequence of notifications following an oil spill that enters or threatens to enter the ocean.

4.1.1 Confirmation of Leak Report

Upon receipt of the initial report of an oil spill, the Operations Supervisor will make an immediate assessment of the approximate quantity and extent of the spilled oil. Normally, this initial assessment can be made by rapid inspection at the operations site. The On-Site Operations Supervisor will evaluate the situation and, if the situation warrants, will activate the Immediate Response Team and make the appropriate notifications.

4.1.2 Company Notification

Chevron requires that all emergencies be brought to the immediate attention of its management. The Operations Supervisor or his representative on-site will notify the Operations Manager by radio or telephone with an initial assessment of the extent and nature of the spill. The Operations Manager will inform the Profit Center Manager or his representative who will decide to activate all or part of the Major Spill Response Team. If activation is deemed appropriate, the Profit Center Manager authorizes the activation sequence as shown in Figure 3.2 of Chevron's OSCP for State Leases.

4.1.3 Government Agency Notification

Following the completion of company notifications, Chevron's Operations Supervisor will notify all required government agencies. These agencies include:

USCG National Response Center
(800) 424-8802

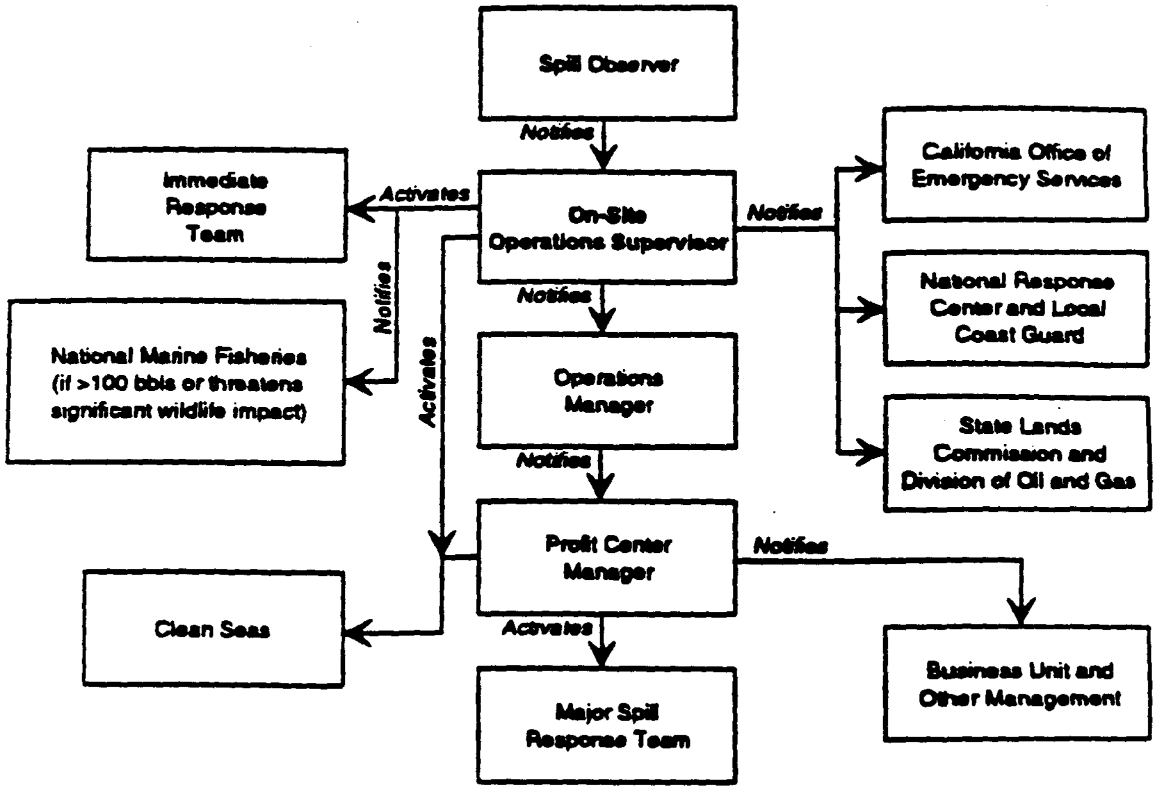
USCG Santa Barbara Office
(805) 962-7430

California Office of Emergency Service
(800) 852-7550

State Lands Commission
(310) 590-5201

4.1.4 Oil Spill Cooperative Notification

Chevron is a partner in the Clean Seas cooperative. The cooperative provides oil spill equipment and resources that are immediately available. If a spill exceeds Chevron's in-company response equipment capability, Clean Seas will be notified immediately. Resources available through Clean Seas are listed in Section 4.4, Available Oil Response Equipment (Resources).



TYPICAL NOTIFICATION PROCEDURE

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FIGURE 4.1-1

4.2 RESPONSE STRATEGY

4.2.1 General Response Strategy

In the event of a spill from a Chevron facility or associated pipeline in state waters, the appropriate Chevron personnel and government agencies will be notified per the procedures given in Section 3 - Notification, of Chevron's OSCP for State Leases.

If the spill is minor, normally only the Immediate Response Team described in Section 4 - Organization, of Chevron's OSCP for State Leases will be activated. Response procedures for minor spills are discussed in the same section and in Section 9 - Procedures.

If the spill is of major magnitude, both the Immediate Response Team and the Major Spill Response Team will be activated. The Major Spill Response Team is described in Chevron's OSCP for State Leases.

Immediate response to an oil spill will depend on the specific circumstances associated with the spill. In all cases, the safety of the response team will have the highest priority.

Initial response for the project platforms is provided by the crew boat which is normally stationed at the Carpinteria Pier. A containment boom is stored on the stern of the crewboat. Additional equipment and manpower can be provided by Clean Seas and other oil spill cooperatives, Chevron's El Segundo Refinery and other equipment sources. Inventories of onsite equipment are provided in Section 4.4.1. Additional equipment inventories are provided in Chevron's OSCP for State Leases.

4.2.1.1 Immediate Command and Control

Upon becoming aware of a spill, the Chevron Operations Supervisor or his representative will assume command of the spill response operations. This person will make sure that proper action is taken and see that appropriate government agencies are notified. Should the spill be a major spill or become uncontainable with immediately available equipment, then activation of the Major Spill Response Team, described in Chevron's OSCP for State Leases, may be appropriate.

4.2.1.2 Specific Strategies

The specific strategies taken to control, contain, and clean up a spill will vary with the type of oil spilled, the location, the amount, and various other factors. General guidelines for various types of spills are given in the following pages of this section. The Operations Supervisor or his representative should analyze the situation and exercise good judgment in formulating the best plan for the type of spill that occurs. Once oil is spilled on water, action should be taken immediately to control and contain the spill and to minimize environmental damage.

Table 4.2-1. General Response Strategy

First Response to a Spill
Anyone observing a spill should immediately contact the necessary qualified personnel to take emergency action to stop flow at the source safely. Examples of such action are: • Close block valves to stop leaks; • Stop pumps if a tank is being overfilled; • Stop fuel pumps and minimize leakage from fuel lines if a fueling leak occurs.
Preventing Fire and Explosion
Fire and explosion are always dangers during petroleum product spills. Although flammability varies dramatically with the spilled product and the circumstances of the spill, it is essential that all reasonable steps be taken, as soon as possible, to minimize the chance of accidental ignition of the spilled product(s). Examples of such steps are: • Extinguish open flames, such as welding torches, immediately. • Cease all operations involving arc welders, grinders, and other sources of sparks. • Cease all operations which vent oxygen or enriched oxygen mixtures (such as certain diving operations) as soon as feasible. • Shut off electric circuits that might create a fire hazard, if possible. Under some circumstances, even a simple switch or electric motor can cause a dangerous spark. Remember that fans, blowers, electric lights, and electric pumps all have switches and/or electric motors. • Extinguish smoking materials, where appropriate.
General Strategies
• Physical removal of the oil is the preferred action in almost all cases. However, from a practical standpoint, much of the oil spilled during a minor spill will be dispersed by wind and wave action. Effective physical removal will depend on relatively calm weather and water conditions, and the speed with which the oil slick can be contained. • Containment and recovery should only be attempted for crude oil, diesel fuel, lubricating oil, or fuel oils. Containment and recovery should not even be attempted on spills of volatile products such as gasoline. Liquefied petroleum gases (LPG or LNG products, obviously, cannot be contained at all, unless they occur inside a vessel or other structure. Volatile products will normally spread and evaporate quickly. Containing them merely reduces their evaporation rate and increases the hazard of fire or explosion. • Spills remaining in the confines of the platform and not reaching the water will be cleaned up using materials such as sorbent pads to pick up any spilled oil or fuel. Oil soaked absorbents and other contaminated debris will be disposed of at an approved onshore site listed in Section 9 - Procedures, of Chevron's OSCP for State Leases. Good housekeeping practices will be maintained on-board the platform to keep the decks clean of oil and other pollutants.

Table 4.2-2. Strategy for Minor Spills

Minor Spill Strategy
In the event of a minor oil spill the following general procedures will apply:
• Ensure personnel safety. • Stop the flow of the spill. • Begin containment and cleanup procedures. • Notify appropriate Chevron and government entities. Note: It is always better to over-respond.
Spills less than 5 barrels (210 U.S. gallons):
• All items listed above • Deploy containment and/or absorbent boom; use absorbent boom and pads and/or skimmer to pick up oil. • Deploy additional equipment and alert oil spill co-op as necessary. • Maintain cleanup operations until no visible sheen is apparent.
Spills of 5 to 10 barrels (210 to 420 U.S. gallons):
• All items for spills less than 5 barrels. • Alert local oil spill co-op immediately. Call out appropriate cooperative and/or contractor equipment if it is apparent that "onsite" containment and pick-up equipment cannot handle the spill. • Assess wind and current direction to determine possible path of the spilled oil.

*See Sections 7 - Resources, and 9 - Procedures, of Chevron's OSCP for State Leases for specifics of the strategies described above.

4.3 ORGANIZATION OF IMMEDIATE RESPONSE TEAM

Chevron's OSCP for State Leases outlines two related response teams to make up the overall Oil Spill Response Organization. The first is the Immediate Response Team which is primarily composed of on-site Chevron, contract and/or Co-op personnel. The second team is the Major Spill Response Team which is composed of Chevron personnel who are based at various locations and under the overall direction of the Incident Commander during an emergency incident.

The Immediate Response Team is designed to make maximum use of the personnel and equipment onsite during platform removal operations. The team is structured to provide an immediate containment and control capability for minor spills. The team will also initiate control actions for large or uncontained spills regardless of their source.

The Major Spill Response Team's role is to provide assistance to the Immediate Response Team for large or uncontained spills which may require supplementary equipment or manpower. In this case, the Major Spill Response Team will provide the necessary support in obtaining the additional resources required to contain and clean up the spill and will oversee the entire response operation. Refer to Chevron's OSCP for State Leases for Major Spill Response Strategies and equipment.

4.3.1 Immediate Response Team

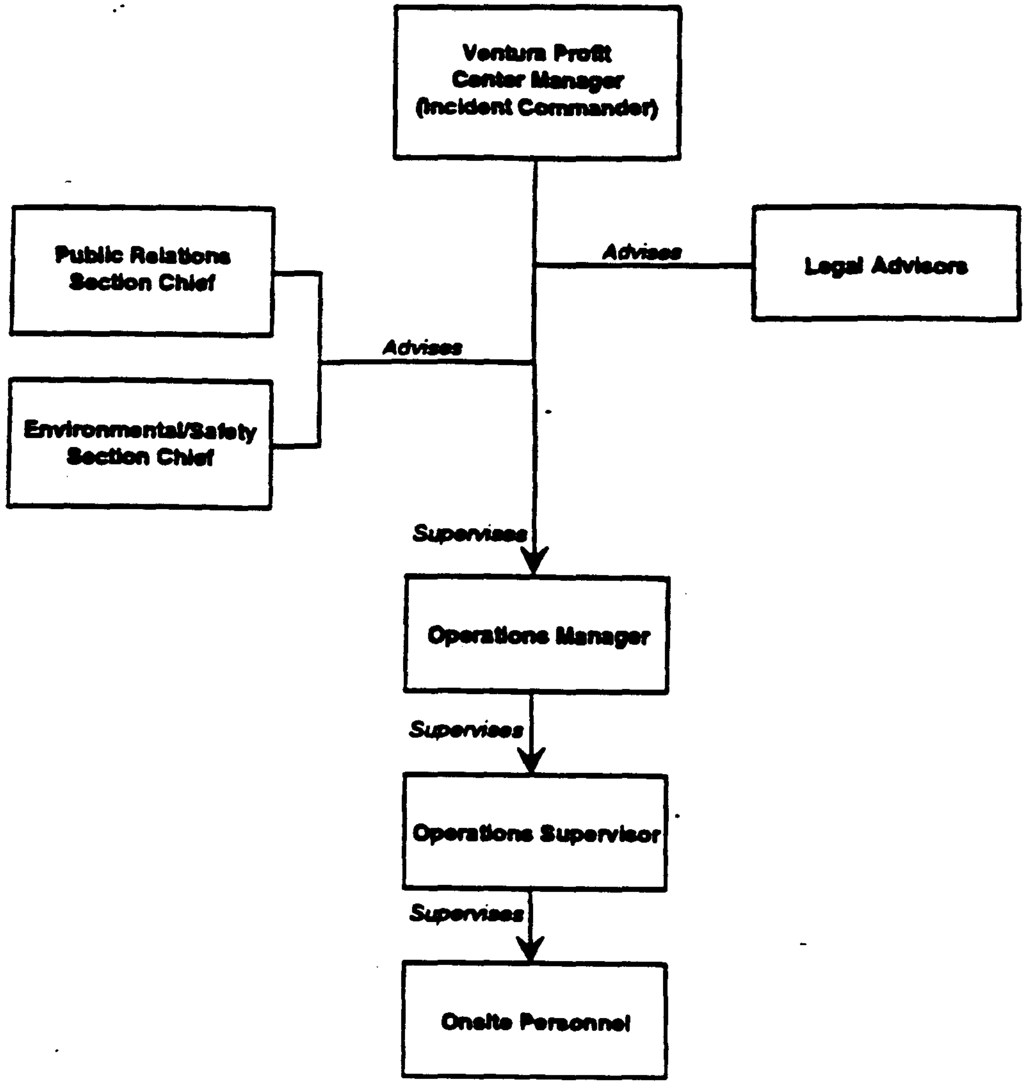
The Immediate Response Team will operate under the direct supervision of the Operations Supervisor, with overall supervision provided by the Incident Commander via telephone or radio communications. This team will respond immediately to any spill which may occur. The Immediate Response Team will utilize oil spill response equipment from crewboats and/or other support vessels. If this equipment is not adequate to contain the spill, the Clean Seas cooperative will be contacted immediately. Upon discovery of an oil spill or the initiation of an equipment deployment drill, the Immediate Response Team should have on-site response equipment deployed and operating within 1 to 2 hours. The organizational structure of the Immediate Response Team is shown in Figure 4.3-1.

Organizations prepared for response to oil spills must be capable of fulfilling responsibilities and requirements established by federal, state, and local laws and regulations. In addition to meeting the specific requirements established by law, Chevron policy is to respond with the best of its available resources and capabilities to prevent or minimize any damage that could result from spilled oil.

4.4 AVAILABLE OIL RESPONSE EQUIPMENT (RESOURCES)

4.4.1 Onsite and Locally Available Equipment

The equipment presented in Table 4.4-1 has historically been maintained on the project platforms. In efforts to retain the same level of spill response during abandonment operations, this equipment will be transferred to onsite support vessels during the platform removal project. In addition, per State Lands Commission Requirement, a minimum of 400 feet of sorbent boom, 5 bales of sorbent pads, and a small motorized boat will be maintained on one of the vessels in the immediate work area throughout the platform removal and pipeline abandonment phases of the project.



IMMEDIATE RESPONSE TEAM

CALENDAR PAGE	627
MINUTE PAGE	3328

FIGURE 4.3-1

Table 4.4-1 Oil Spill Response Equipment Maintained on Project Platforms

Platform Hazel • 360' absorbent boom. • 5 bags absorbent pads (100 pads/bag). • 240' Kepner boom (or equiv.). **Platform Hilda** • 240' Conwed sorbent boom (or equivalent) • 300' Kepner boom (or equivalent) • 5 bags absorbent pads (100 pads/bag). • Oil Skimmer Equipment:* Acme Floating Skimmer, Model 51T Flex hose Inflatable buoy Anchor buoy and line Air Compressor Wilden pump 1200 gallon Kepner Sea container (or equivalent	**Platform Heidi** • 200' absorbent boom. • 6 bags absorbent pads (100 pads/bag). **Platform Hope** • 200' absorbent boom • 5 bags absorbent pads (100 pads/bag). • 150' Kepner boom (or equivalent). • Oil Skimmer Equipment:* Acme Floating Skimmer, Model 51T Flex hose Inflatable buoy Anchor buoy and line Air Compressor Wilden pump 1200 gallon Kemper Sea container (or equivalent) **Crewboat** • 750' Expandi boom with Rotopak (or equivalent)

* Note: Under special circumstances such as drilling and abandonment operations, upon approval of appropriate regulatory agencies, skimming equipment may be transferred from one platform to another.

4.4.2 Clean Seas Equipment

If an oil spill occurs that exceeds the capacity of on-site personnel and equipment, Chevron will request assistance from Clean Seas. Clean Seas is an oil spill cooperative of which Chevron is a member whose operating area includes both the Santa Maria Basin and the Santa Barbara Channel. Major equipment owned by Clean Seas, along with storage locations, are given in this section. Procedures required for activating this equipment are given in Section 9.0 - Procedures, of Chevron's OSCP for State Leases. Due to equipment upgrades, replacements, etc., these inventories are subject to change. Table 4.4-2 provides a partial inventory of Clean Seas equipment contained in storage vans at the Carpinteria facility.

Table 4.4-2. Inventory of Clean Seas Equipment and Materials Effective February 2, 1992

	Quantity	Size
OSRV *Mr. Clean II*		
Offshore Device Advancing Skimmer	2	750 gpm
Expandi 70" Boom	1	1,500 feet
Expandi 43" Boom	1	1,500 feet
Goodyear 12"x14" Boom	1	1,485 feet
Walosep W-4 Skimmer or GT260 or 135 Skimmer	1	90 bbls
15-ton Crane	1	15 foot
Oil or Water Seperation Tank	1	200 gal
Skiff	1	—
Dispersant Application System	1	—
Integral Oil Storage Capacity		1,800 bbls
Absorbent Boom	10 bags	—
Absorbent Pads	10 bags	—

Van No. 05 Carpinteria Clean Seas Yard	Van No. 07 Carpinteria Clean Seas Yard
1500' of Super Max Boom Sorbents 13 bales Booms 12 bags Sheets 4 Anchors Shovels Misc. tow lines Buoys Bags for sandbags	1600' of 43" Expandi Boom 660" of 30" Expandi Boom Sorbents 5 bales Booms 14 bags Sheets 5 Sweeps 1 box Bags 20 boxes Blankets 1 box Oil Snare 4 Anchors with misc. anchor & crown lines, buoys Misc. tow lines & buoy lines Misc. tools Life jackets

Table 4.4-2. (Cont'd)

Van No. 09 Carpinteria Clean Seas Yard	Van No. 10 Carpinteria Clean Seas Yard
1520' of Sorbent Boom Sorbents 75 bags Sheets 5 Sweeps 100 boxes Oil Snare Anchors with misc. anchor & crown lines, buoys Misc. tow lines & buoy lines on reels Misc. buoys 55 gal drums	440' of 14" x 24" Goodyear Boom Sorbents 5 bales Booms 10 bales Sheets 3 boxes Bags 2 boxes Oil Snare 2 - 5,000 gal floating storage bags Anchors with misc. anchor & crown lines, buoys Misc. tow lines & buoy lines on reels 55 gal drums Misc. tools Life jackets
Van No. 11 Carpinteria Clean Seas Yard	**Van No. 12 Carpinteria Clean Seas Yard**
800' of 16" Kepner Boom Sorbents 2 bales Booms 11 bales Sheets 1 box Bags 15 Blankets 1 Anchor 75' of 3/4" tow line 2 - 55 gal drums	2 - 14 hp compressors 2 - 2" pumps 2 M15 pumps 2 Marlow pumps 1 gas driven generator Misc. hose floats Blinking lights Life jackets

This list is not intended to correspond to temporary relocation and/or movement of equipment nor to periods when equipment is out of service for repairs or maintenance.

4.5 OFFSHORE SPILL SCENARIOS AND RESPONSE PROCEDURES

4.5.1 Offshore Spill Scenario - Minor Spill

An offshore oil release during the abandonment procedures would most likely be associated with a fuel transfer spill, with pipeline flushing operations, or during separation of the pipelines from the platforms. Potential spill locations would be in the operational areas of the derrick barge and/or near the platforms. In the event of a release of oil or contaminated water, the following procedures will be implemented utilizing the onsite equipment listed in Table 4.4-1.

Table 4.5-1. Response Procedures - Minor Spill

Responsible Person	Action
Onsite Personnel	1. As soon as possible, onsite personnel shall notify the Operations Supervisor and provide him with information on: - the source of the spill; - the type of product spilled; - the status of control operations. 2. Onsite personnel shall immediately conduct containment control operations: - shut down transfer pumps; - close all flow valves; - turn off all sources of ignition; - deploy Conwed sorbent boom. 3. At direction of the Operations Supervisor, onsite personnel shall deploy appropriate equipment and carry out response and recovery operations. - Oil sorbent materials and any other oily debris recovered during response operations shall be stored in suitable containers or plastic bags. - Oil sorbent materials shall be disposed of at a state approved disposal site. 4. Maintain source and oil slick surveillance.
Operations Supervisor	In the event of a minor offshore oil spill during abandonment procedures, the Operations Supervisor shall: 1. Account for all personnel and ensure their safety. 2. Determine whether there is a threat of fire or explosion. 3. If a threat of fire or explosion exists, suspend control and/or response operations as appropriate until the threat is eliminated. 4. Assess the spill situation: - determine the source of the spill; - determine the status of response operations; - estimate spill volume; - estimate speed and direction of the slick's movement; - determine whether onsite containment and recovery equipment is sufficient to respond to the oil spill situation successfully and completely. 5. Notify Operations Manager, Mr. G.W. Gray Work phone: (805) 658-4630 Home phone: (805) 659-1737 Mobile phone: (805) 340-1853 Pager: (805) 531-4621

Table 4.5-1. (Cont'd)

Responsible Person	Action
Operations Supervisor	6. Notify appropriate government agencies (see appendix D for a complete list of appropriate agencies and interest groups). - California Office of Emergency Services Warning Officer 800-852-7550 (24-hour) - U.S. Coast Guard National Response Center 800-424-8802 (24-hour) - U.S. Coast Guard Marine Safety Office (Los Angeles/Long Beach) Commanding Office 213-499-5555 (24-hour) (Santa Barbara Office) 805-962-7430 - State Lands Commission 310-590-5201 (24-hour) 7. Supervise response, cleanup and storage operations. 8. Complete response, cleanup and storage operations. 9. File written reports with appropriate government agencies through Profit Center environmental staff.
Operations Manager	1. Notify Chevron's Incident Commander, Mr. A. Cornelius. Work Phone: (805) 658-4444 Home Phone: (805) 733-0220 Mobile Phone: (805) 689-7275 Pager: (805) 531-4606 2. Decide on Chevron Major Spill Response Team mobilization. 3. Assess the spill situation and request additional Chevron personnel, if required. 4. Maintain overall supervision of Immediate Response Team.

4.5.2 Offshore Spill Scenario - Major Spill

The potential for a major spill during platform removal is considered to be remote due to the precautionary measures taken as part of the abandonment procedures. However, should an oil spill occur that exceeds the capacity of the available equipment and personnel discussed herein, the procedures outlined in Chevon's OSCP for State Leases will be followed.

5.0. DESCRIPTION OF ENVIRONMENTAL SETTING AND DISCUSSION OF ENVIRONMENTAL IMPACTS FOR CHEVRON STATE WATER PLATFORM ABANDONMENTS (HEIDI, HOPE, HAZEL, HILDA)

5.1 ENVIRONMENTAL SETTING AND PROJECT IMPACTS

The following paragraphs discuss the existing regional and local environmental conditions encountered in the vicinity of platforms Heidi, Hope, Hazel, and Hilda, and their associated pipelines. Platforms Hazel and Hilda are located approximately 1.5 nautical miles (nm) from the Summerland coast in 96 feet (29 m) of water. Platforms Hope and Heidi are located 3 miles to the southeast of Hazel, directly off the coast of Carpinteria. Platforms Hope and Heidi are located approximately 2.6 and 2.5 nm from shore, respectively, in 132 ft (40 m) water depth.

Environmental issue areas contained within this document are generally discussed in both regional and platform-specific levels of detail, as well as offshore and onshore components.

A. Earth

Geology

Regional and local geologic conditions described in this section were compiled primarily from the DEIR for Exploratory Drilling Operations Proposed by Chevron U.S.A. Inc. for State Oil and Gas Leases PRC 2199, 3150, and 3184 (CSA, 1985); and the FEIR/EA for the BEACON Beach Nourishment Demonstration Project (Chambers, 1992).

Physiography

The geology of California's coastline can be characterized as dynamic and rapidly changing compared to most of the North American continent and in terms of the geologic time scale. This dynamic character is reflected in the rugged topography of California's coastal ranges and in the frequent earthquakes caused by crustal rock adjustments to changing stresses (Arthur D. Little, Inc., 1984).

Physiography of the Santa Barbara Channel includes the Western Transverse Ranges, the Santa Barbara Basin, the Channel Islands Platform (thought to be the westernmost portion of the Transverse Ranges physiographic province), and the Southern California Mainland

Shelf. The Transverse Ranges represent a unique feature in California coastal geology because of the predominantly east-west trend orientation relative to the underlying structure. The Coastal Ranges to the north and Peninsular Ranges to the south show northwest trending structure that is characteristic for most of California (Science Applications, Inc., 1984).

Mass Sediment Movements

Sediments in the Santa Barbara Channel area that are granular in nature may be prone to liquefaction (Dames and Moore, 1983; McClelland Engineers, Inc., 1983a,b; Nekton, Inc., 1984a). Seafloor instability triggered by seismic, oceanic, or gravitational forcing is recognized as a primary hazard in locating pipelines and platforms (McCulloch, et al., 1980; Richmond, et al., 1981), but is not considered a significant hazard to platform abandonment activities (Dames and Moore, 1983).

Mass movement of sediments is a common naturally occurring phenomenon along the Southern California continental borderland. These movements may take the form of slow sediment transport such as sediment flow or creep, or of sudden mass movements such as slides, slumps, turbidity currents, or liquefaction (Burdick and Richmond, 1982). Areas with evidence of previous seafloor instability have a high potential for future activity. Areas without evidence of previous instability may also pose a hazard if conditions allowing instability exist (Arthur D. Little, Inc., 1984).

The potential for slope instabilities in the Santa Barbara Channel results from several factors. Beyond the shelf break, thick sequences of water-saturated Pleistocene and Holocene sediments have accumulated. Some of these slopes have gradients approaching 6 degrees, and in many places these shallow sediment accumulations contain considerable quantities of trapped gas that weakens the slope sediment shear strength. Although particular areas of slope instability can be identified from evidence of previous disturbance, the evidence is often subtle and inconclusive (Science Applications, Inc., 1984).

Intertidal Surface Geology

In the intertidal region of the project area between Fernald Point and Rincon Point, the relative percentage of intertidal substrate is approximately 5 percent rock, 20 percent boulder, and 75 percent sand. The relative percentages of each change with seasonal sand movement. Many rock and boulder beaches are covered with sand in summer and exposed to rock during winter storms (Chambers, 1992).

Offshore and Onshore Local Geologic Conditions

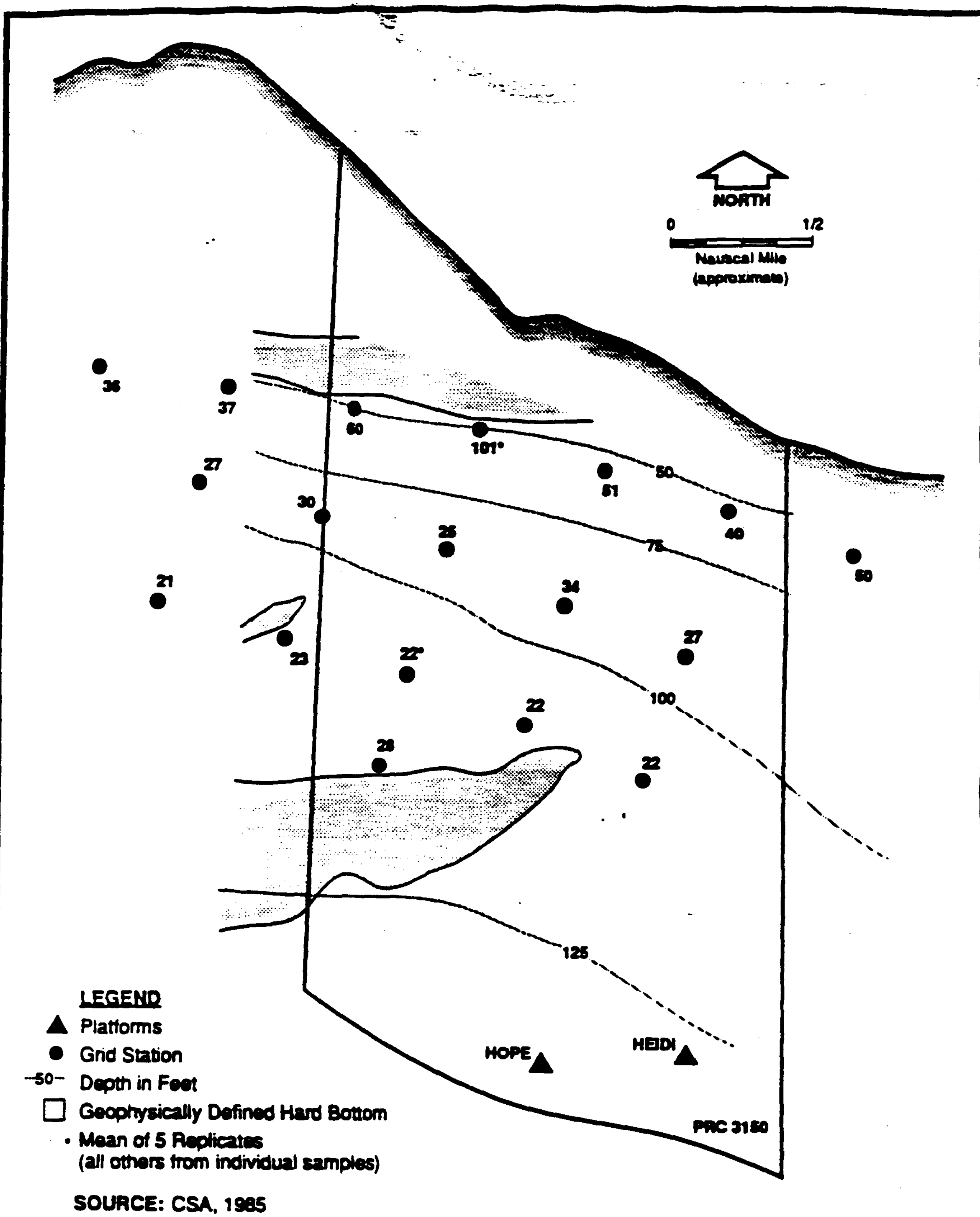
Heidi and Hope

- Bathymetry. In the lease area containing Heidi and Hope (PRC 3150), the seafloor slopes in a generally southwestwardly direction at approximately 0.7 degrees on the northern side and about 0.3 degrees on the southern side. The seafloor is generally smooth and featureless except for sedimentary rock outcrops in the southern and west-central portions. Relief at these locations ranges from 0.3 to 1.5 m (1 to 5 ft) (McClelland Engineers, Inc., 1983a,b).

  Surficial sediments collected during the biological surveys for previous studies in and near PRC 3150 were analyzed for grain size. Figure 1.1.1-1 shows the mean sediment grain size at each of the stations. Mean grain size ranged from 21 to 101 µm and decreased with increasing water depth and distance from shore. Figure 1.1.1-2 shows the spatial distribution of percent sand in the surficial sediments. Nearshore sediments generally contained 40 to 80 percent sand, whereas those farther offshore contained less than 10 percent sand. Silt content ranged from 15.5 to 80.6 percent; nearshore sediments were generally 15 to 50 percent silt, and offshore sediments 70 to 80 percent silt. Clay content ranged from 2.2 to 16 percent, and the values followed a similar nearshore/offshore pattern (CSA, 1985).

- Stratigraphy. Sedimentary rock strata, probably of Tertiary age, underlie Hope and Heidi. These rocks outcrop in the southern and west-central portions of the lease tract. An upper sediment unit overlies the older sedimentary rocks and varies in thickness from zero in the vicinity of the outcrops to a maximum depth of 20 m (65 ft) in the southeastern portion of tract PRC 3150. This sedimentary unit occurs in three east-west trending, shallow, trough-like basins which are separated by seafloor outcrops or sub-seafloor ridges of sedimentary rock strata. Sediment thickness is 11 m (35 ft) in the northeasternmost basin, 12 m (40 ft) in the central basin, and 20 m (65 ft) in the southern basin. Over the top of the sub-seafloor ridges dividing the basins, sediment thickness is generally less than 3 m (10 ft) (McClelland Engineers, Inc., 1983a).

- Structure. Underlying Hope and Heidi in PRC 3150, the shallow structural geology is characterized by generally flat-lying sediment that unconformably overlies older faulted and folded sedimentary rock strata (Figure 1.1.1-3). Upper sedimentary layers seem to be undeformed and unfaulted. An angular unconformity assumed to be an ancient erosional surface separates the upper sedimentary unit from the older-rock strata. In

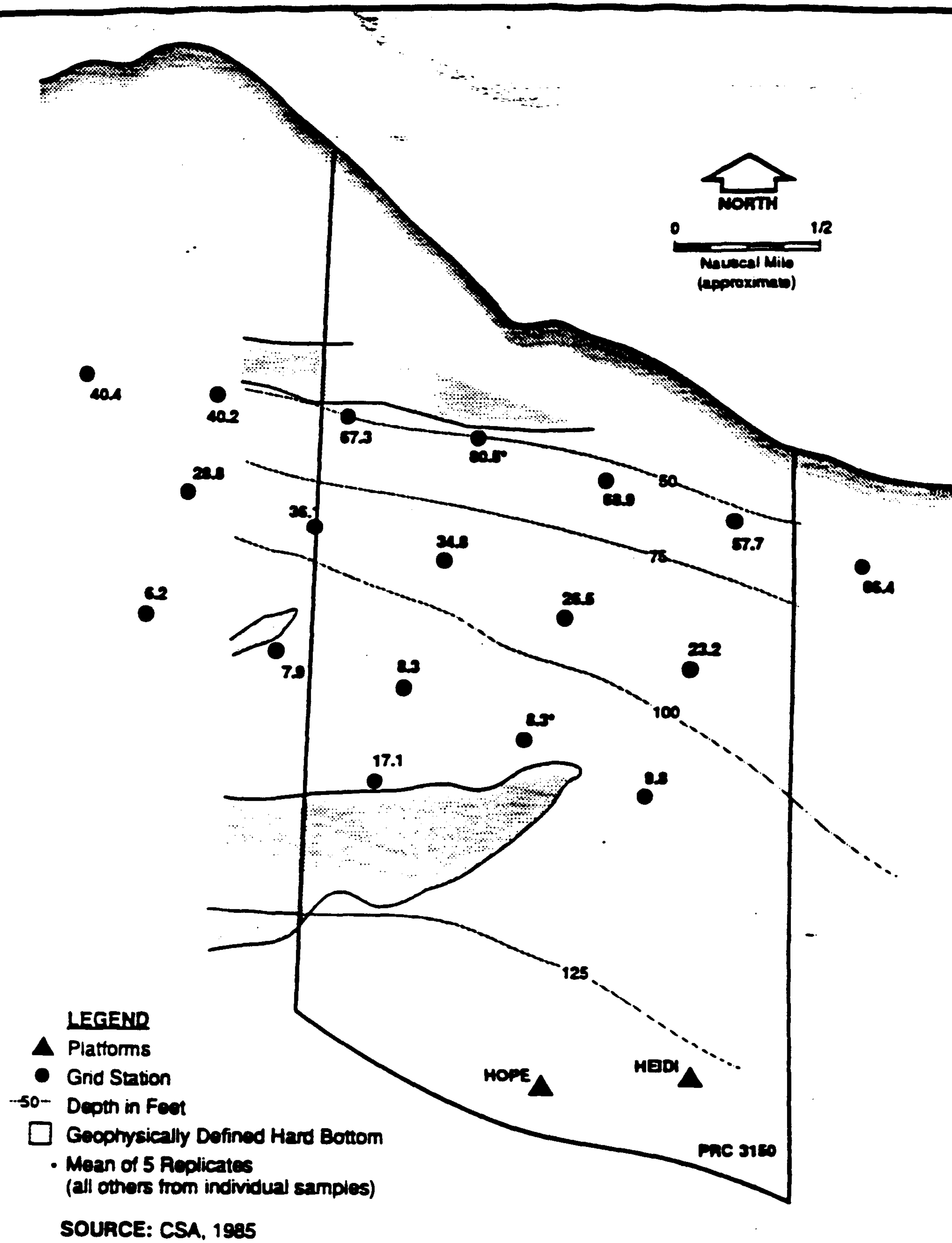


MEAN GRAIN SIZE (µm) OF SURFICIAL SEDIMENTS FROM LEASE PRC 3150 AND VICINITY

CALENDAR PAGE 636

MINUTE PAGE 3337

FIGURE 1.1.1-1

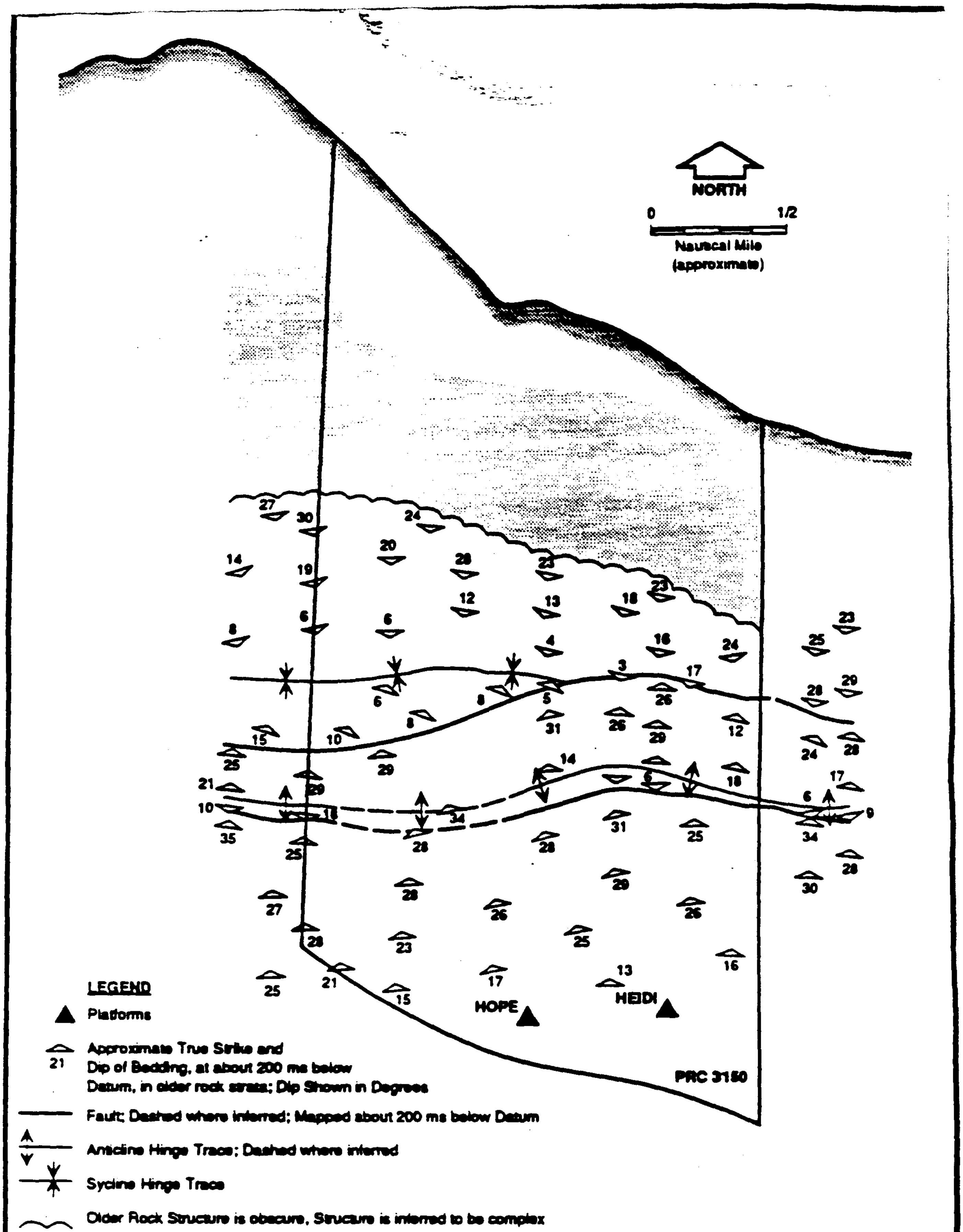


PERCENT SAND (DRY WEIGHT BASIS) IN SURFICIAL SEDIMENTS FROM LEASE PRC 3150 AND VICINITY

CALENDAR PAGE 637

MINUTE PAGE 3338

FIGURE 1.1.1-2



STRUCTURE MAP OF LEASE PRC 3150
(Adapted from: McClelland Engineers, Inc., 1983a)

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FIGURE 1.1.1-3

places, these older rocks are highly faulted and folded. Structural features trend east-west, conforming to the general structural pattern of the Transverse Ranges (CSA, 1985).

Two possibly intersecting faults occur in the lease area containing Hope and Heidi. The southernmost of these faults dips northward while its northern counterpart dips southward, suggesting an intersection at some depth (Figure 1.1.1-3). These faults are exposed only at the rock outcrops. They are covered in the areas where sediment buries the older rocks, suggesting that these faults are inactive. Luyendyk, et al. (1982) suggest that these faults may be associated with the Rincon Creek Fault. Both faults seem to cut only the older rock strata and do not appear to displace the seafloor (McClelland Engineers, Inc., 1983a).

- Seafloor Conditions Below the Platforms. Site specific information regarding the seafloor conditions beneath Hope and Heidi have not been obtained. However, the discussion of the seafloor conditions below Hazel and Hilda provide an approximation of the conditions potentially encountered at Hope and Heidi.

Hazel and Hilda

Site-specific information for the bathymetric, stratigraphic, and structural conditions of Hazel and Hilda at the level of detail provided above is not presently available. However, Simpson (1977) indicates that the ocean area in which platforms Hilda and Hazel are located is characterized by a flat, soft mud seafloor containing few rocks. A natural reef is located inshore of the platforms, northeast of Hazel.

- Seafloor Conditions Below the Platforms. Ayers, et al. (1980a) showed that over 90 percent of discharged drilling-fluid solids settle directly to the bottom, beneath the platform. The distance from the well site and settlement time are primarily a function of current and water depth. As discussed in Section 1.3, Coastal Processes and Water Quality, current speed in the Santa Barbara Channel does not usually exceed 10 cm/sec. Current data obtained in the vicinity of Hazel and Hilda indicate that north to northwest is the predominant direction of the flow of currents. While the precise dispersion radius of mud and cuttings on the seafloor below the platforms under study are not known, previous studies conducted underneath Hazel and Hilda indicate substantial piles at the base of the structures. According to Carlisle, et al., 1964, drill cuttings formed an irregularly shaped pile that reached 25 feet in height and 250 feet in diameter when the initial drilling was completed.

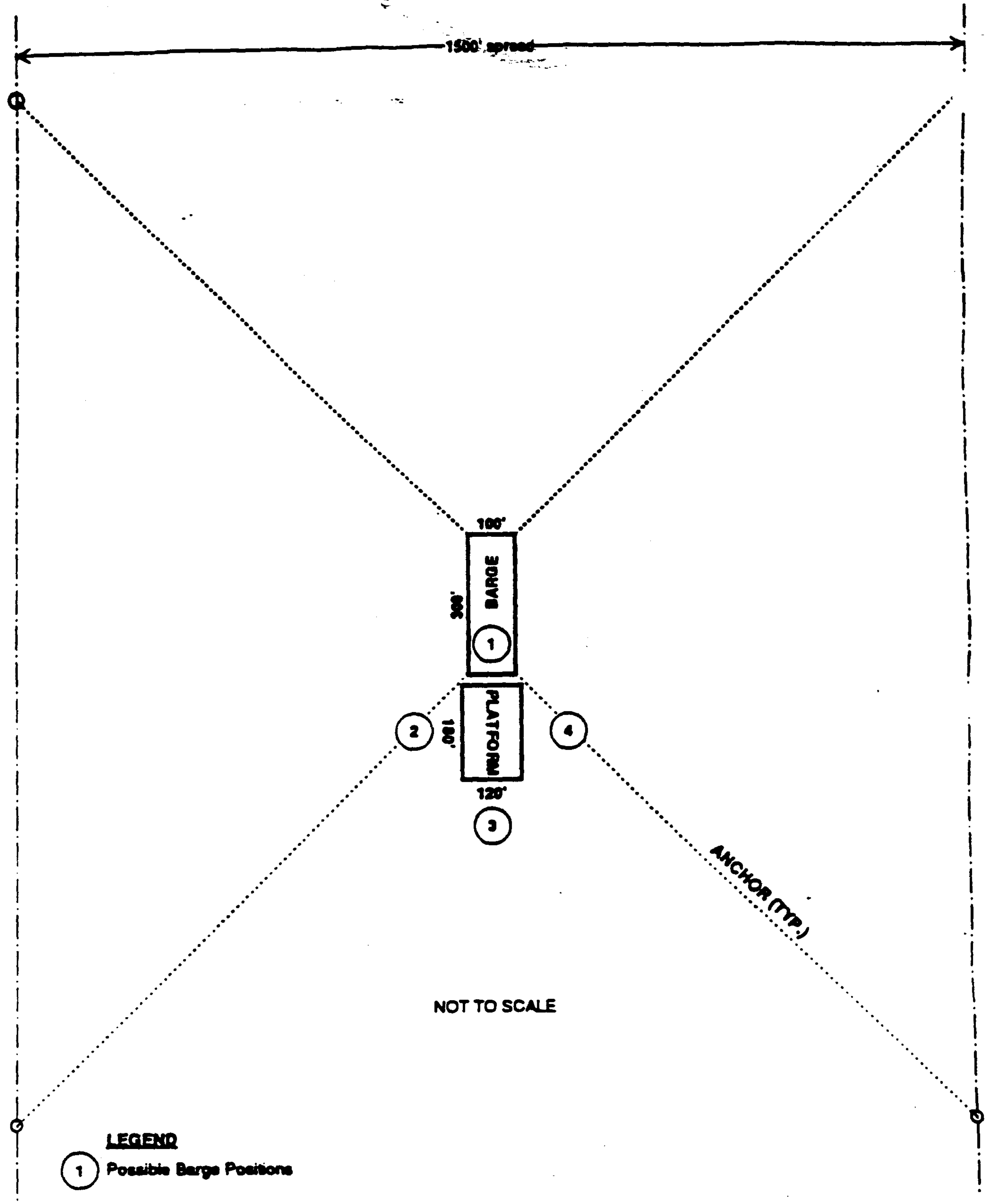
According to a more recent survey conducted in 1976 at platform Hilda, depth readings were taken every 10 feet with an oil-filled depth gauge during high tide. The divers found that the cuttings pile was skewed to the west, reaching a maximum height of 38 feet near the western face of the platform, in the area of the conductors (Simpson, 1977). As the conductors provided the densest area of attachment places for invertebrates on the platform, the study speculates that the pile may have been highest at that location due to the addition of mussel clumps that had torn loose in storm or had fallen from the pipes of their own weight. Carlisle's study indicated that the cuttings pile (without shells at the time), reached a maximum height of 25 feet. The 1976 data suggest that the layer of shells had increased to as deep as 15 feet in some places.

- Nearshore Substrate at Pipeline Landfall. Nearshore substrate at this location is probably Tertiary Age folded and faulted sedimentary rock strata. This is typically overlain by generally flat-lying sediment. The upper sedimentary layers seem to be undeformed and unfaulted (CSA, 1985).

Offshore Impacts

Geologic impacts from the proposed abandonment operations will be localized and short term in nature. Seafloor topography surrounding all platforms and along the pipeline corridors is relatively flat. Vibrations from project removal operations will not induce sediment slides or any other changes to the geologic environment. During derrick and materials barge anchor placement, there will be some localized bottom scarring, and short-term sediment disturbance and redistribution. However, seabottom scarring will be minimized by following the anchor-laying operations described below.

Typical anchor spreads for materials and derrick barges are 2,000 to 3,000 feet (Figure 1.1.2-1). Each anchor weighs approximately 12 tons and is connected to the barge by 1.5-inch-diameter cable onboard the barge. Each anchor typically occupies approximately 70 square feet and is wound on a winch-driven drum. Anchors are vertically placed on the bottom by anchor handling vessels. The barge is then pulled into the required position by winching against the placed anchors. Anchors are picked up by the tending vessel by lifting the anchor vertically with a pendant line. An anchor will bury itself when the required tension is achieved to resist the pulling forces of the barge. Anchors are not dragged on the bottom, but will create a disturbance while they are digging in. Anchor disturbances are generally limited to 16 to 165 feet in length (Centaur, 1984). A correctly placed anchor typically results in a disturbance of about 35 feet. Part of the cable length will also lie on the bottom and cause a minor amount of bottom disturbance. On the



TYPICAL PLATFORM REMOVAL
BARGE MOORING SPREAD

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FIGURE 1.1.2-1

average, about 150 feet of cable per anchor comes into contact with the bottom and disturbs a swath of about 2 feet; therefore, each anchor and its cable generally disturbs about 300 square feet per anchor position. The procedure of vertically lowering and lifting the anchor greatly reduces bottom scarring which usually occurs when anchors are dragged during conventional setting methods.

Jacket Removal: Hope, Heidi, and Hilda

Platforms Hope, Heidi, and Hilda all have similar configurations with two large caisson legs and two smaller, 54-inch-diameter legs with a caisson base. The piles driven through the caisson legs and caisson bases, and the well conductors that are inside the piles will be severed through the use of explosives. Approximately 25 to 45 pounds of explosives will be used per charge, with between 32 and 40 cuts per platform. Charges will be detonated over a 4- to 5-day period per platform. Upon severance, the caisson legs and caisson bases will be physically lifted from the seafloor, leaving shallow depressions in the seafloor.

Impacts to earth resources will result from both the explosives detonations and from subsequent removal of the severed conductors and pile legs. Explosive charges may result in some localized seafloor impacts; however, cuttings mounds accumulated at the base of the platforms will likely remain largely intact.

In order to avoid further bottom disruption to the seafloor after leg and caisson removal, depressions will not be backfilled. Over time, slumping, slides, and local current action will serve to naturally backfill these holes with sediment. Overall bottom topography near the former platform areas will remain as low-lying mounds. Therefore, impacts to earth resources associated with the jacket removal of platforms Hope, Heidi, and Hilda will be localized, short term, and less than significant.

Jacket Removal: Hazel

The existing bottom at the platform is now above the top of the caisson bases. To avoid extensive disturbance to the seafloor, the caisson bases and buried horizontal members will be abandoned in place. The 36-inch-diameter legs will be removed down to the top of the caisson base or at least one foot below the existing mudline. The grouted caisson bases, the bottom horizontal elevation, and some vertical diagonal braces will remain in place. Removal of the vertical platform structure will result in the creation of shallow holes. In order to avoid further platform disruption, these holes will not be backfilled, as local current action will aid in the natural backfilling process. This action will serve to reduce impacts to earth resources from platform structure removal to levels of insignificance. These currents have not proved strong enough over the life of the platform, however, to remove the sediments accumulated around the base of the platform, so it is unlikely that the buried structural componants will be exposed over time. As discussed in a previous section, anchor scarring will be minimal due to the use of fly anchors. Therefore, overall impacts to geologic resources from the jacket removal of platform Hazel will be localized, short term, and less than significant.

Offshore Pipeline and Power Cable Abandonment

All pipelines to be abandoned will be flushed, pigged, and capped. The pipelines will be separated from the platform, capped, and the ends will be jetted down below the mudline. The pipeline pull sleds originally used to pull the pipelines to the platforms will be cut free of the pipelines with an oxy-arc torch and recovered. Some excavation will be required to free the sleds, leaving a trench for burial of the pipeline ends. The pipeline ends will be jetted down one foot below mudline using a high volume diver held hand jet. No backfilling will be required. Rather, the trenches will be left to gradually fill in through natural current processes. Surveillance of local bottom composition maps indicate that there are no rocky outcrop features that would interfere with pipeline abandonment operations.

The power cables will be cut at the platforms and the ends will be jetted down at th platform. Where it enters the mudline, the power cable will be excavated and cut with an oxy-arc torch or a mechanical cutter. Excavation will result in temporary displacement and disruption of localized regions of the seafloor. These operations will not result in any permanent changes in topography or subsea relief features.

In efforts to clean extraneous objects from the seafloor surrounding the platforms a debris recovery program will be undertaken by Chevron after the final heavy lifts have been made. The debris recovery will be performed over a 1,000-foot radius from the platform. The integration of this procedure will reduce abandonment impacts to the benthic environment to less than significant levels.

Onshore Impacts

Nearshore Pipeline and Power Cable Abandonment

The nearshore segment of the pipelines and power cables will be abandoned in place. Abandonment operations will entail flushing, pigging, grouting, and capping of all lines.

The pipelines will be flushed with seawater from the offshore platforms to remove any hydrocarbons. The seawater will be treated at the Carpinteria Plant and discharged in accordance with the plant's existing NPDES permit. Class "G" oilfield cement will be pumped into the lines from the plant to approximately 800 feet offshore, beyond the surf zone in the 5-m (15-foot) depth contour. Grouting to this distance will ensure that the lines are adequately weighted, thereby preventing any movement resulting from dynamic nearshore processes. Abandonment of all offshore lines in place will also ensure minimal disruption of bottom contours and sediments. Therefore, nearshore pipeline abandonment activities will not impact any earth processes.

1. Earth Conditions

   Offshore - Due to their short-term, temporary nature, none of the offshore operations, including derrick and materials barge anchor placement, platform jacket removal, and offshore pipeline and power cable abandonment will create any significant new impacts to existing earth conditions or geological substructures.

   Onshore - None of the nearshore pipeline and power cable abandonment operations such as: flushing, pigging, grouting and capping of all lines will result in significant impacts to any earth conditions or geological substructures.

2. Compaction, Overcovering of Soil

   Offshore - A limited amount of seafloor material will be disrupted during anchor placement for materials and derrick barges. Some seafloor disturbance will also occur as a result of explosive detonation during the jacket removal phase for Platforms Hope, Heidi, and Hilda. Excavation of pipeline and power cable ends near their connections with the platforms will result in temporary displacement and disruption of localized regions of the seafloor. As indicated in Offshore Impacts above, local current action will aid in the natural backfilling process. None of these impacts will be long-term or result in any permanent disruption, displacement, compaction, or overcovering of offshore soil.

   Onshore - Abandonment of all offshore lines in place will ensure that there will be no disruptions, displacements, compaction, or overcovering of soil in the nearshore/onshore region.

3. Topography

This project, both onshore and offshore, is temporary in nature and will not create any permanent changes in topography, nor will this project create any new significant permanent impacts to ground surface relief.

4. Unique Features

The geology in the project area consists of generally flat-lying sediment that uncomfortably overlies older faulted and folded sedimentary rock strata. The removal and abandonment of the oil production platforms and associated pipelines will not create any new permanent significant environmental effects either offshore or onshore.

5. Erosion

Offshore - Any bottom disruption that may be created on the seafloor by project operations will be naturally restored over time by natural current action. Therefore, no significant erosive impacts are expected.

Onshore - As all onshore and nearshore components of the project will be abandoned in place, there will be no physical disturbances that would result in any erosion. Therefore, no erosional impacts will be associated with these portions of the project.

6. Siltation

Offshore - Localized offshore bottom scarring resulting from project operations will create short-term sediment disturbance and redistribution. However, all scarring is expected to silt in naturally with the aid of ocean currents thus restoring the site to its natural state. Thus, this project is not expected to create any permanent significant impacts to the ocean floor affecting natural siltation.

Onshore - As all onshore and nearshore components of the project will be abandoned in place, there will be no physical disturbances that would result in any changes in deposition or erosion of beach sands, or changes in siltation, deposition or erosion. Therefore, no siltational impacts will be associated with the onshore/nearshore portions of the project.

7. Geologic Hazards

The proposed project is within a seismically active area. However, the removal and abandonment of offshore and onshore oil production facilities will not create any new significant geological hazards.

B. Air

Atmospheric Environment

Meteorology

Local and regional meteorological patterns have a primary influence on air quality conditions in Santa Barbara County. These patterns determine the transport and dispersion of pollutants and influence the formation of secondary pollutants such as ozone and aerosols. Meteorological conditions may also indirectly affect response procedures in the case of an accident during the abandonment process.

The factor most responsible for annual weather patterns in the region is a semipermanent high pressure cell centered in the Eastern Pacific Ocean (Reeves et al., 1981). In late spring to early fall, the high deflects storms to the north resulting in dry weather, stable atmosphere, and strong inversions. During winter, the high moves southward and weakens, allowing occasional frontal systems to pass the central coastal region. This movement increases the amount of rain and changes wind and inversion patterns.

Other influences on local weather include the coastal topography and the Pacific Ocean. Coastal topography affects temperature, precipitation, and wind flow. The Pacific Ocean minimizes temperature variations and produces strong sea breezes, especially in summer.

Temperature

Temperatures in the region are generally moderate with a small range of extremes. Offshore temperatures range from 10 to 18°C (50 to 65°F) year-round due to the moderating influence of the Pacific Ocean. Along the coast, maximum daily temperatures in July (representative of summer conditions) are in the 15 to 22°C (60 to 71°F) range. Minimum readings at this time average (13°C) 55°F. Temperatures for January (representative of winter conditions) include a daily average of about (11°C) 52°F with lows averaging (5°C) 42°F and highs in the 13 to 16°C (50 to 60°F) range.

Precipitation

Approximately 90 to 95 percent of the mean annual precipitation occurs between November and April. Coastal areas generally receive less than 50 cm (20 in.) of rainfall per year with the long-term annual average being on the order of 43 cm (17 in.). Offshore areas receive less precipitation than onshore areas (Jacobs Engineering Group, 1981). Annual rainfall on the Channel Islands ranges from 19 cm (7.5 in.) at San Nicholas Island to an estimated 29 cm (11.5 in.) at San Miguel Island.

Air Pollution Control

Air pollution control is administered on three government levels in the State of California: federal, state, and local. The federal government has established ambient air quality standards to protect the public health and welfare. The State of California has established separate, more stringent standards. The Santa Barbara County Air Pollution Control District (APCD) is responsible for administering air pollution control programs within the County. The air quality of Santa Barbara County is monitored by the SBCAPCD and the California Air Resources Board (CARB).

Ambient Air Quality Standards (AAQS)

Ambient air quality standards are adopted pollutant thresholds considered safe, with an adequate margin of safety, to protect the public health and welfare. Concern is focused on those people most susceptible to further respiratory distress such as asthmatics, the elderly, very young children, people already weakened by other disease or illness, and persons engaged in strenuous work or exercise; these people are collectively called "sensitive receptors." Healthy adults can tolerate occasional exposure to air pollutant concentrations considerably above these minimum standards before adverse effects are observed. The federal and state standards currently in effect are shown in Table 1.2.1-1.

Table 1.2.1-1. Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a]	National Standards[b]	
		Concentration[c]	Primary[c,d]	Secondary[c,e]
Ozone	1-hour	0.09 ppm (180 µg/m³)	0.12 ppm (235 µg/m³)	Same as Primary Standard
Carbon Monoxide	8-hour	9.0 ppm (10 mg/m³)	9 ppm (10 mg/m³)	Same as Primary Standard
	1-hour	20.0 ppm (23 mg/m³)	35 ppm (40 mg/m³)	Same as Primary Standard
Nitrogen Dioxide	Annual Average	—	100 µg/m³ (0.053 ppm)	Same as Primary Standard
	1-hour	0.25 ppm (470 µg/m³)	—	Same as Primary Standard
Sulfur Dioxide	Annual Average	—	80 µg/m³ (0.03 ppm)	—
	24-hour	0.05 ppm (131 µg/m³)[f]	365 µg/m³ (0.14 ppm)	—
	3-hour	—	—	1,300 µg/m³ (0.5 ppm)
	1-hour	0.25 ppm (655 µg/m³)	—	—
Suspended Particulate Matter Less Than 10 Microns Diameter (PM_{10})	Annual Geometric Mean	30 µg/m³	—	—
	Annual Arithmetic Mean	—	50 µg/m³	Same as Primary Standard
	24-hour	50 µg/m³	150 µg/m³	Same as Primary Standard
Sulfates	24-hour	25 µg/m³	—	—
Lead	30-day Average	1.5 µg/m³	—	—
	Calendar Quarter	—	1.5 µg/m³	Same as Primary Standard
Hydrogen Sulfide	1-hour	0.03 ppm (42 µg/m³)	—	—
Vinyl Chloride (Chloroethene)	24-hour	0.010 ppm (26 µg/m³)	—	—
Visibility Reducing Particles	10 am to 6 pm	In sufficient amount to produce an extinction coefficient of 0.23 per kilometer when relative humidity is less than 70 percent.[g]	—	—

[a] California standards for ozone, carbon monoxide, sulfur dioxide (1-hour), nitrogen dioxide, and particulate matter (PM_{10}) are values that are not to be exceeded. The sulfate, lead, hydrogen sulfide, vinyl chloride, and visibility-reducing particles standards are not to be equaled or exceeded.

[b] National standards, other than ozone and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than 1.

[c] Concentration expressed first in units which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of Hg (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas. µg/m³ = micrograms per cubic meter, mg/m³ = milligrams per cubic meter.

[d] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than 3 years after that state's implementation plan is approved by the Environmental Protection Agency.

[e] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standard within a "reasonable time" after the implementation plan is approved by the EPA.

[f] At locations where the state standards for ozone and/or suspended particulate matter are violated. National standards apply elsewhere.

[g] Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half of the horizon circle, but not necessarily in continuous sectors.

Source: Air Resources Board, 1990. *California Air Quality Data Summary.*

Baseline Air Quality

The air quality of the Santa Barbara area is monitored by the CARB, the APCD, and industry. Air quality monitoring stations operated by the CARB and the APCD are part of the State and Local Air Quality Monitoring System (SLAMS). The majority of the monitoring stations are operated by industry under protocols developed by the APCD as required by permit conditions to detect project-related impacts. These stations are referred to as Prevention of Significant Deterioration (PSD) stations.

The nearest ambient air quality monitoring station in proximity to the platform project areas are located within the cities of Carpinteria and Santa Barbara. The Carpinteria station is located approximately 2 miles north-northwest of the platform sites and the Santa Barbara station is located approximately 7 miles north of the project site. Data from the Carpinteria station is considered most representative of the ambient air quality of the project sites. However, the Carpinteria station currently does not monitor carbon monoxide (CO) or PM_{10} (particulate matter less than 10 microns); therefore, CO and PM_{10} data were taken from the Santa Barbara station.

Ozone and PM_{10} are of primary interest because monitored concentrations of these pollutants in southern Santa Barbara County occasionally exceed State air quality standards. The concentrations of ozone, PM_{10}, CO and NO_2 monitored in the project area from 1989 through 1991 are presented in Table 1.2.1-2. The air quality data indicates that State standards for both ozone and PM_{10} are occasionally exceeded but federal standards are rarely exceeded for ozone and never exceeded for PM_{10}. Exceedances of state or federal standards for carbon monoxide, nitrogen dioxide or sulfur dioxide did not occur in the project area during the period of 1989 through 1991.

Table 1.2.1-2. Air Quality Standard Exceedances

OZONE - Carpinteria (ppm)	1989	1990	1991
Worst Hour	0.10	0.13	0.12
Number of State Exceedances (Hours >0.09 ppm)	1	5	8
Number of Federal Exceedances (Hours >0.12 ppm)	0	1	0
CARBON MONOXIDE - Santa Barbara (ppm)			
Worst Hour	11.0	11.0	9.0
Number of State Exceedances (Hour >20 ppm)	0	0	0
Number of State Exceedances (8 hours >9 ppm)	0	0	0

Table 1.2.1-2 (Continued)

NITROGEN DIOXIDE - Carpinteria (ppm)			
Worst Hour	0.06	0.05	0.07
Number of State Exceedances (Hours >0.25 ppm)	0	0	0
PM_{10} - Santa Barbara (micrograms/cubic meter)			
Worst Sample	83	96	96
Number of State Exceedances (Samples >50)	10	4	8
Annual Geometric Mean (Standard is 30)	40.8	34.5	33.5
Annual Arithmetic Mean (Standard is 50)	42.9	36.9	36.6

Source: California Air Resources Board, Air Quality Summaries, 1989, 1990, 1991

Offshore and Onshore Impacts

Methodology and Significance Thresholds

Methodology and significance thresholds used in this impact analysis are consistent with the *Environmental Thresholds and Guidelines Manual* (Guidelines) (Santa Barbara County, 1990). Generally, emissions are calculated for each source and summed for the entire proposed project. The short-term (construction) and long-term emissions are individually compared to thresholds adopted by the APCD to determine significance.

The short-term threshold for ozone precursors (nitrogen oxides [NO_x]) and reactive organic compounds [ROC]) and PM_{10} is 2.5 tons per 3-month period. Best available control technology is required for sources emitting between 2.5 and 6 tons per 3-month period. Additional mitigation is required for sources emitting greater than 6 tons per 3-month period.

Equipment to be utilized for offshore abandonment and removal operations would generate short-term exhaust or combustion emissions. Emissions during abandonment and removal activities would be produced primarily by power-generating equipment, welding equipment, tug boats, utility vessels, crew boats, and derrick barges. Offshore equipment emissions were calculated using fuel-specific and diesel vessel emission factors from the Environmental Protection Agency (EPA) document, *Compilation of Air Pollutant Emission Factors* (AP-42, 1992 update), which is accepted and utilized by the Santa Barbara County APCD. Emission factors and general assumptions pertaining to project equipment numbers, usage factors, power ratings (i.e., horsepower), and fuel consumption are presented within Appendix B.

1. Emissions

Implementation of the proposed project would include the abandonment and removal of four oil and gas platforms. The primary emission-generating activities would consist of the mobilization of offshore equipment, pre-abandonment activities, pile and conductor cutting, topside removal, jacket removal, debris removal, site clearance verification, and pipeline abandonment. As currently proposed, the four project platforms would be abandoned and removed in pairs (i.e., Hope and Heidi, Hazel and Hilda). Project emissions have been estimated for each pair of platforms (Table 1.2.2-1) and the total project (Table 1.2.2-2). Since the mobilization and demobilization of equipment would occur once for all four platforms, emissions generated due to this activity have been added to the total project.

Emissions would be reduced by utilizing the following Santa Barbara County APCD standard measures which are included in the 1991 Air Quality Attainment Plan (AQAP) as control measures N-IC-7:

- Equipment shall be maintained as per manufacturer's specifications;
- Catalytic converters shall be installed on all gasoline-powered equipment (if applicable);
- The fuel injection timing shall be retarded on diesel-powered equipment by two (2) degrees from manufacturer's recommendations;
- Gasoline-powered equipment shall be substituted for diesel-powered equipment if feasible;
- Direct injection diesel engines (i.e., Caterpillar D399 or equivalent) shall be used if available;
- Turbocharged diesel engines with intercooling shall be used if available; and
- Reformulated diesel fuel and high pressure injectors shall be used in all diesel-powered removal and abandonment equipment.

The Santa Barbara County APCD guideline document (Scope and Content of Air Quality Sections in Environmental Documents, 1992) indicates that fuel injection retard, high pressure injections and reformulated diesel fuel would reduce NO_x and ROC emissions of diesel-powered equipment by 40 percent and 15 percent, respectively. Direct injection diesel engines may emit up to 50 percent less NO_x.

Table 1.2.2-1. Emission Estimates - Per Pair of Platforms (i.e., Platforms Hope and Heidi; and Platforms Hazel and Hilda)

Operation	Emission - Total Tons		
	NO_x	ROC	PM_{10}
Pre-Abandonment	0.548	0.042	0.084
Pile and Conductor Cutter	2.158	0.262	0.204
Topside Removal	14.958	1.914	1.494
Jacket Removal	7.586	1.094	0.880
Transport to LB/LA	1.37	0.22	0.160
Debris Removal	0.594	0.102	0.072
Site Clearance Verification	1.062	0.080	0.112
Pipeline Abandonment	0.186	0.136	0.022
Total Tons	28.47	3.86	3.03
Santa Barbara APCD Threshold	25 tons/3 months	25 tons/3 months	25 tons/3 months

Table 1.2.2-2. Total Project Emission Estimates

Operation	Emission - Total Tons		
	NO_x	ROC	PM_{10}
Mobilization/Demobilization of Removal Equipment[a]	0.690	0.098	0.077
Abandonment and Removal - Platforms Hope and Heidi	28.47	3.86	3.03
Abandonment and Removal - Platforms Hazel and Heidi	28.47	3.86	3.03
Total Tons	57.622	7.808	6.130
Santa Barbara APCD Threshold	25 tons/3 months	25 tons/3 months	25 tons/3 months

[a] Mobilization/Demobilization requires one operation for all four platforms.

As indicated on Table 1.2.2-1, the abandonment and removal of Platforms Hope and Heidi would produce approximately 28.47 tons of NO_x, 3.86 tons of ROC, and 3.03

tons of PM_{10}. Abandonment and removal of Platforms Hazel and Hilda would produce the same amount of pollutants. Each pair of platforms to be abandoned and removed would require approximately 45 days to complete. Overall, implementation of the proposed project (Table 1.2.2-2) would contribute approximately 57.622 tons of NO_x, 7.808 tons of ROC and 6.130 tons of PM_{10} to the south central coast air basin. These emissions are covered by the existing SBAPCD permits for the four platforms, which expire early in 1997. While, based on the Santa Barbara APCD thresholds of 2.5 tons per quarter for NO_x, ROC, and PM_{10}, the project abandonment and removal would, within the confines of the time of operation, result in short-term air quality impacts. These emissions are less than those permitted by the SBAPCD on an annual basis until 1997 for all reactants. The values, in tons per year, for the four platforms in operation were 8.7 t/y for NOx, 203.37 t/y for ROC and 1.08 t/y for PM10. After the short-term impacts of the removal operation, there will be a return to zero emissions.

Emissions associated with the cutting up of platforms within the Long Beach/Los Angeles port have been addressed in environmental documentation required for permitting of these scrapping facilities, in accordance with guidelines set by the South Coast Air Quality Management District (SCAQMD).

While the short-term air quality impacts of the proposed project may be considered adverse, project emissions are below those permitted under Chevron's existing Santa Barbara County (1997) APCD permit.

2. Odors

During the operational period, diesel fumes will be noticeable within several hundred yards downwind of the emission source(s). These odors will be noticeable to the workers involved in project operations, but will be dispersed by the prevailing winds long before they would reach any sensitive onshore receptors. No long-term odors will be generated by either the offshore or the onshore portions of the project.

3. Climate

Upon completion, this project will not create any major changes in air movements, temperature, or climate, nor create any abnormal weather conditions.

C. Water

Coastal Processes and Water Quality

Santa Barbara Channel Circulation

The Santa Barbara Channel is a generally east-west oriented coastal region bounded to the north by the land mass extending from Point Conception to Port Hueneme and to the south by the Channel Islands (from east to west: Anacapa, Santa Cruz, Santa Rosa, and San Miguel). Transport into and out of the Santa Barbara Channel is primarily limited to the vertical sections extending from Anacapa Island to Port Hueneme on the eastern end of the Channel and from San Miguel Island to Point Conception on the western end.

Currents within the Santa Barbara Channel are extremely variable and complex, generally of low velocity (5 to 10 cm/sec) and highly dependent upon flow between basins to the north and south (Emery, 1960 in Texaco, 1987). They are the result of several types of phenomena, i.e., wind-driven circulation, density-driven circulation, tides, storm surges, and various types of waves (Newberger, 1982). Flow direction is dependent upon the driving current. Flow is toward the northwest during the Davidson Current period (winter) and southeast during the Southern California Countercurrent period (majority of the year). Flow velocities and directions are affected only slightly by tides.

Episodic currents occasionally affect the waters of the Southern California Bight, e.g., "El Niño," an episodic event of relatively long-term scale that results in abnormally warm water. These events last approximately one year, but occasionally terminate shortly after initiation. El Niño events have occurred most recently in 1957, 1965, 1972, 1976, and 1982-1983, 1985-1986, and 1992-1993.

Wind Driven Currents

Currents in the Santa Barbara Channel may be characterized as weak and variable (National Ocean Service, 1980). Circulation is wind-dominated with a weak easterly nontidal flow predominating during the spring and summer months whereas a westerly set persists in fall and winter. The nearshore tidal current along the north shore of the Channel generally ranges from 0.5 to 1 knot (Chambers, 1992).

Littoral Currents

Movement of littoral materials is in response to wave direction and the configuration of the coast. Waves approach the Santa Barbara Channel predominantly from the west-to-northwest, producing a southerly transport of littoral sands. Less frequent waves from the southeast cause occasional reversals in the direction of littoral transport. Sources of littoral materials include the streams entering the channel basin, eroded coastal rocks and sediment, and sands from coastal dunes (Little, 1985).

Santa Barbara Channel Tides

The tide in the Santa Barbara Channel is classified as a mixed semidiurnal type because there are normally two unequal high and two unequal low waters in a day. The tide enters the Channel through the eastern end, sweeps up the coast, and exits the western end. The peak time difference between these two ends of the Channel is normally 1 hour (Science Applications, Inc., 1984). Maximum tides occur near the coastline and gradually decrease away from shore. Expected tidal induced surface currents have speeds of around 10 cm/sec (0.2 km) in the open Channel (A. H. Glenn and Associates, 1979). Tidal data presented by Science Applications, Inc. (1984) are given in Table 1.3.1-1. Data are for Santa Barbara and Port Hueneme and are typical of expected values in the western and eastern portions of the Channel.

Table 1.3.1-1. Santa Barbara Channel Tides

Extreme High (observed January 1983)	8.0 ft. MLLW
Average Yearly Highest	7.3 ft. MLLW
Mean Higher High Water (MHHW)	5.4 ft. MLLW
Mean High Water (MHW)	4.7 ft. MLLW
Mean Sea Level (MSL)	2.8 ft. MLLW
Mean Low Water (MLW)	1.0 ft. MLLW
Average Yearly Lowest	-1.8 ft. MLLW
Extreme Low (Predicted)	-2.6 ft. MLLW

Source: National Ocean Service, 1988.

Santa Barbara Channel Wave Climatology

Along Southern California, the most protected coastal area is from Point Conception to Ventura. Oceanic waves cannot approach this shoreline without being modified by the Channel Islands (Anacapa, Santa Cruz, Santa Rosa, San Miguel) or drastically refracted over the shelf (Chambers, 1992). Protection afforded by the offshore islands is generally so complete that significant waves over the shelf are mainly formed in the local area. This restricted fetch allows, for the most part, development of low waves with short lengths and periods.

Winds, waves and swell in the Santa Barbara Channel are produced by four basic meteorological patterns: Eastern Pacific High, Eastern Pacific Low, Tropical Cyclones, and Southern Hemisphere Low.

The Eastern Pacific High (EPH) occurs over the area of interest most of the year especially during the late spring, summer, and fall. Due to the dominating influence of the EPH, waves approach from the west most of the time. Consequently, the primary direction of longshore sediment transport within the littoral cell is toward the east and south (downcoast) (Chambers, 1992).

The Eastern Pacific Low (EPL) generates the largest waves within the Santa Barbara Channel during the months of November to April. These waves generally approach the shoreline from the west to northeast. Not only are these waves high, but they can occur when fluvial discharges from the rivers and streams maximize. Consequently, EPL events may also be responsible for movement of large amounts of sediment in a relatively brief time period (Chambers, 1992).

The Tropical Cyclones (TC) develop off the west coast of Mexico and can produce fairly large waves in Southern California, but their impacts to the project area are basically insignificant. The most important TC to have affected Southern California in the past 75 years occurred in September 1939 and produced significant wave heights of about 4.6 m (15 ft) from the south quadrant at the east end of Santa Barbara Channel (Chambers, 1992).

The Southern Hemisphere Low (SHL) activity occurs during the period from May to October. Although the wave periods are long, 16 to 22 seconds, the wave heights are relatively low (U.S. Army, 1987). Waves generated from SHL activity approach the coastline from the south (Bailard, 1991).

Tsunamis

Tsunamis are long-period waves that are generated by an earthquake or offshore volcano. Their effect is magnified along the shoreline, sometimes producing intense wave action. The tsunamis which have struck the Santa Barbara coast in the past have generally been generated a considerable distance away. The probability of a locally generated destructive tsunami is considered remote (Science Applications, Inc., 1984).

Water Quality

Santa Barbara Channel waters feature mean surface temperatures from 57°F (14°C) near Point Conception to 59°F (15°C) at the eastern end. Salinity averages about 33.5 parts per thousand with very low variability. Dissolved oxygen generally ranges from six to seven milligrams per liter at the surface and is about 2 milligrams per liter at a depth of 825 feet (250 m). The sea water features low transparency within 1 mile (1.6 km) of the shoreline.

Natural oil, gas, and tar seeps significantly contribute to the levels of oil substances and sediments. More than 2,000 oil, gas, and tar seepage zones have been located in the California offshore area (SLC, 1977). The most widespread seepage occurs along the northernmost part of the Santa Barbara Channel with a concentration in three areas: Coal Oil Point, Point Conception, and the Santa Barbara to Rincon area. The total volume of oil, gas, and tar released in the Channel has been estimated at up to 100 barrels per day (SLC, 1977).

Onshore wells improperly plugged and abandoned from historic oil production activity at the turn of the century in the Summerland Beach area west of Loon Point continue to seep as much as 15 bbls/day of crude oil into the water. A semi-permanent sheen is often seen directly offshore at this location. A state-funded project was recently undertaken which permanently plugged and abandoned a portion of the remaining onshore wells.

The main water quality problem in the Santa Barbara Channel is caused by municipal and industrial discharges. Most disposal outfalls are located close to shore and thus only minimal dilution and dispersion is achieved. The communities of Santa Barbara, Montecito, Summerland, and Carpinteria all discharge secondary-treated sewage to the Channel. The total volume of discharges is approximately 12.23 million gallons per day (Chambers, 1992). These effluents contain about 30 milligrams per liter suspended solids and 60 milligrams per liter of chemical oxygen.

Local Setting

Platform-Specific Conditions

1. Offshore

   - Currents: All Platforms. All four platforms are located within the same basic littoral cell and are thus subject to currents of similar speed and direction. Velocities are within the 5-10 cm/sec range. Current studies of Dr. Terry Hendricks of the Coastal Water Research Project estimates that north to northwest is the predominant direction of the flow of currents near the project platforms (Simpson, 1977).

   - Water Quality (Platform Discharge). The only current discharge from the platforms is sanitary discharge from sewage treatment units, excluding Hazel, which has no discharges.

2. Onshore. As the proposed project will not impact nor be impacted by onshore water resources or water quality, those issues are not addressed.

Offshore Impacts

As the proposed project will be conducted primarily offshore, impacts to water will largely be associated with coastal processes. While the platform removal and pipeline abandonment will be subject to impacts from currents and coastal processes, the project would not result in any changes to currents or alterations of the course or direction of water movements. During the course of the proposed project, removal of the subsea portions of the platforms, and the exposing, cutting, and capping of associated pipelines will result in short term, less than significant turbidity impacts, as discussed below.

During past abandonment operations, water quality problems occurred with the removal of Platforms Helen and Herman in 1988. These problems were associated with pipelines from Platforms Helen and Herman that were not properly flushed and pigged at shutdown in 1973. The inadequate flushing and pigging of these lines caused some release of hydrocarbons during abandonment operations. In addition, no cathodic protection was in place following shutdown of the platforms. Considerable corrosion occurred to these pipelines over the 15 years prior to abandonment operations. The release of oil from these lines was a result of pigging operations during final abandonment operations. The pipelines involved in the proposed project have been inspected and are in much better physical condition, and, as mentioned above, will be fully flushed and pigged prior to removal.

All conductors, pipelines, and other oil-containing vessels have been flushed in efforts to remove all residual oil. In spite of these precautions, small oil spills may occur while final cleaning is undertaken. These spills will not release more than one barrel (42 gals.) of fluids, as that is the estimated maximum amount of cleaning fluids in use at any one time. The majority of the spilled oil would float at the surface. In such cases, onsite spill response equipment would be immediately deployed. Some of the spilled oil, however, would be dispersed and retained in the water column. The weathering mechanisms that result in surface oil being retained in the water column include dissolution, dispersion, sinking, and sedimentation (MMS, 1989). No hazardous substances will be released to the ocean following detonation of the explosive charges. Chemicals used in the explosive charges will become inert gasses following detonation. Completion of the project will result in a beneficial impact to water quality by eliminating existing discharges from the platforms. No other impacts to water quality or quantity would result from implementation of the proposed project.

Resuspension of Bottom Sediments

1. Jacket Removal: All Platforms. Cuttings piles accumulated at the base of the caissons will likely be disturbed, but remain largely intact, as a result of the removal process. Impacts to water quality will result in short-term turbidity and localized redistribution of bottom sediments. Such increases will be temporary, and low current speeds (approximately 10 cm/sec) in this portion of the channel dictate that redistribution will be confined to a narrow radius around the platforms.

   Observations by Simpson (1977) have indicated that much of the disposal piles located at the platform base may be solidified, with thick layers (18-20 feet) of shells and other material covering the inner layer of hardened drill cuttings. Therefore, due to their weight and composition, cuttings piles will not likely be heavily resuspended by platform removal operations.

   The bottom will also be disturbed by platform removal barge anchors. Figure 1.1.2-1 shows the anchor spread and movements of a typical platform removal barge. See Offshore Impacts, page 8, for a description of the barge mooring process. As discussed in Offshore Impacts, anchors are not dragged on the bottom, but will create a disturbance while they are digging in. A correctly placed anchor typically results in a physical disturbance on the bottom of about 35 feet (Chambers, 1986). Turbidity plumes of suspended sediment from each anchor will be short-term and localized to an approximately 100-foot radius within the water column. Water quality impacts from anchor placement and removal will be localized, short term, and less than significant. No residual water quality impacts are anticipated.

2. Offshore Pipeline and Power Cable Abandonment. Excavation required to expose pipeline pull sleds and power cables will entail the use of diver-held hand jets. These operations will result in short-term, localized turbidity impacts within the immediate region of the platforms. Turbidity plumes from suspended sediments are anticipated to be confined to a 100-foot radius surrounding areas of operations for short durations. Therefore, offshore water quality impacts from pipeline and power cable abandonment are determined to be less than significant.

Liquid Waste Disposal

All liquid wastes will be pumped to Carpinteria Plant via pipeline or stored in appropriate containers and hauled to shore for disposal. All tanks and storage vessels will be flushed to remove residual hydrocarbons. Spills of small quantities of liquid and solid materials (less than 10 gallons) such as diesel fuel may occur during the removal/abandonment process. With proper supervision, accidental discharges are expected to be infrequent and very small. In the event an oil or diesel spill were to occur in association with the abandonment operations, onsite response equipment will be stationed to quickly and effectively contain and recover the oil. Please refer to Section 4.0, "Oil Spill Contingency Plan" for a discussion of onshore and offshore oil spill contingency equipment and oil spill and response scenarios. Impacts will be short term and less than significant.

Sewage produced by removal work crews will be treated in U.S. Coast Guard approved units, including portable facilities, and discharged to the ocean after chlorination. These effluents should be completely dispersed throughout the water column within a few hundred yards of the platforms. Impacts will be short term and less than significant.

All marine vessels utilized in the removal/abandonment operations will use designated vessel traffic corridors and shipping lanes. This will serve to avoid collisions with other vessels not associated with the proposed project as well as inter-project vessels.

Onshore Impacts

Nearshore Pipeline Abandonment

As the nearshore pipelines will be abandoned in place, there will be no abandonment activities conducted within the nearshore area. Pipeline pigging and flushing operations will be conducted from the platforms. Pipeline grouting will be conducted at the valve box on the bluff. Therefore, as no work will actually be conducted in the nearshore area, there will be no impacts to water quality.

1. Currents

   As indicated in "Offshore Impacts" above, the offshore portion of this project will be subject to the impacts from the currents and coastal processes. However, the project would not result in any changes to currents or alterations of the course or direction of water movements. The onshore portion of this project will not have any impact on the ocean currents.

2. Runoff

   By their nature, neither the offshore nor the onshore portions of the proposed project would affect absorption rates, drainage patterns, etc.

3. Flood Waters

   See #2 above.

4. Surface Water

   See #2 above.

5. Discharge and Turbidity

   Offshore - Removal of the subsea portions of the platforms, and the exposing, cutting, and capping of associated pipelines will result in short-term, less than significant turbidity impacts. Barge anchor placement and removal will also create short-term, localized turbidity impacts.

All liquid and other wastes will be treated prior to discharge to the ocean. All impacts will be short-term and less than significant. Completion of the project will result in a beneficial long-term impact to water quality by eliminating existing discharges from platforms.

Onshore - There will not be any discharges associated with the onshore portion of this project. Short-term, localized turbidity will be created in the nearshore region during the pipeline capping phase. Coastal processes will rapidly disperse suspended sediments. Thus, onshore turbidity impacts will be less than significant.

7. Ground Water Quality

This project will not alter any aquifers nor consume any ground water. There will not be any changes to ground water quantity caused by this project.

8. Water Supplies

This project will have no effect on public water supplies.

9. Flooding

This project will not expose people or property to water-related hazards such as tidal waves or induce flooding.

10. Thermal Springs

No known thermal springs are located either onshore or offshore in the vicinity of this project which could be affected by this project.

D. & E. Plant and Animal Life

Regional Biologic Setting

Offshore

The project area, which encompasses the nearshore region between Fernald Point and Rincon Point, lies at the central portion of the Santa Barbara Channel. The Santa Barbara Channel is bordered on its seaward margin by the northern Channel Islands. In addition to protecting the coastline from significant waves, the islands support unique and important marine communities. Point Conception at the western end of the Santa Barbara Channel and the east-west orientation of the coast provide additional protection from northwest swells. The channel thus comprises a relatively protected and benign environment for marine life (Chambers, 1992).

The Santa Barbara Channel lies along important migration routes for marine mammals, fishes, and seabirds and also contains a rich, diverse assemblage of resident marine life. These abundant marine resources support a number of important commercial fisheries, mariculture, and kelp harvesting. Recreational activities dependent on Santa Barbara Channel marine life include sports fishing, SCUBA diving and snorkeling, bird watching, whale watching, and tide pooling. The Santa Barbara Channel's wealth of marine life also provides a resource for teaching and for scientific research (Chambers, 1992).

The Santa Barbara Channel is considered a biogeographical transition zone between the northern Oregonian Province and the more southerly marine assemblages of Southern California. Point Conception itself is usually pinpointed as the major biogeographic boundary point, but instead of a distinct break in distributions at Point Conception there is a zone of overlap of 4 to 5 degrees latitude (Murray, et al., 1980).

This section describes the marine biological resources of the platform removal project region. The following paragraphs describe important marine flora and fauna beginning with the platforms and the outer waters and progressing to near-shore communities.

1. Marine Flora and Fauna

- Avifauna. The Southern California Bight, in general, and the Santa Barbara Channel, in particular, have been characterized as exhibiting a diverse and abundant marine avifauna (Chambers Consultants and Planners, 1982; USDOI, MMS, 1983). As a consequence of its location within a portion of the Pacific Flyway and due to the variability of its mainland and insular coastal terrain, the Santa Barbara Channel region, including Santa Barbara and Ventura Counties, provides foraging and breeding habitat for over 250 species of birds (Webster, et al., 1980).

The sandy beach habitats and occasional coastal cliff and nearshore rock prominence of the Channel are typically characterized by the presence of migrating and wintering populations of sandpipers (*Erolia* spp.), plovers (*Charadrius* spp.), and gulls (*Larus* spp.), as well as resident species of plovers, oyster catchers (*Haematopus bachmani*), and gulls. Table 1.4.1-1 lists the common marine bird species of the coastal area of the Santa Barbara Channel.

Dames and Moore (1977b) identified seven species which were characteristic of the offshore areas of the Santa Barbara Channel, including three species of gulls (Heermann's [*L. heermanni*], western [*L. occidentalis*], and Bonaparte's [*L. philadelphia*]) two species of cormorant (Brandt's [*Phalacrocorax penicillatus*] and double-crested [*P. auritus*]), the western grebe (*Aechmophorus occidentalis*), and the endangered brown pelican (*Pelecanus occidentalis*) (Tables 1.4.1-1 and 1.4.1-2).

- Fishes. By virtue of the diversity of habitats it encompasses and its proximity to a major biogeographical boundary (at Point Conception), the Santa Barbara Channel supports a diverse fish fauna. Of 554 species (144 families) of coastal marine fishes found in California waters, 481 species (129 families) are found off Southern California (between Point Conception and the Mexican border) (Miller and Lea, 1974). Most of these Southern California species occur in the Santa Barbara Channel. The fish species most commonly observed by commercial fish spotters while operating off central and Southern California were the Northern anchovy (*Engraulis mordax*) jack mackerel (*Trachurus symmetricus*), Pacific mackerel (*Scomber japonicus*), Pacific Sardine (*Sardinops sagax*), and bluefin tuna (*Thunnus thynnus*) (Squire, 1983). A partial list of the most commonly taken fishes by commercial fishing operations in the Santa Barbara Channel is provided in Table 1.8.1-1.

Table 1.4.1-1. Coastal Associated Birds Found Within the Platform Abandonment Project Area

	Seasonal Status		Seasonal Status
Seabirds			
PHALACROCORACIDAE		PODICIPEDIDAE	
Brandt's cormorant	RB	Eared grebe	WV
Double-crested cormorant	RB	Horned grebe	WV
Pelagic cormorant	RB	Pied-billed grebe	RB
		Western grebe	WV
HYDROBATIDAE		ALCIDAE	
Ashy storm petrel	SR	Ancient murrelet	WV
Black storm petrel	SR	Cassin's auklet	SR
Leach's storm petrel	SR	Common murre	WV
		Pigeon guillemot	SR
		Rinocerus auklet	WV
		Tufted puffin	WV
		Xantus' murrelet	SR
PROCELLARIIDAE		LARIDAE	
Manx shearwater	X	Arctic tern	X
Northern fulmar	WV	Black tern	X
Pink-footed shearwater	X	Black-legged kittiwake	WV
Sooty shearwater	X	Bonaparte's gull	WV
		California gull	WV
		Caspian tern	M
		Pomarine jaeger	X
		Parasitic jaeger	X
		Glaucous-winged gull	WV
		Western gull	RB
		Herring gull	WV
		Ring-billed gull	WV
		Mew gull	WV
		Heerman's gull	WV
		Common tern	X
		Least tern	SR
PELECANIDAE			
Brown pelican	RB		
Migratory Water Fowl			
ANATIDAE		GAVIIDAE	
American wigeon	WV	Arctic loon	WV
Black scoter	WV	Common loon	WV
Blue-winged teal	WV	Red-throated loon	WV
Brant	M		
Bufflehead	WV		
Canvasback	WV		
Cinnamon teal	WV		

Table 1.4.1-1. (Continued)

	Seasonal Status		Seasonal Status
Migratory Water Fowl (continued)			
ANATIDAE (continued)			
Fulvous whistling duck	C		
Gadwal	WV		
Greater scaup	WV		
Green-winged teal	WV		
Lesser scaup	WV		
Mallard	WV		
Northern pintail	WV		
Northern shoveler	WV		
Red-breasted merganser	WV		
Redhead	WV		
Ruddy duck	WV		
Surf scoter	WV		
White-winged scoter	WV		
Wood duck	WV		
Shorebirds			
PHALACROCORACIDAE		HAEMATOPODIDAE	
Brandt's cormorant	RB	Black oystercatcher	M
Double-crested cormorant	RB		
Pelagic cormorant	RB		
SCOLOPACIDAE		CHARADRIIDAE	
Black turnstone	WV	Black-bellied plover	WV
Common snipe	WV	Killdeer	RB
Dunlin	WV	Lesser golden plover	WV
Greater yellowlegs	WV	Semipalmated plover	M
Least sandpiper	WV	Snowy plover	WV
Lesser yellowlegs	WV		
Long-billed curlew	WV		
Long-billed dowitcher	WV		
Marbled godwit	WV		
Red knot	X		
Ruddy turnstone	WV		
Sanderling	WV		
Short-billed dowitcher	X		
Solitary sandpiper	MM		
Spotted sandpiper	WV		
Surfbird	WV		
Wandering tattler	WV		
Western sandpiper	WV		
Whimbrel	WV		
Willet	WV		

Table 1.4.1-1. (Continued)

	Seasonal Status		Seasonal Status
Wetland Birds			
ARDEIDAE		RALLIDAE	
American bittern	WV	American coot	WV
Black-crowned night heron	RB	Black rail	C
Cattle egret	WV	Clapper rail	SUN
Great blue heron	M	Common Gallinule	WV
Great egret	WV	Virginia rail	WV
Green-backed heron		Sora	WV
Snowy egret			
RECURVIROSTRIDAE		THRESKIORNITHIDAE	
American avocet	M	White-faced ibis	M
Black-necked stilt	RB		

RB: **Resident Breeder.** The species is a year-round resident and breeds within the given habitat type.

SR: **Summer Resident.** The species occurs only as spring-summer breeder; migrates south for winter months.

WV: **Winter Visitor.** The species occurs only as a winter visitor and is not known to breed in the region.

M: **Spring/Fall Migrant.** The species occurs within the given habitat only as a spring or fall migrant.

C: **Casual.** Records for the species are few and intermittent for the region.

X: **Transient.** The species occurs as a regular visitor to the project site. Pertains to wide-ranging species with extensive home range territories.

SUN: **Status Uncertain.** Documentation of occurrence or breeding is based on limited information; regional status not clearly defined.

Source: Chambers, 1992

Table 1.4.1-2. Seabird Species

Common Name	Species Name
Common loon	*Gavia immer*
Arctic loon	*Gavia arctica*
Red-throated loon	*Gavia stellata*
Western grebe	*Aechmophorus occidentalis*
Eared grebe	*Podiceps caspicus*
Pink-footed shearwater	*Puffinus creatopus*
Manx shearwater	*Puffinus puffinus*
Sooty shearwater	*Puffinus griseus*
Black storm-petrel	*Oceanodroma melania*
Ashy storm-petrel	*Oceanodroma homochroa*
Least storm-petrel	*Oceanodroma microsoma*
Brown pelican	*Pelecanus occidentalis*
Brandt's cormorant	*Phalacrocorax penicillatus*
Double-breasted cormorant	*Phalacrocorax auritus*
Pelagic cormorant	*Phalacrocorax pelagicus*
Black brant	*Branta nigricans*
Black scoter	*Melanitta nigra*
White-winged scoter	*Melanitta deglandi*
Surf scoter	*Melanitta perspicillata*
Northern phalarope	*Lobipes lobatus*
Parasitic jaeger	*Sterorarius parasiticus*
Pomarine jaeger	*Steroratrius pomarinus*
Western gull	*Larus occidentalis*
Herring gull	*Larus argentus*
California gull	*Larus californicus*
Ring-billed gull	*Larus delawarensis*
Mew gull	*Larus canus*
Heermann's gull	*Larus heermanni*
Bonaparte's gull	*Larus philadelphia*
Common tern	*Sterna hirundo*
Forster's tern	*Sterna forsteri*
Elegant tern	*Thalasseus elegans*
Pigeon guillemot	*Cepphus columba*
Rhinoceros auklet	*Cerorhinea monocerata*
Cassin's auklet	*Ptychoramphus aleutica*
Xantus' murrelet	*Endomychura hypoleuca*

The above are common and scientific names of the seabirds encountered in the study area, Santa Barbara Channel.

Source: Varoujean, et al., 1983

- Marine Mammals

  - Cetaceans. Thirty-four of the 111 marine mammal species known worldwide have been recorded off the Southern California coast. Twenty-seven of these mammals are cetaceans (whales, dolphins, and porpoises). The remaining seven species are carnivores represented by six species of seals and the California sea otter (Table 1.4.1-3).

    Twenty of the 27 cetaceans recorded in the Southern California Bight are oceanic species widely distributed throughout the Pacific Ocean (Watson, 1981). These open ocean species occasionally transit the coastal waters within the Santa Barbara Channel.

    Fourteen species of cetaceans commonly occur within the Channel because of either their abundance, migratory pattern, or coastal habitat preference. These include Dall's porpoise (*Phocoenoides dalli*), Pacific pilot whale (*Globicephala macrorhynoa*), Pacific whitesided dolphin (*Lagenorhynchus obliquens*), common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*), gray whale (*Eschrichtius robustus*) and Minke whale (*Balaenoptera acutorostrata*) (Table 1.4.1-4).

Table 1.4.1-4. Seasonal Status of Cetacean Species in the Santa Barbara Channel Area

Species	Status	Population Peak
California gray whale	Migrant	21,000; winter and spring
Blue whale	Visitor	<100; summer
Fin whale	Resident	<50; spring and summer
Minke whale	Resident	<250; spring, summer, and autumn
Humpback whale	Seasonal visitor	<50; spring, summer, and autumn
Northern right whale	Rare visitor	Unknown
Common dolphin	Resident	10,000; summer and autumn
Pacific white-sided dolphin	Resident	2,000; spring and autumn
Northern right whale dolphin	Seasonal visitor	1,000; winter and spring
Dall's porpoise	Resident	1,000; year-round
Risso's dolphin	Visitor	<50; summer
Pacific bottlenose dolphin	Visitor	<50; spring
Killer whale	Visitor	<50; summer and winter
Beaked whale (2 species)	Rare visitor	Unknown

Source: Chambers, 1992

Table 1.4.1-3
MARINE MAMMALS OF THE SOUTHERN CALIFORNIA BIGHT
(Point Conception-Mexican Border)

Common Name	Genus/Species	Legal Status		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PINNIPEDS															
California sea lion	*Zalophus californianus*														
Steller sea lion	*Eumetopias jubatus*	T													
Northern fur seal	*Callorhinus ursinus*														
Guadalupe fur seal	*Arctocephalus townsendi*	T													
Northern elephant seal	*Mirounga angustirostris*														
Harbor seal	*Phoca vitulina* **														
FISSIPEDS															
Sea otter	*Enhydra lutris*	T													
CETACEANS															
Bryde's whale	*Balaenoptera edeni*														
Minke whale	*Balaenoptera acutorostrata*														
Blue whale	*Balaenoptera musculus*	E													
Sei whale	*Balaenoptera borealis*	E													
Finback whale	*Balaenoptera physalus*	E													
Humpback whale	*Megaptera novaeangliae*	E													
Gray whale	*Eschrichtius robustus (gibbosus)*														
Common dolphin	*Delphinus delphis*														
Pacific pilot whale	*Globicephala macrorhyncus*														
Risso's porpoise	*Grampus griseus*														
White-sided dolphin	*Lagenorhynchus obliquidens*														
Northern right whale dolphin	*Lissodelphis borealis*														
Killer whale	*Orcinus orca*														
Harbor porpoise	*Phocoena phocoena*														
Dall (spray) porpoise	*Phocoenoides dalli*														
False killer whale	*Pseudorca crassidens* *														
Long-beaked dolphin	*Stenella coeruleoalba* *														
Pacific bottlenose dolphin	*Tursiops gilli*														
Sperm whale	*Physeter catodon* *	E													
Pygmy sperm whale	*Kogia breviceps* *														
Baird's beaked whale	*Berardius bairdii* *														
Densebeaked whale	*Mesoplodon ginkgodens* *														
Cuvier's beaked whale	*Ziphius cavirostris* *														
Pacific right whale	*Balaena glacialis* *	E													
Pacific spotted dolphin	*Stenella graffmani* *														
Rough-toothed dolphin	*Steno bredanensis* *														
Hubb's beaked whale	*Mesoplodon carlhubbsi* *														

* Occasional Visitor
** Compliance: Beach closed during and pupping season December 1 through May 31.

R Rare (California State designation)
T Threatened (Federal)
E Endangered (Federal)

Source: Bureau of Land Management, 1979

Presence in the Santa Barbara Channel
Breeding, pupping, haulout/ ... season

The whiteside dolphin, common dolphin, and pilot whale are predominantly offshore deepwater species, but they occasionally transit the area of the lease tracts while migrating inshore during winter months or while following prey (Watson, 1981). The bottlenose dolphin, however, is predominantly a nearshore species commonly observed riding the surf or bow waves of vessels along the mainland coast of Southern California and is the most likely toothed whale (Odontoceti) to occur within the vicinity of all the lease tracts. Two baleen whales (Mysticeti), the grey whale and the Minke whale, can also be expected to transit nearshore within the Santa Barbara Channel. Minke whale favor shallow water and venture near shore more often than other baleen whales (Watson, 1981). They seem to be curious about shipping and approach moving vessels.

The recovery of the gray whale population over the past several years has been successful enough to elevate this species to "threatened" status. Approximately 17,000 whales migrate through Southern California waters twice annually, traveling from arctic feeding grounds to calving grounds off Baja and back. This 20,917-km (11,297-nm) migration is considered the longest of any mammal. Gray whales are not social animals, but they do congregate as they migrate along common routes which generally follow the coast. Point Conception is a major point from which the historic migratory path splits. Some animals choose the coastal route and move through the Channel, while others travel offshore along the outer Channel Islands route to their Baja breeding grounds. They transit the project area during their southward migration from November through January, and then again from February through May on the return north to their feeding grounds. More animals (usually females with calves) move along the coastal nearshore route in spring. They also tend to move more slowly along this route and their numbers are more concentrated. Gray whales have been observed within 91 m (300 ft) of shore. They have been seen moving through both kelp beds and sand bottom areas. They are therefore likely to transit both of the lease tracts.

- Pinnipeds. Six of the 36 species of pinnipeds known worldwide occur off the Southern California coast. Four are eared seals (Otariidae) and two are earless seals (Phocidae). Otariidae are represented by Guadalupe fur seal (*Arctocephalus townsendi*), northern fur seal (*Callorhinus ursinus*), Steller sea lion (*Eumetopias jubatus*), and California sea lion (*Zalophus californianus*).

The Steller sea lion was listed as a federally threatened species by the National Marine Fisheries Service on December 4, 1990. The Channel Islands, especially San Miguel, serve as rookeries for all of the above-mentioned pinnipeds except the Guadalupe fur seal (Table 1.4.1-5).

By far the most abundant eared seal in the Southern California Bight is the California sea lion. It is estimated that there are 74,000 animals in Southern California alone (W. Perryman, 1984, personal communication, Chambers, 1992). Three distinct populations exist and each has been designated as a separate subspecies. *Zalophus c. californianus* breeds along the west coast from Baja to the Farallon Islands off San Francisco and ranges as far north as Vancouver, British Columbia. Like Steller sea lion, California sea lion are opportunistic feeders and forage relatively close to shore when compared to fur seals. Although California sea lion use offshore islands as rookeries, they do haul out to rest on the mainland. They are commonly observed transiting the Channel individually and in groups. This is the only pinniped off California that regularly uses man-made structures such as docks, buoys, oil and gas structures, and even slow moving vessels on which to haul out. California sea lions commonly occur within the subject lease tracts and at times use mooring buoys and support vessels as haul-out sites on which to rest between foraging bouts.

Two species of earless seals (Phocidae) live and breed within the Southern California Bight: the northern elephant seal and the Pacific harbor seal. Northern elephant seal range from Alaska to Baja and breed on offshore islands from the Farallon Islands off San Francisco to San Benito Island off Baja California (Haley, 1978). During the breeding season an estimated 30,000 northern elephant seal use the Channel Islands as rookeries (W. Perryman, 1984, personal communication, in Chambers, 1992). These animals usually remain offshore foraging in deep water, only returning to shore during the breeding season and for a short time in summer months when they haul out in small groups to molt (Table 1.4.1-5).

Table 1.4.1-5. Species of Pinnipeds Found in the Santa Barbara Channel Area

Species	Status	Seasons of Maximum Abundance
California Sea Lion *Zalophus californianus*	Year-round resident	Peak numbers on land during summer breeding season on San Miguel Island.
Harbor Seal *Phoca vitulina richardi*	Year-round resident	Peak numbers on land in early summer molting season. Breeding season occurs from late February through May.
Northern Fur Seal *Callorhinus ursinus*	Year-round resident	Breeds/pups on San Miguel Island in the summer. Population on rookeries declines greatly following breeding season. Pelagic population in offshore waters augmented by migrants from the Bering Sea in winter and spring.
Northern Elephant Seal *Mirounga angustirostris*	Year-round resident	Breeds/pups on San Miguel Island in the winter. Some age classes on land in each season for annual molting.
Steller (Northern) Sea Lion *Eumetopias jubatus*	Summer visitor	No longer breeds in the area; a few adult and sub-adult males usually present on San Miguel Island and associated rocks in the summer.
Guadalupe Fur Seal *Arctocephalus townsendi*	Rare seasonal visitor	One or more adult or sub-adult males have been observed on San Miguel Island each summer in recent years.

The Pacific harbor seal is the most common and widely distributed pinniped in the world. This species is divided into five subspecies according to their distribution. The only subspecies that occurs in the project area is the eastern Pacific harbor seal (*Phoca vitulina richardi*) which ranges along the Pacific coast from Alaska to Baja California. There are an estimated 4,000 animals within the Southern California Bight. Although these animals are common and widely distributed, they do not form large groups. Pacific harbor seal maintain small (usually <100), stable local populations at haul-out sites scattered along the mainland and island coastlines. Unlike all the other pinnipeds occurring off Southern California, Pacific harbor seal maintain haul-out sites on the mainland on which they pup and breed (Rambo, 1978; Bowland, 1978). These seals are commonly observed on and along the mainland coast. There are at least six continuously inhabited haul-out sites from Point Conception to Point Dume, and probably 12 more used as occasional haul-out sites. Four major hauling grounds of the Pacific harbor seal are located directly onshore of the two eastern platforms, Heidi and Hope: Sand Point; Carpinteria State Beach; 0.3 km west of Chevron Pier, Carpinteria; and 0.1 km east of Chevron Pier, Carpinteria (Table 1.4.1-6) (Hanan, 1990).

Table 1.4.1-6. Major Hauling Grounds of the Harbor Seal (*Phoca vitulina*) Within or Near the Casitas Pier

Locations	Maximum Count Between 1982 and 1989	1989
Sand Point	11	0
Carpinteria State Beach	53	0
0.3 km West of Chevron Pier, Carpinteria	70	66
0.1 km East of Chevron Pier, Carpinteria	116	3

From Hanan 1990

Table 1.4.1-3 illustrates the seasonal presence of known cetaceans and pinnipeds in the Santa Barbara Channel.

- Kelp beds. The coastline along much of the Southern California coast has typically been fringed by large beds of giant kelp (*Macrocystis pyrifera*) (MMS, 1983). Kelp offers food, attachment sites, and microhabitats for invertebrates and provides food and shelter for fishes. Although few fish species seem to be completely dependent on kelp for survival, kelp beds probably contribute to higher fish productivity and higher standing crop. Kelp has been shown to be especiall important as a refuge for young fishes (Ebeling and Laur, 1985).

  In addition to the importance of living kelp as a structural and nutritional resource, drift kelp is extremely important in detritus-based food chains. Drift kelp is an important food source for such key species as sea urchins and abalone. Drift kelp also seems to be of nutritional and structural importance well beyond the limits of the kelp bed both inshore on intertidal beaches and offshore in deeper water habitats. Kelp beds between Point Conception and Ventura have historically supported the largest kelp cover in Southern California: 64 percent of the mainland kelp bed area in 1977 (Hodder and Mel, 1978).

  Kelp beds along the California coast are numbered in ascending order starting at the California-Mexican border. Kelp beds 20 and 21 are found within the abandonment project area. Figure 1.4.1-1 shows the kelp beds as they were mapped in 1989. This figure also shows the maximum kelp area observed in the region between 1980 and 1989. A major "Growing Area" of the kelp is located directly offshore of Fernald Point and extends eastward nearly to Loon Point in Summerland. The width of this band spans the entire width between Platforms

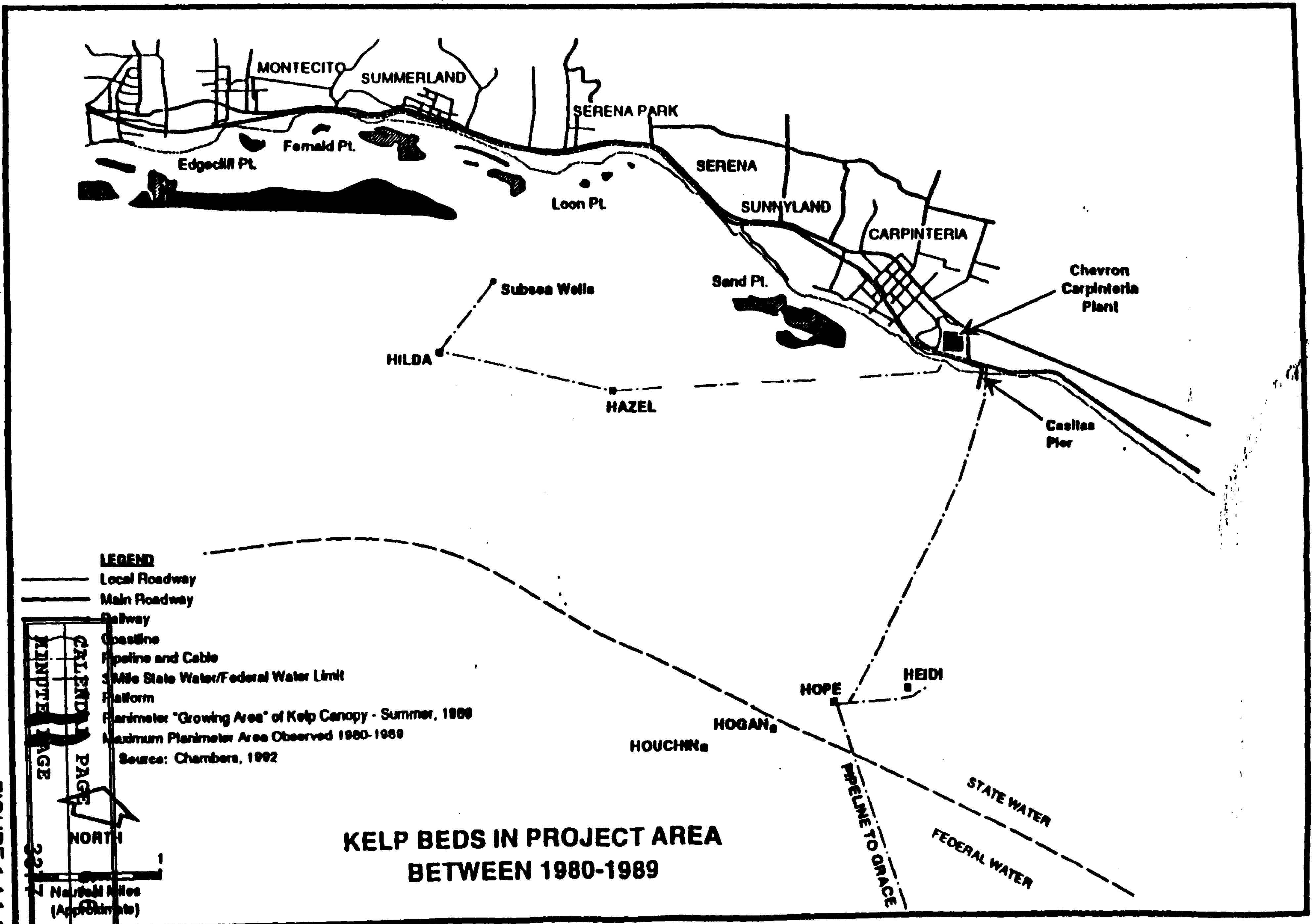

MONTECITO
SUMMERLAND
SERENA PARK
Fernald Pt.
Edgecliff Pt.
Loon Pt.
SERENA
SUNNYLAND
CARPINTERIA
Chevron
Carpinteria
Plant
Sand Pt.
Subsea Wells
HILDA
HAZEL
Casitas
Pier
LEGEND
Local Roadway
Main Roadway
Railway
Coastline
Pipeline and Cable
3 Mile State Water/Federal Water Limit
Platform
Planimeter "Growing Area" of Kelp Canopy - Summer, 1989
Maximum Planimeter Area Observed 1980-1989
Source: Chambers, 1992
HEIDI
HOPE
HOGAN
HOUCHIN
PIPELINE TO GRACE
STATE WATER
FEDERAL WATER
NORTH
1
KELP BEDS IN PROJECT AREA
BETWEEN 1980-1989

FIGURE 1.4.1-1

Hazel and Hilda. Another substantial kelp bed is found on Carpinteria Reef offshore from Sand Point directly inshore from Platforms Hope and Heidi.

Aerial surveys of kelp beds offshore Summerland were conducted on March 22, 1988 by Kelco, a commercial kelp harvesting company operating in Southern California. According to Glantz of Kelco (August 17, 1990), the kelp beds offshore Summerland have changed little in size since March 1988. The kelp beds are scattered, close to shore, and are not harvested commercially.

- Plankton. The term plankton refers to organisms that drift with the currents and includes the phytoplankton or drifting plants such as diatoms and dinoflagellates, and the zooplankton which are slightly mobile animals such as small crustaceans, swimming mollusks, jelly fish, and free-swimming larvae of fishes and bottom animals. Planktonic communities are characterized by patchiness in distribution, composition, and abundance (MMS, 1983).

Oguri and Kanter (1971) measured the phytoplankton productivity of the Santa Barbara Channel following the Santa Barbara oil spill of 1969. They concluded the productivity of the Santa Barbara Channel is the result of a number of factors including seasonal upwelling, runoff from land, and sewage discharges. Patterns of seasonal nutrient enrichment of the waters increase the phytoplankton populations. Coastal currents can interact with the shoreline to produce upwelling and eddies that can hold a phytoplankton population in fertile areas. Phytoplankton productivity peaks during the spring months. The high productivity values in the spring months are about five times the summer values and about ten times the low winter values.

Zooplankton are composed of members of many phyla. Holoplankton ("Entire" Drifters) spend their entire lives as floaters while Meroplankton ("Part" Drifters) generally spend their larval or juvenile phase in the plankton. Zooplankton species include many of the fishes and invertebrates important to commercial recreational fisheries that spend the early stages of their life histories in the plankton.

The most comprehensive data for zooplankton in California waters comes from the CALCOFI (California Cooperative Fisheries Investigation) program initiated in 1949. This program has shown that zooplankton tend to be extremely variable in space and time. CALCOFI data have shown that zooplankton abundance at any given location may vary by as much as an order of magnitude from season to season and year to year (Thrailkill, 1969). The occurrence of particular zooplankton species or populations along the California coast is governed largely by currents. Long-term averages of zooplankton standing stock in the Southern California Bight show peak zooplankton abundances in the spring and summer months and lowest abundances during the winter (Kramer and Smith, 1972). Copepods, thalaceans, euphausids, and chaetognaths usually accounted for the bulk of the zooplankton biomass in the CALCOFI samples. The most abundant fish larvae were those of northern anchovy, pacific hake, and rockfish (Kramer and Smith, 1972).

- Benthos. Twenty-two species of macroinvertebrates were collected in two trawl samples from the Carpinteria tract (3150) near platforms Hope and Heidi [water depths of 59 and 100 ft (18 and 30 m), respectively]. Eight species of algae and seagrasses (*Phyllospadix torreyi*) were also collected in the shallow-water trawl sample. The most common macroinvertebrates in both trawl samples were *Sicyonia ingentis* and the sand shrimp (*Crangon nigromaculata*) (CSA, 1985).

  A diver transect survey was conducted in the hard-bottom area inshore of the platform sites. Four benthic habitat types were identified along the two transects surveyed: sand bottom; large rock outcrops with little or no attached kelp; large rock outcrops with attached kelp, interspersed with sand bottom; and small, widely scattered rock outcrops (some with attached kelp). Few macroepibiota were seen in the sand-bottom areas, but a variety of macroinvertebrates were common in the rocky habitats. Kelp was the most conspicuous alga, but other brown (*Desmarestia ligulata* var. *ligulata*) and red (*Rhodymenia* spp., *Gigartina* spp., *Scinaia articulata*) algae were common. Conspicuous invertebrates included sea urchins (*Stronglocentrotus franciscanus*) and (*S. purpuratus*); sea stars (*Pisaster brevispinus* and *P. giganteus*); the gorgonian (*Muricea* cf. *fruticosa*); and the whelk, (*Kelletia kelletii*) (CSA, 1985).

Onshore

1. Intertidal

As discussed in Section 1.1.1.3, Intertidal Surface Geology, intertidal habitat shoreward of the platform removal project area consists of rock, boulder, and sand habitat. Boulder fields are often present under sandy beaches and are alternately exposed and covered by shifting sand. East of Fernald Point the intertidal substrate is predominantly cobble and sand with prominent rocky intertidal only at Carpinteria.

Rocky intertidal organisms tend to be distributed in bands or zones related to tidal height. The occurrence of species is based on physical and biological factors such as ability to withstand exposure to air and to survive "sanding-in" as well as competition for limiting resources, especially space. Typical dominant rocky intertidal organisms are the barnacle (*Chthamalus fissus*), blue green algae and the green algae (*Enteromorpha* spp. and *Ulva* spp.) in the upper intertidal and filamentous red algae, corralline algae and at some sites, mussels (*Mytilus* spp.) in the mid-intertidal. The low intertidal is generally dominated by surf grass (*Phyllospadix torreyi*) and feather boa kelp (*Egregia menziesii*). Brown algae (*Halidrys dioica*) is also characteristic of the low intertidal (Chambers, 1992).

Compared to the highly productive and diverse rocky intertidal, the sandy intertidal is relatively low in productivity and diversity. Sandy intertidal organisms must cope with a rigorous environment of constantly shifting sands. There is, however, a characteristic suite of organisms that are adapted to this environment and, like the marine biota of the rocky intertidal, they show a zonation related to tidal exposure. Characteristic sandy beach organisms of the project region include the sand crab (*Emerita analoga*), t' bloodworm (*Euzonus mucronata*), and beach hoppers (*Orchestroidea* spp.) (MMS, 1983).

2. Unique Marine Environments

The State of California has established four categories for those areas within the State which are of special concern due to their biological importance. These categories include: (1) ecological reserves; (2) marine life refuges; (3) ecological preserves; and (4) area(s) of special biological significance (ASBS). Ecological reserves and marine life refuges have been maintained to protect marine resources previously threatened by human disturbances and the indiscriminate collection of organisms. Areas of special biological significance are those areas designated by the State Regional Water Quality Resource Board (SRWCB) (1975) which contain biological communities of such extraordinary, although unquantifiable, value that no risk of change in their environment resulting from man's activities can be acceptable (Chambers, 1992).

In addition to those categories, the United States Department of the Interior (USDOI) has established two additional categories to classify important biological environments:

(1) unique biological areas (UBA); and (2) biologically sensitive areas (BSA). Although not legally defined, these clarifications include areas that have been determined to be potentially biologically sensitive to oil and gas activities. Local coastal plans also provide a mechanism for the identification of unique environments at the county or city level.

There are 9 ecological reserves, 9 marine life refuges, and 15 ASBS between Point Conception and the U.S.-Mexican border (MMS, 1983). The unique marine environments located within the platform abandonment project area have been summarized in Table 1.4.1-7. These are considered to be exceptionally productive biological habitats, providing breeding, nesting, and foraging sites for a variety of fauna, including several endangered species. Carpinteria Marsh (El Estero), located just west of the City of Carpinteria, is the largest marsh complex (150 acres of marsh, 25 acres of mud flats, 15 acres of tidal channels) in Santa Barbara County. It has been designated as both a biologically sensitive area and an environmentally sensitive habitat, and researchers have identified over 120 species of birds which utilize the marsh. It is also habitat for two endangered species of avifauna; the light-footed clapper rail and Belding's savannah sparrow, as well as a population of the endangered plant, salt marsh bird's beak (Chambers, 1992).

Table 1.4.1-7. Unique Marine Environments within the Eastern Santa Barbara Channel Region (adapted from: USDOI, MMS, 1983; Science Applications, Inc., 1984; Westec Services, Inc., 1984; Woodward-Clyde Consultants, 1984)

Carpinteria Marsh (El Estero)	BSA: SBC and CC environmentally sensitive habitat; extensive marsh/estuarine habitat; intense avifauna utilization, including endangered light-footed clapper rail and Belding's savannah sparrow; salt marsh bird's beak plant also present.
Casitas Pier (Chevron Pier)	BSA: SBC and CC environmentally sensitive habitat; haul-out and rookery area (Harbor Seal).
Carpinteria Reef	SBC and CC environmentally sensitive habitat; rocky intertidal and subtidal habitat.

BSA: biologically sensitive area
CC: City of Carpinteria
SBC: Santa Barbara County

Southern California coastal wetlands, such as the Carpinteria Marsh, provide four critical habitat functions for migratory waterfowl and shorebirds:

- They furnish wintering waterfowl and shorebirds with sufficient food, rest, and space to minimize natural mortality through the fall and winter months.

- They return adequate numbers of healthy birds to the breeding grounds to insure maintenance of Flyway population levels.

- They provide spring and fall migration habitat for birds wintering in Southern California and Mexico.

- They provide "back-up" habitat during dry years when the Central Valley habitat is minimal.

Wetlands also provide excellent habitat for juvenile fishes because of their warm, calm conditions, high food supply, and protection from predation by larger fishes (Currin, et al., 1984; Boesch and Turner, 1984). Thus, a number of fish species including topsmelt and diamond turbot use coastal wetlands as nurseries. Shallow coastal embayments seem to be particularly important for California halibut. This important sport and commercial species which uses coastal wetlands as a nursery area appears to have declined as a result of lost wetland acreage (Onuf and Quammen, 1985; Kramer, 1990).

Endangered/Threatened/Candidate Species

This section discusses species within the region of the proposed platforms and associated pipelines which have been listed by the federal government of the State of California as Endangered of Threatened or which have been proposed as candidates for listing.

1. Plants

One plant species, the salt marsh bird's-beak, (*Cordylanthus maritimis* ssp. *maritimis*), has been listed as endangered by both the State of California and by the federal government. The salt marsh bird's-beak has become endangered primarily through the loss of its salt marsh habitat. Carpinteria salt marsh is the northwestern limit of occurrence for this plant (Ferren, 1985).

2. Fishes

There are no marine fish species within the platform and pipeline removal/abandonment area which are listed by the state or federal government as threatened or endangered.

3. Birds

Several listed bird species inhabit the offshore and onshore areas surrounding the platforms and pipelines.

- California Brown Pelican (*Pelecanus occidentalis californicus*). The California brown pelican was listed in 1970 and 1971 by the U.S. Fish and Wildlife Service and the California Fish and Game Commission following several years of pollutant-related (DDT) reproductive failures (Schreiber and De Long, 1969; Keith, et al., 1971; Risebrough, 1972; Gress and Anderson, 1983). Although population levels have gradually recovered from the effects of DDT, the subspecies retains its endangered status due to its low reproductive rate and small U.S. breeding population. Within California, brown pelicans only nest on the Channel Islands; however, they are classed as relatively common year-round visitors to the nearshore waters of Santa Barbara and Ventura County (Lehman, 1982; Webster, et al., 1980). Peak abundance occurs July through December when migrants from Mexico are present.

  Brown pelicans forage in the nearshore environment out to about 20 km (12 miles). They locate prey while flying and then plunge from the air to capture the prey underwater. This requires clear waters for prey location, as they feed almost exclusively on near-surface schooling fish. Pelicans commonly occupy offshore platforms as daytime roosting sites.

- Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*). The Belding's savannah sparrow has been a California State-Listed Endangered subspecies since 1974 and a Category 2 candidate for federal listing. It is one of four savannah sparrows that inhabit a wide variety of grassland, tundra, mountain meadow, and marsh habitats throughout north and central America. In addition to the Carpinteria Marsh, breeding occurs at Goleta Slough, Oxnard Beach, and McGrath State Park.

- Light-Footed Clapper Rail (*Rallus longirostris levipes*). The light-footed clapper rail is designated as an endangered species by the federal government and the State of California. Preferred habitat is tidal salt marshes with extensive growths of cord grass or pickleweed (Massey, et al., 1984). Censuses taken between 1980 and 1988 indicate that this species occurs in the central coast only in Carpinteria Marsh and Mugu Lagoon (Chambers Group, 1992).

- Snowy Plover (*Charadrius alexandrius nivosus*) - The coastal breeding population of the snowy plover is severely depleted and was listed as threatened by the Federal government on March 5, 1993. This small shorebird nests on large expansive sandy areas and forages on sand flats or intertidal mudflats. In addition to the Carpinteria Marsh, the snowy plover nests near the mouth of the Santa Clara River, on Ormond Beach, on McGrath State Beach, and at Mugu Lagoon between mid-March and the end of July (Page and Stenzel, 1981). Snowy plovers are commonly seen around the sandy beaches at the mouths of Devereux and Goleta Sloughs during the winter migration (Chambers Group, 1987).

4. Marine Mammals

- Cetaceans. The cetacean fauna of Southern California waters includes six species of whales that are listed as endangered and one as threatened by the federal government. Endangered species include: the blue, fin, sei, humpback, the northern right whale, and the sperm whale. As a result of population growth stemming from decreased fishing pressure, the status of the California gray whale was changed from endangered to threatened in 1992. All except the sperm whales occur seasonally in the SBC. Sperm whales are found almost exclusively in deeper offshore waters beyond the continental shelf.

  Location of sightings of whales recorded on BLM-OCS surveys conducted from 1975-1978 indicate that only the California gray whale would be expected in the nearshore waters of the platform removal project area.

- Pinnipeds, Fissipeds (Sea Otters), and Reptiles (Sea Turtles). The pinniped species found in the SBC that are designated as rare, threatened, or endangered on state or federal lists are the Steller (northern) sealions (*Eumatopias jubatus*) and Guadalupe fur seal (*Arctocephalus townsendi*), both federally and state listed threatened species. Guadalupe fur seals presently breed only on Isla de

Guadalupe, Baja California, Mexico. The Guadalupe fur seal would not be expected in the nearshore waters of the platform removal project area.

Although Ano Nuevo Island has the largest breeding population of Steller (northern) sea lions south of Alaska (Loughlin et al., 1984), the numbers of this species have been declining throughout their range over the last 30-year period. Due to their rapid decline, NMFS on November 6, 1990 listed the Steller sea lion as a threatened species (55 FR 49204) with an effective date of the final rule on December 4, 1990. These sea lions presently breed almost exclusively on offshore rocks to the northwest of Ano Nuevo Island. The Steller sea lion is a summer visitor and no longer breeds in this area. A few adult and sub-adult males are usually present on San Miguel Island and associated rocks in the summer.

The southern sea otter was federally listed as a threatened species under the Endangered Species Act in 1977. The subspecies presently occurs only in nearshore waters along the central California coast between Año Nuevo Point near San Francisco, to the mouth of the Santa Maria River, located about 17.6 km (11 miles) south of Pismo Beach. Numbers of sea otters outside the range are low and no specific locations of preferred use have been identified. Because this population is susceptible to devastation by an oil spill, the U.S. Fish and Wildlife Service began a program in 1987 to transplant up to 250 otters from central California to San Nicholas Island. This program appears not to have been successful.

Wanderers from the established sea otter range have been reported from Cape Mendocino in northern California to Point Loma near San Diego. Numbers of sea otters outside the range are low. Otters have been reported within the platform removal area, but in low numbers. Impacts to sea otters from project operations are anticipated to be less than significant.

Platform-Specific Setting

Offshore Flora and Fauna

1. **Avifauna**

The most common avifauna observed at the platforms are the western gull (*Carus occidentalis*), cormorants (*Phalacrocorax* spp.), and the brown pelican (*Pelecanus* *occidentalis*). These species and others frequently use the crossmembers below deck and the helipad above deck as perching and sunning areas.

2. Fishes

In addition to providing substrate for biofouling communities, the platforms also attract a diverse assemblage of fish species. Studies have been conducted in recent years based on catch results of the Santa Barbara party vessel sport fishery and from diving observations. Results indicate that there are between 16 to 60 times more fish beneath the platforms as compared to adjacent areas (Simpson, 1977). While there is a definite link between platforms and higher fish populations, based on study results, there is considerable variation between platforms on fish species encountered. The primary factors involved in distribution are, predictability, distance from shore, water depth, kelp abundance, and height and surface area of substrate.

According to personal communication with Milton Love (Feb. 1993), the locations with the highest number of fish count per unit of effort (defined as number of fish taken per angler hour) for kelp bass (*Paralabrax clathratus*) in California are at platforms Hilda and Hazel. Results from this study are based on census data collected during a 4-year random party boat survey conducted in the mid-1980's by the California Department of Fish and Game. No other data from this study is available at this time.

In Love and Westphal (1990), catch results from the sportfishing vessel *Hornet* were analyzed. Platforms visited by the *Hornet* were A, B, Hillhouse, Houchin, and Hogan. Each of these are in federal waters contiguous with the 3-mile State water boundary. Results indicated that rockfishes (*Sebastes*, sp.) predominated at all platform sites in both species numbers and abundance, comprising 8 of the 10 most frequently taken species. According to Love's as yet unpublished study, kelp bass, the dominant fish species taken at the much closer to shore Hazel and Hilda, were also present at the outer platforms but in lesser numbers (3.4 percent of total caught) (Table 1.4.1-8). The lower percentage of *P. clathratus* at the outer platforms is probably due to their relatively extreme depth. Hillhouse is located in 192 feet (59 m), below the 46 m maximum depth of *P. clathratus* (Eschmayer, et al., 1983).

Table 1.4.1-8. Fishes Taken by a Sportfishing Party Vessel Around Oil Platforms Near Santa Barbara

Common Name	Species	Total Length (mm)	Number Caught	% Total
Oil Platforms[1]				
Olive rockfish	*Sebastes serranoides*	270.0	831	30.3
Widow rockfish	*Sebastes entomelas*	265.4	420	15.3
Chub mackerel	*Scomber japonicus*	358.3	283	10.3
Canary rockfish	*Sebastes pinniger*	238.8	191	7.0
Brown rockfish	*Sebastes auriculatus*	269.1	193	6.7
Picaccio rockfish	*Sebastes paucipinis*	260.8	147	5.4
Vermillion rockfish	*Sebastes miniatus*	262.1	143	5.2
Blue rockfish	*Sebastes mystinus*	243.0	128	4.7
Kelp bass	*Paralabrax clathratus*	318.5	92	3.4
Squarespot rockfish	*Sebastes hopkinsi*	213.2	60	2.2
Copper rockfish	*Sebastes caurinus*	260.2	60	2.2
Yellowtail rockfish	*Sebastes flavidus*	255.9	59	2.2
Lingcod	*Ophiodon elongatus*	490.2	17	0.6
White croaker	*Genyonemus lineatus*	294.6	16	0.6
Jack mackerel	*Trachurus symmetricus*	226.5	15	0.6
N/A	*Sebastes dalli*	157.1	14	0.5
Halfmoon	*Medialuna californiensis*	259.2	13	0.5
Barred sand bass	*Paralabrax nebulifer*	455.2	12	0.4
Flag rockfish	*Sebastes rubrivinctus*	238.7	12	0.4
Rosy rockfish	*Sebastes rosaceus*	213.4	10	0.4
Starry rockfish	*Sebastes constellatus*	280.0	5	0.2
Pacific bonito	*Sarda chiliensis*	512.5	4	0.2
Pacific sanddab	*Citharichthys sordidus*	208.7	3	0.1
Blacksmith	*Chromis punctipinnis*	290.0	2	0.1
California scorpionfish	*Scorpaena guttata*	219.0	2	0.1
Cabezon	*Scorpaenichthys marmoratus*	362.5	2	0.1
Spiny dogfish	*Squalus acanthias*	989.5	2	0.1
N/A	*Sebastes umbrosus*	147.0	2	0.1
Total			**2,728**	

All fish surveyed off Santa Barbara aboard the sportfishing party vessel *Hornet*, April 1975-April 1978, around the oil platforms (A, B, Hillhouse, Houchin, and Hogan).

[1] No. trips = 15; No. anglers = 352; No. hours fished = 47.0; Effort = 8,251 angler hours; CPUE = 33 fish per angler hour; H' = 1.03.

Source: Love and Westphal, 1990.

Love and Westphal's results conflict with an earlier study conducted by Simpson in 1976. According to Simpson, the species seemingly most abundant at Hilda and Hazel was the olive rockfish (*Sebastes serranoides*). Study team divers estimated seeing as many as 4,000 per platform per visit, at depths ranging from surface levels to 80 feet (24 m). Three other species of notable abundance were the white surfperch (*Phanerodon furcatus*), blue rockfish (*S. mystinus*), and brown rockfish (*S. auriculatus*). Members of these species were also found at almost all depths in the water column. With only a few exceptions, all rockfish taken around the platforms were juveniles. A difference in species composition was also noted between the platforms and natural reefs. Much of the differences came from the relative abundance of high-relief substrate-associated rockfish (such as *S. constellatus* and *S. rubrivinctus*) over the reefs and their near absence around the platforms. The substrata around these structures are composed of a mixture of drill cuttings and shells which have broken off the platform pilings. This does not appear to be suitable habitat for many rockfish species (Love, Westphal, 1990).

3. Biofouling Organisms

A single platform in 96-137 feet of water may add 1 to 2 acres of hard substrate. The submerged portion of platforms, or jackets, are covered with biofouling organisms requiring suitable substrate for metamorphosis to adulthood. Over time the jackets support complex invertebrate communities. Shells of primary fouling organisms provide surface of attachment for secondary organisms. These organisms create hiding places for small fish and invertebrates, form the base for a highly complex food chain, and provide excellent breeding grounds (Scarborough-Bull, 1989, Driessen, P., 1989).

In his study of Platforms Hazel and Hilda in 1976, Simpson indicated that the California mussel (*Mytilus californianus*) and various starfishes of the genus Pisaster (P. *andochraceous and* P. *giganteus*) were found at all depths on the platforms and on the cuttings pile below, though they rarely occur at these depths on the rocky coast. In addition, the sizes of the specimens encountered were unusually large. Two studies of other vertical sea structures have revealed similar results: extended depth ranges for several intertidal organisms and unusually large mussels and starfishes (Chan 1973; Paine 1976).

While mussels appeared to dominate the platform fouling communities in terms of total weight, the anemone, *Corynactis californica*, seemed to be the most abundant of the attached animals. Divers estimated that clusters of these anemones covered 70 to 80 percent of the space available on the platforms at depths below 50 feet. Another anemone, *Epicactus prolifera*, was present in great numbers on Hilda but was rarely seen on Hazel. Divers in this survey reported that this was the only obvious difference in the animal communities of the two structures.

Over 200 invertebrate species were found on or near platforms Hazel and Hilda, including purple sea urchins (*Stronglyocentrotus purpuratus*), hydroids (Fam. *hydrozoa*), nesting clams, rock scallops, and jingle shells (Simpson, 1977). Various crabs and shrimp species were also seen.

4. Benthos

While the cuttings piles beneath the platforms were originally devoid of sea life, shell accumulation provided an uneven substrate surface suitable for further invertebrate life. Invertebrates living on the cutting piles beneath Hazel and Hilda included anemones, crabs, sea cucumbers, and numerous species of starfishes and batstars (Simpson, 1977).

In a study of polychaetes (worms that live on and in the seafloor), grab sampling of bottom sediment near Hazel revealed that the number of species present near the platform was typical for the open coast region. The effect of the platform was to increase the numbers of tube-dwelling worms. Polychaetes near the platform (filter-feeders in particular) may have been benefitting from the continuous "rain" of eggs, waste, and other biological material from the organisms living above them on the platform. Abundant species found within the immediate vicinity of the platform were *Trochochaeta franciscanum* and *Diopatra ornata*.

Onshore Flora and Fauna at Pipeline Landfall

The Hazel and Hilda pipeline landfall consists of predominately rocky intertidal with sandy beach habitat. The intertidal organisms discussed in Offshore Flora and Fauna above, provide a description of organisms likely to be encountered at the pipeline landfall locations.

Offshore Flora and Fauna Impacts

Prior to initiating abandonment operations, a survey will be conducted of the seabed within a 1,000 foot radius of the platforms. All sensitive bottom features, including pipelines, rocky outcrops, and kelp beds will be noted during the survey. These areas will be noted on applicable navigation charts and no anchors will be placed in the areas. Impacts to offshore flora and fauna will be directly related to physical disturbances associated with the removal of the platform jackets and caissons and with pipeline capping. Physical disturbance of the bottom sediments associated with removal of the structures will directly encompass the area occupied by the structures themselves. As indicated in Section 2.4.5 of the Execution Plan, explosive charges will be utilized for the cutting of anchor piling and conductors on platforms Hope, Heidi, and Hilda. Figure 1.4-1 details the placement of explosive charges for conducting pile cutting operations. Further, the bottom will be disturbed by materials and derrick barge anchors. Please refer to Section 1.1.2.1 of the Project Description for a discussion of typical anchor spreads and placement procedures. The majority of the literature reviewed has been generated about abandonment operations where explosives are used within the confined areas of piles and conductors. Such literature has been generated predominantly from abandonment operations in the Gulf of Mexico.

Jacket Removal: All Platforms

1. Avifauna

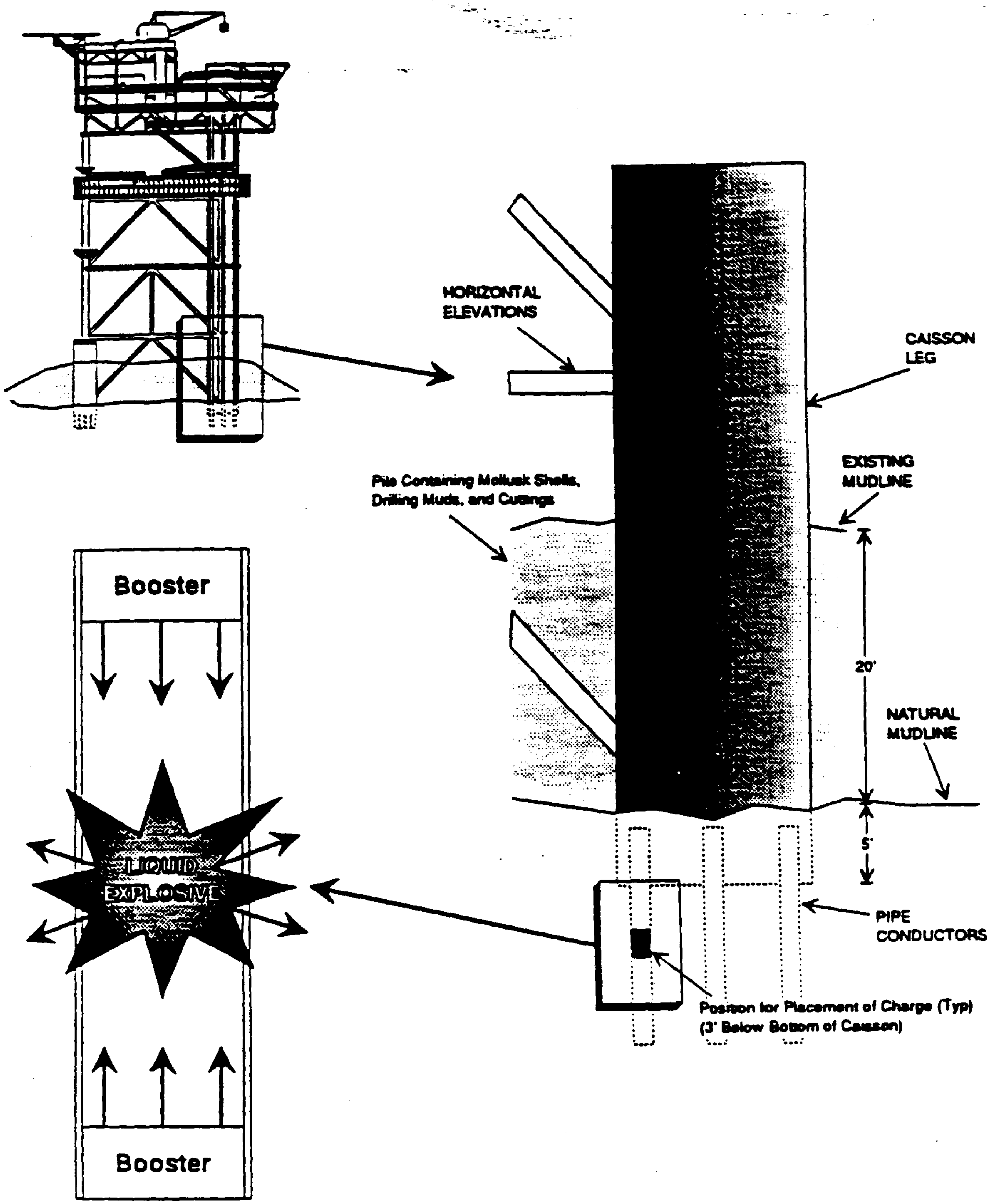
Seabirds are accustomed to perching on and foraging from platforms and are extremely tolerant of human activity. Most seabirds will likely remain at the platforms during most of the platform removal process and will only relocate to other habitat during periods of physical activities at the platform site and upon the complete removal of each platform. Seabirds are highly mobile and are capable of avoiding disturbances in the offshore project area for the duration of the removal activities. Therefore, short-term impacts to seabirds during removal activities would be less than significant.

Long-term impacts would result from loss of perching and foraging habitat. However, the four platforms under study represent only a small portion of the offshore habitat available to seabirds. Removal of this habitat would result in less than significant impacts.

Waterfowl, which normally utilize the waters as resting areas during migratory periods, would easily be able to avoid removal activities. No injuries, mortalities or long-term effects are anticipated.

2. Fishes

- Pelagic Fish. Short-term impacts on pelagic fish located within a several hundred meter radius of the platforms may be significant due to concussive impacts from



DETAIL OF EXPLOSIVE CHARGES
FOR CONDUCTOR/PILE CUTTING OPERATIONS

CALENDAR PAGE 690

MINUTE PAGE 3301

FIGURE 1.4-1

subsea explosions. Between 32 and 40 individual charges each containing between 25 to 45 pounds of explosive material will be detonated per platform. Explosive cutting operations will be conducted over three to four day periods per platform. Prior studies have indicated that fish remaining in the zone nearby the platforms upon detonation receive impacts which include mortality, perforated air bladders, and lung hemorrhage (Klima, et al., 1989; Baxter, et al., 1982). The exact relationship between fish mortality and distance from charge has not been conclusively determined. The maximum discharge from project explosives will emit less than one fourth the percussive pressure as the sample case because those explosions took place within the water column, while those for this project will be inside the casings and below the mudline. Therefore, the mortality radius will be correspondingly narrower. The explosive impacts will be confined to the immediate area of the platform. Impacts associated with the detonation will be significantly reduced by the fact that the explosives will be set off approximately 8 feet below natural mudline and significantly deeper than the existing mudline within the existing casing. In addition, all detonations will be staggered, which reduces the maximum pressure generated by the explosions (Connor, 1990). Impacts to the overall pelagic fish populations are determined to be less than significant due to factors such as: lack of endangered, threatened, or candidate fish species; relatively small percentage of fish taken by explosive charges (less than 20 fish per charge); and mortality reduction measures incorporated into the project.

As noted in the initial study, a number of measures will be undertaken to avoid impacts to marine mammals. These measures include delaying detonations until no marine mammals are observed within 1,000 yards of the platform. The remaining impact to marine mammals, according to the National Marine Fisheries staff, may reach harassment levels for which a permit may be required. Although impacts to pelagic fish will be minimized through the use of smaller charges detonated on a staggered timetable, there will be an unavoidable "incidental take" of fish located within the immediate zone surrounding the platforms (Goertner, 1981; Goertner, 1982). To reduce the potential of impacting marine birds and mammals attracted to the platform area to feed on fish killed by the explosion, mitigation measures will include the removal of all observed fish, either damaged or killed immediately following detonation operations.

All of the explosives will be detonated below natural mudline inside on the casing. Therefore, discharge will result in short-term, localized turbidity for the 3- to 4-day duration, per platform, from the piling and conductor severing operations. Anchor mooring of materials and derrick barges will also create localized, short-term turbidity impacts. Reduced visibility within the region of the turbidity plumes will force the fish to relocate to undisturbed areas for feeding. As all pelagic fish are extremely mobile, turbidity impacts from removal operations are anticipated to be less than significant. No other short-term project operations will have any measurable impacts to pelagic fish.

Long-term impacts of platform removal would include loss of habitat, foraging grounds, shelter, and support for numerous other forms of marine life. While numerous studies have provided evidence that oil platforms are major pelagic fish attractors, there has been no evidence indicating platforms in shallow waters increase productivity. The removal of the four platforms under study would result in the loss of a portion of the habitat available to pelagic fish within the Santa Barbara Channel. However, pelagic fish are highly mobile and there is an abundance of natural reefs and other platforms within the area that provide similarly suitable habitat. In addition, fish species congregating around the platforms are known to exhibit considerable transiency, as documented by the findings of Simpson (1977) and Love (personal communication, 1993). Therefore, the removal of habitat is projected to have less than significant impacts to the pelagic fish populations in the Santa Barbara Channel.

- Demersal Fish. Short-term platform abandonment and removal procedures will result in impacts similar to those described for pelagic fish. Mortality of individuals will occur within a several hundred meter radius surrounding each platform. Impacts to the overall demersal fish community are anticipated to be less than significant for the same reasons provided for pelagic fish species: lack of endangered, threatened, or candidate fish species; relatively small percentage of fish taken by explosive charges; and mortality reduction measures incorporated into the project.

Long-term impacts would result in a decrease of prey at former platform locations. However, most demersal fish are able to leave the area once they have been disturbed, such as by suspended sediments, and would most likely be able to find similar habitat. The brief duration of any disturbances along with the small area impacted should result in insignificant impacts. The localized disturbances on prey items should also have an insignificant impact.

3. Marine Mammals

The primary agents that may impact marine mammals during the 4- to 5-month platform removal period would be percussive impacts from explosives detonations, increases in turbidity, vessel traffic, and noise. While removal operations will be timed to avoid critical cetacean migratory periods, resident pinnipeds are expected to periodically frequent the platforms' vicinities. Physical presence of work boats, barges, and other associated vessels and personnel, however, will likely be a factor in causing most marine mammals to avoid the immediate platform areas. A mitigation monitoring plan is included as Appendix F to ensure implementation of mitigation measures designed to reduce impacts to marine wildlife. The use of a helicopter or surface vessel is considered to be a suitable alternative to observers located on the platform. All vessel operators will be properly briefed on procedures designed to reduce impacts to marine wildlife. In addition to the above factors which will inadvertently serve to protect marine mammals from injury and/or mortality from explosives, the following standardized conditions will be incorporated into project operations:

- An observer located on abandonment vessels will monitor the area prior to, during and after detonation of charges;
- Detonation will be delayed until any marine mammals observed within 1,000 yards [914 m] are certain to have vacated the area;
- Detonation will only occur during daylight hours to facilitate visual monitoring;
- Pre- and post-detonation surveys by divers, including recovery of any injured or dead fish, which might attract marine mammals, will be conducted; and
- Staggering of detonations will reduce the maximum pressure generated by the explosions.

In addition to the above standardized procedures, the following measure will further reduce the risk of having any marine mammals within mortality or injury range of the platforms during detonation periods:

- A killer whale sonic warning system which emits sounds nearly identical to those emitted by "killer whales" will be placed in the waters near the platforms prior to blasting. The killer whale is a natural predator of pinnipeds and the sounds emitted from the warning system will serve to scare off any pinnipeds in the area.

Under the auspices of the Endangered Species Act, after a threshold examination has been conducted by the appropriate federal agency (USFWS or NMFS) to determine if a "may affect" situation exists, the appropriate Service issues a biological opinion to the requesting agency. If the consultation and biological opinion conclude that the agency action will harm endangered species or offers reasonable and prudent alternatives that would prevent potential harm, the agency may issue an "incidental take statement," which specifies the impact of the take (number of individuals), delineates the reasonable and prudent measures to be taken, and sets forth terms and conditions under which the activity must be conducted (16 U.S.C. 1536(b)(4)). At this point it has been determined that no marine mammals will be injured or killed by this project, but that the use of explosives as described may constitute "harassment," and if so, a permit for which application will be made.

The Marine Mammal Protection Act generally places a moratorium on the taking of any marine mammals, but provides several specific exceptions to the prohibition. The exception relevant to rig removal is found at Section 101(a)(5) of the Act, which allows for the incidental take of small numbers of marine mammals during an activity other than commercial fishing if the proposed take will have a negligible impact on the affected species or stock.

Adherence to the aforementioned standards and procedures should eliminate the risk of injury and/or mortality to all marine mammals. Therefore, under CEQA, the short-term impacts to marine mammals from platform removal are anticipated to be less than significant.

Vessel traffic impacts to marine mammals are discussed in detail in "Offshore Impacts" of Section M, Transportation/Circulation; noise impacts are discussed in "Offshore Impacts" of Section F, Noise. However, these items are also discussed below as they relate to marine mammals in general.

Turbidity resulting from explosives detonation and anchor mooring will result in only minor localized avoidance impacts since coastal marine mammals are normally exposed to some turbid water conditions. Harbor seals and California sea lions may temporarily seek nearby areas if turbidity hampers their ability to forage. Blue, fin, and humpback whales are sometimes found in deeper, relatively clear pelagic waters and therefore would not be affected by platform removal. As the explosive charge portion of project operations will occur outside the gray whale migration window, gray whales will not be affected by localized turbidity associated with this component. Toothed whales, i.e., Pacific white-sided dolphin, common dolphin, occur in the vicinity of the platform-removal areas but are not likely to be adversely impacted by increased turbidity (Little, 1985).

Dismantlement equipment such as cranes, compressors, welding equipment, barges, and boats would all constitute noise sources that would likely impact cetaceans. Noise can cause impacts to gray whales and other cetaceans. However, only the loudest industrial noises have been reported to affect gray whale behavior (Malme, et al., 1983). Gray whales have acclimated somewhat to human activity since they are commonly observed near urbanized areas of Los Angeles (MMS, 1984) as well as in the Santa Barbara Channel amid boat traffic, production, and exploratory activities. Impacts to gray whales are classified as insignificant.

Noise generated from crew and tug boats, derrick barges, etc., are expected to cause insignificant impacts to pinnipeds. Project-generated boat traffic will be of short-duration and barely perceptible above existing levels.

4. Kelp Beds

Prior to initiating abandonment operations, a survey will be conducted of the seabed within a 1,000 foot radius of the platforms. All sensitive bottom features, including piplines, rocky outcrops, and kelp beds will be noted during the survey. These areas will be noted on applicable navigation charts and no anchors will be placed in the areas. In addition, all vessels associated with the project will transit within designated corridors. Abandonment of the platforms will have no impact on the kelp bed community. Kelp beds located several hundred yards inshore of Hazel and Hilda do not rely on the platforms for substrate or protection. Due to water depth, no kelp beds are located nearby Platforms Hope and Heidi. Therefore, jacket removal would have no impact to nearby kelp beds.

5. Plankton

Platform removal will result in elevated turbidity levels which will have little impact on the phytoplankton community; turbidity plumes are not expected to reach the euphotic zone and impact the phytoplankters. Elevated suspended sediment levels in the water column could adversely affect the feeding abilities of zooplankters near the bottom, but the duration would be short and magnitude localized so that impacts would be insignificant. Previous studies have indicated that platform removal will not have a measurable impact.

6. Benthos

- Organisms on Seafloor. Benthic organisms within the immediate region of the conductors, pilings, and external legs will undergo considerable damage and/or mortality as a result of the platform removal operation. Impacts will be greater to these immobile organisms than to mobile organisms able to evacuate the removal area. Impacts to benthic organisms will be less than significant, however, due to the relatively small percentage of overall benthic organisms that will be disturbed from the removal operation.

  As discussed in the Offshore Impacts section of "A. Geology" of the Project Description, the bottom will be disturbed by the anchors of the platform removal derrick barge and materials barges. Anchors are not dragged on the bottom, but will create a disturbance while they are digging in. This activity would disturb and temporarily eliminate epibenthic and infaunal organisms where the anchors and anchor chains contact the seafloor. The number and size of anchor scars depend on several variables, including bottom current speeds, character of bottom sediments, distance along which the anchor is dragged, type of anchor, and method of placement (SLC, 1986). All anchors will be deployed vertically from the barge or from anchor assist vessels (workboats). A correctly placed anchor typically results in a disturbance of about 35 feet (Chambers, 1986). Organisms in the area of the anchor scars would be eliminated and the local bottom topography altered. Organisms recolonizing the anchor scar might differ from those in the surrounding undisturbed benthic community due to differences in sediment character. Localized increases in turbidity would also be caused by the movement. Therefore, impacts to seafloor benthos would be adverse but less than significant.

- **Biofouling Organisms on Platform Jackets.** Removal of platform caissons, legs, and subsea bracing would disrupt and/or eliminate many benthic invertebrate organisms. Encrusting organisms directly attached to the jacket would, unless incidentally scraped off during platform removal and subsequent transport to land, likely remain attached to the platform indefinitely. Marine growth located on the jacket legs and subsea bracing will be removed with hydroblasting equipment at all cut locations. Removal from water and hydroblasting will result in direct invertebrate mortality. Increased standing crop on platform legs and cross members, used as new substrate for attachment of epibiota, will be lost as the structures are removed. This loss, although resulting in a return to conditions which extended prior to construction, can be considered an adverse but insignificant impact.

  Other encrusting organisms, existing on the accumulation of shells atop the cuttings piles, would likely be damaged by the physical removal of the jackets. Caisson removal would leave open pits on the seafloor and alteration of the cuttings piles would occur. As a result, benthic organisms and other invertebrates on cuttings piles would be eliminated and/or dislodged from their substrate. These impacts would be confined to localized regions. Due to the relative abundance of this resource, no significant impacts will occur.

7. Endangered/Threatened/Candidate Species

Removal of the proposed platform jackets is not anticipated to pose any significant impacts to any endangered, threatened, or candidate species. As indicated above, preventative measures incorporated into the project will serve to reduce impacts to endangered marine mammals to levels of insignificance. The only avian species that would be affected in the long term would be the California brown pelican as they use the platform crossmembers for resting and perching areas. The platforms scheduled for removal, however, comprise only a small portion of the available offshore roosting areas. Therefore, impacts to the California brown pelican will be less than significant. The California gray whale, a federally listed threatened species will not be impacted as the timing of the explosive charge portion of the removal schedule will occur completely outside their migration window, roughly between December and May.

Offshore Pipelines and Cable

1. Avifauna

As discussed in Subsection 1, "Avifauna," seabirds and waterfowl are extremely tolerant of human activity, are highly mobile, and are capable of avoiding disturbances in the offshore project area for the duration of the removal activities. Impacts to avifauna from offshore pipeline and cable abandonment would be less than significant.

2. Fishes

- Pelagic Fish. Impacts to pelagic fish from offshore pipeline and cable abandonment would be less severe than those described for platform jacket removal in that no explosives will be used during this portion of the operations. Due to the highly mobile nature and abundance of habitat of pelagic fish, impacts will be less than significant.

- Demersal Fish. Impacts associated with the abandonment of the offshore portions of the pipelines and cable would be less severe than those described for platform jacket removal in that no explosives will be used during this portion of the operations. Impacts should be insignificant due to the short duration of pipeline abandonment operations and the relatively small area of the soft benthic habitat involved.

3. Marine Mammals

Impacts to marine mammals associated with the abandonment of the offshore portions of the pipelines and cable would be similar, with respect to turbidity and noise, to those described for platform jacket removal. Disturbance of bottom sediment and resuspension of sediments may affect feeding activities of pinnipeds or small cetaceans causing local insignificant impacts (Little, 1985). Impacts to cetaceans and pinnipeds from pipeline abandonment are projected to be short-term and less than significant.

4. Kelp Beds

Abandonment of the offshore portions of the subsea pipelines and cables would have no impact on local kelp bed resources, as described for platform jacket removal operations. There are no kelp beds within the immediate vicinity of the proposed operations.

5. Plankton

Impacts to phyto- and zooplankton would be similar to those described for platform jacket removal. Due to the short duration and localized magnitude of pipeline and cable abandonment activities, impacts to plankton would be less than significant.

6. Benthos

Impacts to benthic organisms on the seafloor will occur from pipeline/cable separation from platform, capping, and end burial activities. Benthic organisms within the immediate vicinity of the pipeline/cable ends will likely be entrained within the suction of diver held-hand jets. Localized impacts will also occur near the jetting area as displaced bottom sediments settle onto immobile benthic organisms. These impacts will be very localized, short-term and thereby not significant.

7. Endangered/Threatened/Candidate Species

There would be no impacts to any endangered, threatened, or candidate species resulting from the abandonment of the offshore pipelines.

Nearshore Pipeline Abandonment

As the nearshore pipeline will be abandoned in place, there will be no abandonment activities conducted within the nearshore area. Pipeline pigging and flushing operations will be conducted from the platforms. Pipeline grouting will be conducted from the pipeline end at the Carpinteria Plant. Therefore, as no work will actually be conducted in the nearshore area, there will be no impacts to any of the biological resources listed above.

1. Endangered/Threatened/Candidate Species

For reasons described above, nearshore pipeline abandonment activities will not result in any impacts to endangered, threatened, or candidate species.

Unique Marine Environments

The pipeline landfall is located approximately one-third of a mile east of the Carpinteria Reef and Marsh entrance and approximately one-third of a mile west of the Casitas Pier. Each of these three areas are designated Environmentally Sensitive Habitats (ESH).

As the nearshore pipeline will be abandoned in place, there will be no abandonment activities conducted within the Carpinteria Reef or Carpinteria Marsh. Pipeline pigging and flushing operations will be conducted from the platforms, and pipeline grouting will be conducted from the valve box on the bluff. Therefore, project operations will have no impacts to these Environmentally Sensitive Habitats.

The Casitas Pier will continue to be used as a base for support vessel operations during the course of the project. In order to avoid disturbance to the Carpinteria harbor seal colony located east of the Casitas Pier, the following measures which are presently observed will continue to be used during this project:

- Avoid sudden movements and loud noises when on the pier. Limit trips and equipment to the minimum necessary for efficient operations.
- Minimize time spent at the base of the pier and turnaround area. Use the parking areas to meet or drop-off personnel using the pier.
- Use only the main access road exiting the turnaround to the West.
- Demonstrate extra sensitivity at the Casitas Pier during Carpinteria's beach closure for the seal pupping season December 1 through May 31 (City of Carpinteria Ordinance No. 469).

As these measures are already in use at the Casitas Pier, no further mitigations are necessary. Existing operations have utilized the pier without any significant disturbance to the harbor seal colony. Proposed project operations will not result in a major increase in vessel traffic from the pier. Therefore, impacts to unique marine environments and environmentally sensitive habitats are projected to be less than significant.

D. Plant Life

1. Species Diversity

No plant communities are located within the offshore or onshore regions of the project area that would be significantly affected by this project. Therefore, there will not be any significant impacts to terrestrial or aquatic plants within the vicinity of this project.

2. Endangered Species

Offshore - No rare or endangered benthic plants are known to occur within the vicinity of the proposed platform abandonment. This project will not, therefore, result in any significant effects on rare or endangered plants.

Onshore - No onshore or nearshore aquatic flora has been identified as being at risk due to project activities. Therefore, project impacts to onshore flora are projected to be less than significant.

3. Introduction of Plants

By its nature, neither the offshore nor the onshore components of the proposed project would result in the introduction of any new plant species.

4. Agriculture Crops

There are no known onshore agricultural crops that would be impacted in any way by the proposed project.

E. Animal Life

1. Animal Species Diversity

Offshore - Abandonment activities associated with platform and subsea pipeline removal will result in some habitat loss and disturbance to bottom-dwelling fish and other marine animals which utilize these habitats. However, these impacts have been determined to be less than significant due to the abundance of other suitable habitat. Therefore, any loss of or disturbance to any habitat resulting from platform removal and pipeline abandonment is considered less than significant due to the relatively small percentage of marine organisms impacted and the foregoing.

Onshore - As discussed above, no abandonment activities will be associated with the nearshore portion of the pipelines. It is anticipated that onshore operations will have less than significant impacts to the diversity of local biological resources.

2. Endangered Species

Offshore - As indicated in Subsection 7 and Subsection 1 above, the proposed project will not result in the reduction of the numbers of any unique, rare, or endangered species of animals.

Onshore - As indicated in Subsection 1, the onshore portions of the pipeline abandonment would not result in any impacts to any unique, rare, or endangered species of animals.

3. Introduction of Animals

Neither the offshore nor the onshore portion of this project are anticipated to create any permanent change of habitat which could introduce new species to the area. Upon completion of the project, the area will be restored to its previous state.

4. Habitat Deterioration

Offshore - As indicated in "Jacket Removal" above, impacts of platform removal would include loss of habitat for avifauna, pelagic fish, demersal fish, and marine mammals. However, these organisms are highly mobile and there is an abundance of natural reefs and other platforms within the area that provide similarly suitable habitat. Therefore, impacts of habitat removal for mobile offshore fauna are projected to be less than significant.

As previously described, immobile benthic organisms on the seafloor and bioufouling organisms on platform jackets will undergo considerable damage and/or mortality in localized areas. Impacts to benthic organisms will be less than significant, however, due to the relatively small percentage of overall benthic organisms that will be disturbed by the proposed activities.

F. Noise

Offshore Setting

All wells on the platforms will be plugged and abandoned as a separate project prior to removal of the platforms. Human activity on the platforms is limited to a daily walk-through by personnel to ensure the proper operation of the equipment that is left in service. Current noise-generating sources originating from the platforms consist of air compressors, saltwater pumps, emergency power generators, foghorns, and emergency alarm systems. Until the platforms are physically dismantled these noise-generating sources will remain functional.

Supply/crew boats operate on a continual basis from the Casitas Pier to producing platforms from before dawn to after dark 7 days a week. A harbor seal rookery is located immediately adjacent to the pier. Noise originating from boat traffic, and oil related activities from the pier and on the cliffs have had no visually discernible impacts upon harbor seal breeding, pupping, or hauling out activities.

Onshore Setting

The Carpinteria area adjacent to the two easternmost platforms, Hope and Heidi, has a number of potentially sensitive receptors. Occupied single-family residences exist in the adjacent unincorporated area along Sand Point Road and Del Mar Avenue (known locally as the Sandyland and Sandyland Cove communities, respectively). Carpinteria City Beach and Carpinteria Beach State Park are immediately adjacent to the ocean for approximately 1.6 km (1 mi) in the western part of the City. The westernmost section of Carpinteria adjacent to the City beach is characterized by existing mixed occupancies - predominantly large multi-family dwellings adjacent to the beach, single-family dwellings farther inland, and commercial activities along Linden Avenue (CSA, Inc., 1985).

The nearest onshore receptors to platforms Hazel and Hilda consist of low-density single family residences along Padaro Lane, an unincorporated 1-1/2-mile-long street immediately east of Summerland; approximately 10 houses located on Finney Street in Summerland; and Lookout Park, also in Summerland. All of these receptors are located south of the Southern Pacific Railroad right of way and U.S. Highway 101. Noise generated from U.S. 101 and the Southern Pacific Railroad effectively buffer any platform-generated noise that may otherwise have been detected from noise sensitive receptors in the remainder of Summerland, located north of U.S. 101 and the Southern Pacific Railroad.

With the possible exception of emergency alarms and foghorns, none of the noise generating sources remaining on the platforms are detectable from coastal noise receptors.

Offshore and Onshore Impacts

1. Increase in Existing Noise Levels

Implementation of the proposed project would include the abandonment and removal of four oil and gas platforms. Offshore equipment utilized for project purposes would be the primary noise sources and include tug boats, crew boats, utility vessels, welding equipment, generators, and compressors. Noise would be generated during the mobilization of offshore equipment, pre-abandonment activities, pile and conductor cutting, topside removal, jacket removal, debris removal, site clearance verification, and pipeline abandonment.

Noise level increases will be greatest during the removal of platform topsides, and therefore represent a worst-case scenario. Project platforms will be removed in pairs, with one equipment spread operating at a time. Noise modeling conducted for the proposed project is presented in Tables 1.5.2-1 and 1.5.2-2.

Episodic noise events will occur as a result of explosive detonations used during the jacket removal phase. As indicated in the Impacts to Animal Life section, between 32 and 40 individual charges, each containing between 25 to 45 pounds of explosive material, will be detonated per platform. Explosive cutting operations will be conducted over 3 to 4 days per platform. All detonations will be conducted below natural mudline in approximately 100 feet of water. As the deck packages will be removed prior to explosive detonations, the sound from the subsea detonations will be directed skyward through the conductor and jacket casings. A cement plug inserted above each charge and the earth material surrounding each charge serve to further buffer the noise impacts. The resulting noise level experienced on the surface will be highly muffled. Explosive detonations will occur at least 1 mile from shore; therefore, noise levels at onshore receptors are projected to be scarcely audible. Noise levels from explosive detonations are, therefore, considered to be less than significant.

Currently, a number of residential land uses are situated along the shoreline between Summerland and Carpinteria within proximity to the abandonment and removal project area. Based on noise monitoring conducted by the Chambers Group for the FEIR/EA BEACON Beach Nourishment Demonstration Project (1992), existing noise levels along the shoreline within these areas average between 60 and 61 dBA. During project abandonment and removal activities, worst-case noise levels due to offshore equipment operations would result in onshore Leqs of between 46 and 48 dBA, and overall CNEL levels of between 56 and 58 dBA. Projected noise levels would be lower than existing ambient conditions and would be generally masked, resulting in less than significant impacts. No sensitive land-based receptors will be exposed to severe noise levels.

With the removal of the platforms, the number of related support vessel trips will be reduced. Such a reduction in trips will reduce noise levels at the Casitas Pier and crew boat travel routes.

2. Exposure to Severe Noise Levels

See #1, above.

Table 1.5.2-1. Noise Prediction Topside Removal Hazel and Hilda

Noise Source	Number of Units	Assumed Use Factor	Max Sound Pressure Level @ 50 Feet (dBA)	Distance (feet)	Noise Level Leq (dBA)
Receptor:	**shoreline**				
Assumed Attenuation:	**6 dBA per doubling of distance**				
Tug Boat	6	0.25	90	10032	46
Crew Boat	2	0.2	90	10032	40
Utility Vessel	2	0.2	90	10032	40
Welding Machine	4	0.6	65	10032	23
Generator	4	0.1	76	10032	26
Compressor	4	0.2	81	10032	34
Total Leq Daytime During Normal Operations					**48**
Measured Daytime Ambient Without Construction					50
Assumed Nighttime Ambient					40
Number of Daytime Hours Operating					12
Number of Nighttime Hours Operating					12
Estimated Ldn or CNEL					56

Note: NA = Not Applicable

SOURCES: EPA (1971), Noise From Construction Equipment and Operations, EPA PB 206 717
Harris, C.M. (1979), Handbook of Noise Control, 2nd. Ed

Table 1.5.2-2. Noise Prediction Topside Removal Hope and Heidi

Noise Source	Number of Units	Assumed Use Factor	Max Sound Pressure Level @ 50 Feet (dBA)	Distance (feet)	Noise Level Leq (dBA)
Receptor:	shoreline				
Assumed Attenuation:	6 dBA per doubling of distance				
Tug Boat	6	0.25	90	10032	44
Crew Boat	2	0.2	90	10032	39
Utility Vessel	2	0.2	90	10032	39
Welding Machine	4	0.6	65	10032	21
Generator	4	0.1	76	10032	25
Compressor	4	0.2	8	10032	33
Total Leq Daytime During Normal Operations					46
Measured Daytime Ambient Without Construction					50
Assumbed Nighttime Ambient					40
Number of Daytime Hours Operating					12
Number of Nighttime Hours Operating					12
Estimated Ldn or CNEL					55

Note: NA = Not Applicable

SOURCES: EPA (1971), Noise From Construction Equipment and Operations, EPA PB 206 717
Harris, C.M. (1979), Handbook of Noise Control, 2nd. Ed

G. Light and Glare

Offshore Setting

As a navigational and operational safety measure, offshore oil platforms are equipped with extremely bright lights. Light emitted from the platforms at night creates the appearance of illuminated stationary ocean vessels. Blinking lights serve as beacons for seagoing vessels and aircraft and can be observed from great distances. At approximately 1.5 nm from shore for Hilda and Hazel, and 2.6 nm for Hope and Heidi, the four offshore platforms proposed for removal constitute four of the five platforms in existence in Santa Barbara County located within the 3-mile State water boundary and are the only ones within State waters visible within the Summerland to Carpinteria region. As such, Hope, Heidi, Hilda and Hazel are presently the most conspicuous nighttime offshore light sources from the Summerland through Carpinteria coastal region.

Onshore Setting

Existing onshore sources of light and glare associated with the project are limited to nighttime lighting at the Casitas Pier and the Carpinteria Plant. Security and safety lights are illuminated at these facilities during nighttime hours.

Offshore Impacts

1. Short-term light and glare impacts at the platforms will result from the presence of offshore equipment on a 24-hour per day basis for a two- to three-month period per two platforms (Hope/Heidi, Hazel/Hilda). Vessels such as derrick barges will be periodically positioned along the structures and will add to the existing light sources for periods of approximately one month per platform. Two materials barges will also be moored in remote locations adjacent to the platforms. All additional vessels and equipment will be brightly lit for navigational safety and for nighttime work purposes. Project-related light and glare in the offshore regions near the platforms will be visible from shore.

   While there will be a visible increase in additional light, the increase will not result in a significant impact due to its distance from shore and the existing amount of other artificial light sources in the Channel. The additional lighting will also reduce the likelihood that other seagoing vessels will collide with the moored barges. Therefore, short-term project-related offshore light and glare is projected to be less than significant.

Long-term light and glare impacts in the Summerland and Carpinteria areas will be reduced upon removal of the project platforms. This net reduction of artificial light sources will result in an environmental enhancement.

Onshore Impacts

The onshore components of the proposed project will not be conducted at night and there will not be substantial glare-emitting sources during daylight operations. Therefore, there will be no onshore light and glare impacts.

H. Land Use

Offshore Setting

Oil and gas exploration and development activities were conducted from the platforms during the period from 1958-92. All hydrocarbon production has ceased and all wells will be permanently abandoned prior to the removal of the platforms.

Onshore Setting

The nearshore areas between Summerland and Carpinteria are characterized as generally low density residential with public access beaches comprising approximately 50 percent of the onshore area located between the two sets of offshore platforms. The unincorporated community of Summerland supports a population of approximately 5,000. The land use mix in this community is approximately 95 percent residential, 4 percent commercial, and 1 percent public facilities (Fire Department and Water District). County-maintained Lookout Park is located on the cliff overlooking Summerland Beach.

Low-density homes line the cliffs immediately east of Summerland along Padaro Lane for approximately 1.5 miles. Padaro Lane thereafter turns into Santa Claus Lane. Land uses along this 0.5-mile stretch include a public beach and a few tourist-serving commercial facilities. Many of the commercial structures along this stretch are presently vacant.

Downcoast of Santa Claus Lane lies the private communities of Sandyland, Sand Point, and Sand Cove. The homes in these communities line the beach fringing El Estero estuary, a State-designated environmentally sensitive habitat. Carpinteria City and State Beaches and the Chevron processing facility and associated pier are located to the south. The City of Carpinteria borders the inland portion of El Estero to the southeast, and is directly inland from the State Beach. With a population of approximately 13,500, Carpinteria (1990 Census) is comprised of mostly residential units, with sizable percentages of commercial, industrial, and agricultural land uses.

South of the Casitas Pier the beach widens and extends approximately 3 miles south to Rincon Point. The Carpinteria Bluffs represent a significant portion of the undeveloped land overlooking this stretch of beach. A handful of light-industrial facilities are located further east toward Rincon.

In addition to Chevron's processing facility at Carpinteria, Mobil's Rincon processing facility is another existing onshore oil and gas processing facility along the Santa Barbara coastline in the vicinity of the project area.

Offshore Impacts

1. The proposed project would represent the permanent removal of offshore structures utilized for oil and gas production. The removal of these structures would return the production areas to a near natural state. Therefore, the proposed project would return the area to those uses which occurred off the coast of Summerland and Carpinteria prior to platform installations.

Onshore Impacts

Onshore components of the proposed project would include nearshore pipeline abandonment. As the pipelines will be abandoned in place, the proposed abandonment operations will not result in any alteration of the present or planned land use of the area.

I. Natural Resources

Regional Offshore Setting

1. Commercial Fishing

In 1986, 390 vessels made up the fishing fleet from Santa Barbara Channel ports. Santa Barbara, Ventura, Oxnard, and Port Hueneme harbored 172, 94, 40, and 84 vessels, respectively (SCB, 1988).

Two California Department of Fish and Game (CDFG) statistical data sets are used to help describe Santa Barbara Channel fisheries and assess impacts: port landings for years 1985 through 1990, and landings assigned to catch blocks for years 1981 through 1990. Annual port landings present a general overview of fish landed in Santa Barbara Channel ports and harbors. Monthly averaged port landings for years 1988 through 1990 are used to determine seasonality of landings and catches.

Santa Barbara Channel fish landings increased significantly from 1985 to 1989 and decreased in 1990. In 1985, landings totaled 35,698,478 pounds, and in 1989 landings totaled 74,589,823 pounds. In 1990, landings declined to 49,839,260 pounds (CDFG 1985). A compilation of the data for the four ports shows that squid was the top, bu. sporadic producer, followed by sea urchin, mackerel, rockfish, shark, tuna, hagfish, anchovy, halibut, prawn, rock crab, swordfish, abalone, white croaker, lobster, sole, sea cucumber, crab claw, white seabass, sablefish, shrimp, thornyhead, and salmon. Total averaged value of these species, in 1990 dollars, is $20,490,341. Santa Barbara accounted for about half of the revenue ($10,285,056) followed by Oxnard ($4,014,647), Ventura ($3,400,339), and Port Hueneme ($2,790,299) (GTC Marine Terminal EIR, 1992).

- Fishing Technologies and Species Taken. The fishing industry of the Santa Barbara Channel is characterized by extreme diversity in both marine resources and vessel/gear type. Although fishermen from the entire West Coast are attracted by the local abundance and variety of marine species, most fishes taken in the Channel are landed in the Ports of Los Angeles (Terminal Island and San Pedro), Port Hueneme, Oxnard, Santa Barbara, Avila, and Morro Bay (GTC Marine Terminal EIR, 1992).

The gear types employed in harvesting the marine resources of the Santa Barbara Channel include: drag nets (trawlers), gill nets (drift and set nets), harpoons, hook-and-line, long line, purse seines, scuba and surface air (hookah diving units) troll gear, and various types of traps.

Drag nets are used in the Santa Barbara Channel to fish for halibut, rockfish, sole, prawn, shrimp, and sea cucumber. Incidental catches of other species are also made, including sablefish (blackcod), shark, and other bottom fishes. CDFG regulations limit dragging to beyond 5 km (2.7 NM) from shore, except for halibut which may be taken to within 1.6 km (0.9 NM) of shore. Shelf and slope areas are fished to depths of about 305 m (1,000 feet). Dragging for prawn and shrimp occurs from Point Conception to Sacate, between El Capitan and Carpinteria, along the north side of the Channel Islands, and over reefs between and west of Platforms Hogan and Grace. Rockfish areas are primarily at the west end of the Channel, and on the south side of San Miguel and Santa Rosa Islands. Dragging for sole is conducted in the eastern end of the Channel and along the north side of the Channel Islands. Halibut dragging occurs between Point Arguello and Point Conception, Sacate and Tajiguas, and Carpinteria and Port Hueneme. Some of the most productive halibut tows are made in the vicinity of PRC 3150, the lease area containing Hope and Heidi (CSA, 1985).

Two types of gill net are used: drift nets and stationary or set gear. Drift nets are regularly used in the Santa Barbara Channel to fish for barracuda, seabass, swordfish, thresher shark, and occasionally bonito. Primary target species are swordfish and thresher shark, which are both pelagic, migratory fishes. Fishing areas generally are located adjacent to shipping lanes between Santa Barbara and Point Conception.

Set gear is fished in relatively shallow nearshore water, within the 55-m depth contour. Target species include barracuda, halibut, seabass, and several varieties of shark. A few years ago, several fisherman also experimented with rock cod gill nets, but this practice has been abandoned within the Channel.

The primary hook-and-line fishery in the Santa Barbara Channel is "drop lining" for red snapper, also known as "rock cod," but scientifically referred to as the Vermilion rockfish (*Sebastes miniatus*). This type of fishing occurs throughout the Channel over the continental shelf particularly near rock piles and some platforms. As noted in recreational fisheries, above, *S. miniatus* is a commonly taken species by recreational fisherman off of Platform Hope. Fishing spots are located both by visual reference to landmarks and nautical charts, and by electronic means.

Purse seining occurs throughout the Santa Barbara Channel, exclusive of the shipping lanes, for pelagic species such as anchovy, mackerel, and squid. Nearshore areas outside of kelp beds are generally more productive than offshore areas, especially at the western end of the Channel (CSA, 1985).

Almost all commercial abalone diving now occurs south of Point Conception. Abalone are harvested along the mainland coast and around the Channel Islands out to a depth of about 30 m (100 ft). At least six species of abalone are found in the Channel: red, white, black, pink, green, and threaded. Most of the harvest, however, is composed of red, pink, and white abalone. Black abalone are harvested for the Japanese market (CSA, 1985).

Sea urchin are harvested along the mainland coast and around the Channel Islands to depths of about 18 m (60 feet). The large red urchin (*Strongylocentrotus franciscanis*) makes up most of the harvest, although the purple urchin (*S. purpuratus*) is taken as well. Sea urchin has clearly replaced abalone as the overall most valuable commercial shellfish resource in Southern California. AL but a small fraction of the sea urchin harvest is landed in the port of Santa Barbara (Little, 1985).

Trolling is a variation of hook-and-line technology used by members of the Santa Barbara commercial fishing community to pursue albacore, bonito, salmon, and, until their recent depletion, barracuda. Most salmon trolling within the Channel has traditionally been conducted within 1.6 km (0.9 nm) of shore near the kelp beds between Gaviota and Point Conception. However in recent seasons, significant catches have been made in the nearshore region between Carpinteria and Ventura; this has been the result of an ambitious CDFG program to develop the salmon potential of south coast area habitats, as most streams and rivers emptying into the Santa Barbara Channel were natural salmon spawning areas within the historic period. This unique Southern California salmon run, begun primarily for the benefit of sportsmen, has resulted in substantial commercial benefit for local fishermen, processors, and commercial passenger fishing vessel operators. Albacore and bonito trolling takes place in open water throughout the Channel wherever and whenever these fishes can be found (Little, 1985).

The rock crabs *Cancer anthonyi*, *C. Antennarius*, and *C. productus* and the spiny lobster *Panulirus interruptus* are trapped in the Santa Barbara Channel. Both crab and lobster traps are placed in shallow water (less than 55 m [180 feet]) along the mainland and at the Channel Islands. Some of the most productive crab and lobster grounds are located in the vicinities of Pitas Point and Gaviota (CSA, 1985). Table 1.8-1 summarizes fishing methods utilized, species taken, and regulated seasons for commercial fisheries in the Santa Barbara Channel.

- Kelp Harvest. Giant kelp (*Macrocystis pyrifera*) has been harvested commercially in California since 1911. Alginates extracted from giant kelp are constituents in a variety of products, namely: as a substitute for agar; as an additive to prevent or retard boiler scale formation; binder for printers ink; a dye vehicle for cloth printing; as stabilizers for cosmetics, dairy products, dentifrices, jams, and paints. Three companies currently lease kelp beds in the Santa Barbara Channel. Although kelp beds are present within the lease areas under study, they are not exploited commercially.

- Mariculture. Fifteen mariculture operations are active in the SBC. The majority of these operations are clustered within the Goleta Point and Santa Barbara Point regions. Other operations extend as far west as Cojo Bay and south to Port Hueneme. The sole mariculture operator in the Summerland/Carpinteria Region is Ecomar, Inc. Under an arrangement with various operators, Ecomar is contracted to maintain the platform's underwater surfaces at a low level of fouling. Under this program, which is an open-ended contract with no cost to the operator, Ecomar harvests between $25,000 and $75,000 worth of bay mussels (*Mytilus edulis*) biannually, per platform (Meek, personal communication, February 1993). The harvest amount varies according to mussel growth patterns and market conditions at the time of harvest.

- Recreational Fishing. Pier, jetty, and shoreline fishing are limited to the mainland coast within the Santa Barbara Channel because access to the Channel Islands is somewhat restricted. Shoreline fishing occurs wherever public access is available, particularly at Summerland Beach, Santa Claus Lane Beach, and Carpinteria State Beach. Recreational fishing from private craft occurs along the coastline as well as around the Channel Islands; fishing activity is generally concentrated in or adjacent to kelp beds. Skin and scuba divers enter the water from shore, private craft, and party boats. Most sport diving occurs in kelp beds or rocky reef areas (CSA, 1985).

Table 1.8.1-1. Commercial Fisheries in the Santa Barbara Channel[1] (SBC)

Fishing Method	Species	Regulated Seasons
Purse Seine	Squid Mackerel Anchovy	Year round Year round Year round
Set Gill Net	Halibut Angel Shark Bonito Shark Rockfish White Croaker Bonito White Seabass	Year round Year round Year round Year round Year round Year round 6/16 - 3/14
Drift Gill Net	Swordfish Thresher Shark	5/1 - 1/31, coastwide. Within 75 miles of coast, closed from 5/1 - 5/14, within 25 miles of coast, closed 12/15 - 1/31.
Trap	Crab Hagfish Spot Prawn Lobster	Year round Year round Year round 1st Wed. in Oct. - 1st Wed. after 3/15.
Dive	Urchin Abalone	Year round, except for weekly and daily restrictions 5/1 - 9/30. 2/1 - 7/31, 9/1 - 12/31.
Trawl	Halibut Shrimp Prawn Sole Sea Cucumber Shark Rockfish Sablefish Thornyhead	CA halibut trawl grounds: 1/16 - 3/15. 4/1 - 9/30. Ridgebacks: 10/1 - 5/30; Spots: 2/1 - 10/31. Year round Year round Year round Year round Year round Year round
Troll	Salmon Albacore	Generally 4/15 - 9/30 Year round
Hook & Line	Rockfish	Year round
Harpoon	Swordfish	Year round

[1] Gill nets, trap, dive, and trawl are also subject to area restrictions, depending on gear design and species.

Sources: CDFG, 1991 b; SCB, 1988; MBC Applied Environmental Sciences, 1987; Richards, 1991; Fusaro, 1991; Wagner, 1991.

Commercial passenger fishing vessels (party boats) represent a valuable component of the tourism industry of the Santa Barbara Channel communities. Party boat fishing is available from Goleta (1 vessel), Santa Barbara Harbor (5 vessels), Ventura Marina and Channel Island Harbor (7 vessels), Port Hueneme (4 vessels), and Oxnard (14 to 16 vessels). Operators of these crafts and their passengers fish coastal areas from Point Mugu to Point Arguello and around the Channel Islands. Most fishing is conducted within 3 to 5 km (1.6 to 2.7 nm) of shore along the coast, except in the Santa Barbara to Carpinteria area where fishing extends 6.5 to 8 km (3.5 to 4.3 nm) offshore to include several subsea structures and Fourmile Reef (CSA, 1984).

Carpinteria Reef is believed by recreational fishermen to be an extremely sensitive area due to its importance as a spawning ground for California halibut, calico bass, sand bass, and other species. The reef also provides habitat for rare resident populations of white seabass and barracuda. Party boats from the port of Santa Barbara rely on Carpinteria Reef as one of six principal inshore fishing sites. Platforms are also regular stops as part of the normal party boat circuit.

As discussed in Biology, above, 20 to 50 times more fish are located beneath the platforms compared to adjacent soft bottom areas and 5 times as many fish as natural reefs. For this reason, waters surrounding the platforms serve as excellent recreational fishing areas (Simpson, 1977).

Regional Onshore Setting

There are no significant onshore natural resources located in the vicinity of the project area. See Land Use discussion.

Platform-Specific Setting

1. Commercial Fishing

The area seaward from Carpinteria Reef and shoreward from Hope and Heidi is fished by gillnetters and crab and lobster trappers. Approximately 15 to 20 commercial vessels regularly fish the area. It should be noted that no trawling is conducted in the vicinity of any of the platforms. Carpinteria Reef is believed by both commercial and sport fishermen to be a principal habitat and spawning area for several marine species (CSA, 1985).

Lobster trapping occurs shoreward of platforms Hazel and Hilda due to the proximity of some rocky substrate (Blunt, 1980). Gill nets are set, primarily for halibut and white seabass, with occasional rounds/hauls set off shore for mackerel and bonito (Chambers, 1992).

- Mariculture. In addition to mussel harvests, Ecomar has in recent years developed a viable oyster culture industry off of platform Hazel. Cages and nets are suspended from the vertical structure below where the mussels grow, at depths between 30 and 60 feet (9 to 18 m). Oysters are "planted" from these objects and are harvested every 24 months. Revenues from the oyster culture are greater than 50,000 dollars biannually (Meek, personal communication, February 1993). Over the past 10 years approximately 30 percent of Ecomar's revenues have been generated between the four platforms under study (Meek, personal communication, February 1993). Ecomar's contract for mussel/oyster "farming" on the project platforms expired in 1993.

2. Recreational Fishing

Please refer to Biological resources for a discussion of fish taken by recreational fishing operations at the platforms under study.

Platform - Specific Onshore Setting

1. Onshore Recreational Fishing

The discussion for regional onshore recreational fishing located above can be applied to the platform-specific recreational fishing conditions.

Offshore Impacts

Short-Term (Removal/Abandonment Operations)

1. **Jacket Removal**

- Commercial Fishing. Impacts to commercial fishing from the removal of the project platforms are anticipated to be less than significant. During platform removal operations increased vessel traffic within the platform regions will occur.

However, all vessels will operate within existing traffic corridors, thereby minimizing impacts to fishing operations.

Moored vessels, such as derrick and materials barges will be located within platform vicinities during jacket removal operations. Anchor mooring spreads from these vessels are laterally suspended for a span of approximately 2,000 feet. A several thousand foot radius clear zone would be established around these areas during jacket removal operations to avoid interference. As all of the platforms are located inside of the 5 km (2.7 nm) commercial net dragging restricted zone, there would be no impacts to most commercial net dragging operations. However, drag net trawling for halibut is allowed within the 1.6 km (0.9 nm) contour. The areas surrounding the platforms are avoided for this type of fishing. Restriction from their vicinity during jacket removal operations, therefore, would have no impact to drag net trawling operations.

Set gill nets, also allowed to within 1.6 km (0.9 nm), are used for halibut, angel shark, bonito shark, rockfish, and other demersal fish species. As with drag net trawler, set gill net fishing would be restricted from this zone for the duration of the jacket removal operations. Due to the relatively small percentage of the overall fishery occupied by the abandonment operations, impacts to stationary gill net fishing operations are projected to be less than significant.

Salmon trolling, also conducted within 1.6 km (0.9 nm) of shore between Carpinteria and Ventura would be restricted from the nearshore area near the easternmost platforms, Hope and Heidi. As the regions surrounding the platforms are off limits during normal operations, their restriction during the jacket removal operations would be less than significant.

Other types of fishing operations, such as urchin diving, and crab and lobster trapping would not be impacted from platform jacket removal as the platform areas are not locales ordinarily utilized for these fisheries.

- Recreational Fishing. The presence of abandonment vessels will preclude the use of the waters surrounding the platforms by recreational fishing vessels for the duration of the removal operations. Recreational fishing opportunities will continue, without constraint, following the completion of the project.

2. Offshore Pipeline and Power Cable Abandonment

- Commercial and Recreational Fishing. There will be no impacts to commercial and recreational fishing from offshore pipeline and power cable abandonment operations.

Long Term

1. Jacket Removal

- Commercial Fishing. By allowing access to previously inaccessible areas, the removal of the platform structures is anticipated to have a beneficial impact on the local commercial fishing industry. Once the platforms are removed, it is foreseeable that fishing methods currently practiced in the nearby, nearshore region will expand into the former platform locations. Drag net trawling for halibut, stationery gill netting, and trolling will likely be utilized in the waters formerly occupied by the platforms. Trapping operations will also likely expand into these waters.

- Mariculture. The removal of the four project platforms would have a direc' impact on the revenues generated from bay mussel and oyster harvests. Ecomar, the sole harvester of Hope, Heidi, Hazel, and Hilda, grosses approximately $50,000 biannually in oyster revenues, and between $25,000 to $75,000 biannually in bay mussel revenues. Income generated from the project platforms has accounted for approximately 30 percent of Ecomar's historic revenues.

  While the removal of the platforms will diminish the amount of substrate available for mussel harvest, other options exist for oyster cultivation. Oyster-growing hardware attached to Hazel over a 7-year period will be retrieved and a portion of it reused at an alternate location (Meek, personal communication, 1993). Ecomar currently leases a one acre tract near Santa Barbara that will eventually replace the apparatus currently used on Hazel. The subsurface structure will consist of a series of subsurface buoys. Some substrate suitable as mussel habitat will also be included.

- Recreational Fishing. Removal of the project platforms would result in a reduction of the artificial structures around which recreational fishing occurs.

However, these platforms and their subsea artificial reefs represent only a small portion of the habitat available to recreationally sought-after fish. The eastern Santa Barbara Channel is home to numerous other platforms located in a variety of water depths and distances from shore. Further, there are numerous other natural reefs, canyons, ridges, and other subsea land forms that provide suitable habitat for fish. These are all currently utilized by the sport fishing industry. Due to the variety of options available and the belief that the platforms may serve as only fish attractors versus true fish breeding ground habitat, the removal of the project platforms is anticipated to have a less than significant impact on the offshore recreational fishing industry.

2. Offshore Pipeline and Power Cable Abandonment

- Commercial Fishing. Abandonment operations for the offshore portions of the pipelines and power cables would occur within the immediate vicinities of the platforms. No additional mooring spreads or vessel traffic would result from this component. Therefore, impacts to commercial fishing are anticipated to be the same as those described for platform jacket removal.

- Recreational Fishing. Abandonment operations for the offshore portions of the pipelines and power cables would occur within the immediate vicinities of the platforms. No additional mooring spreads or vessel traffic would result from this component. Therefore, impacts to recreational fishing are anticipated to be the same as those described for platform jacket removal.

Onshore Impacts

Short-Term and Long-Term Nearshore Pipeline Abandonment

As the nearshore pipeline will be abandoned in place, there will be no abandonment activities conducted within the nearshore area. Pipeline pigging and flushing operations will be conducted from the platforms. Pipeline grouting will be conducted from the valve box on the cliff. Therefore, as no work will be conducted in the nearshore area, there will not be any impacts to commercial or recreational fishing or to any other natural resources that may occur in the area.

1. Increase in Use

By its nature, the proposed platform removal/pipeline abandonment program would not entail an increase in the rate of use of any natural resources, nor would it result in a substantial depletion of any nonrenewable resources.

2. Depletion of any Nonrenewable Resources

See #1. above.

J. Risk of Upset

The following section contains a brief overview of procedures that will be undertaken to avoid upset conditions during platform removal and pipeline abandonment operations. A list of "Critical Operations" and corresponding "Curtailment Measures" are provided in Section 3.0 Critical Operations and Curtailment Plan, and Section 4.0 Oil Spill Contingency, for detailed procedures that will be followed in the event of an emergency situation.

Offshore Setting

The platforms in their existing condition are dormant structures. All wells will be permanently plugged and abandoned prior to platform removal. The platforms also contain storage vessels which previously contained hydrocarbons. These vessels have been emptied and cleaned; however, residual hydrocarbons may still be present in small quantities. Thus, while the risk of an explosion or any other upset conditions is extremely low, the remote potential exists for the release of hazardous substances into the air and/or water column.

Onshore Setting

Pipelines used to transport oil and gas from the platforms are still in place. Landfall for these pipelines are within the immediate vicinity of the Casitas Pier. Residual hydrocarbons are likely to be present within these pipelines to be abandoned.

1.& 2. Offshore and Onshore Impacts

During the course of the proposed platform removal and pipeline abandonment, handling of residual hydrocarbons as well as diesel fuel will occur. Seawater used for the pipeline flushing will be collected and processed through the existing oil/water separators at the Carpinteria facility. The water will then be discharged in accordance with the plant's existing NPDES Permit requirements.

All containment vessels and pipes that have remained operational will be cleaned out as a part of the topside removal phase. Fluids collected during the cleaning operations will be drained into appropriate containers on a work boat and transported to shore for appropriate processing and disposal. In the event of a fire, explosion, hydrocarbon leakage or other hazardous condition, a series of curtailment measures outlined in Chevron's existing Oil Spill Response Plan will be followed. As a result of the procedures listed above, the risk of upset from the proposed platform removal/pipeline abandonment project is anticipated to be less than significant.

K. Population

Offshore and Onshore Setting

The removal of the platforms will not have any impacts on the distribution, density, or growth rate of the population of the area.

Offshore and Onshore Impacts

1. By its short-term nature, the proposal will not result in the alteration, distribution, density, or growth rate of the human population of the area. Any additional hiring that may be required during the course of the project is anticipated to be able to be accommodated by the local industry work force. Therefore, population issues are anticipated to be less than significant.

L. Housing

Offshore and Onshore Setting

The removal of the platforms will not have any impacts on the housing supply of the local or regional area.

Offshore and Onshore Impacts

1. By its short-term nature, the proposal will not result in any additional permanent residents that would create a demand for the construction of new housing. The existing rental housing market in Carpinteria would sufficiently accommodate any temporary workers hired for the proposed project. Impacts to housing, therefore, would be short-term and less than significant.

M. Transportation/Circulation

Offshore Setting

Crew Boat Routes

Offshore transportation presently consists of crew boat trips to and from the platforms. Chevron uses one contracted crew boat, the *Price Tide*, to ferry workers to and from all four platforms. Four other boats run by different operators regularly use the Casitas Pier facility. Including the *Price Tide*, crew boats make between four and 10 runs each for a total of approximately 38 runs per day. The *Price Tide* generally makes 10 runs per day. Chevron has two other contracted boats, the *Wendy Tide* and the *Murdock Tide* that make approximately one run from the Casitas Pier each per week.

Vessel Corridors

Crew boats are assigned designated routes to and from the platform, as shown on Figure 1.12.1-1. These routes have been designed to aid in the prevention of collisions at the approaches to landing facilities and between the platforms and to avoid interference with commercial fishing operations.

Shipping Lanes

All transport of goods within the Santa Barbara Channel is done within designated north and south shipping lanes. The shipping lanes are located in the channel, approximately 13 nm from the Casitas Pier facility. Each shipping lane is 1 nm wide separated by a 2 nm separation zone.

Onshore Setting

Regional Setting

U.S. 101 provides the major north-south link to the Casitas facility within Santa Barbara County. For much of its length through this region U.S. 101 is a four-lane, limited access freeway. However, stretches of five and six lane road with at-grade access exist along its length. A portion of the southbound direction through Carpinteria widens to three lanes, between Bailard Avenue and the Ventura County line.

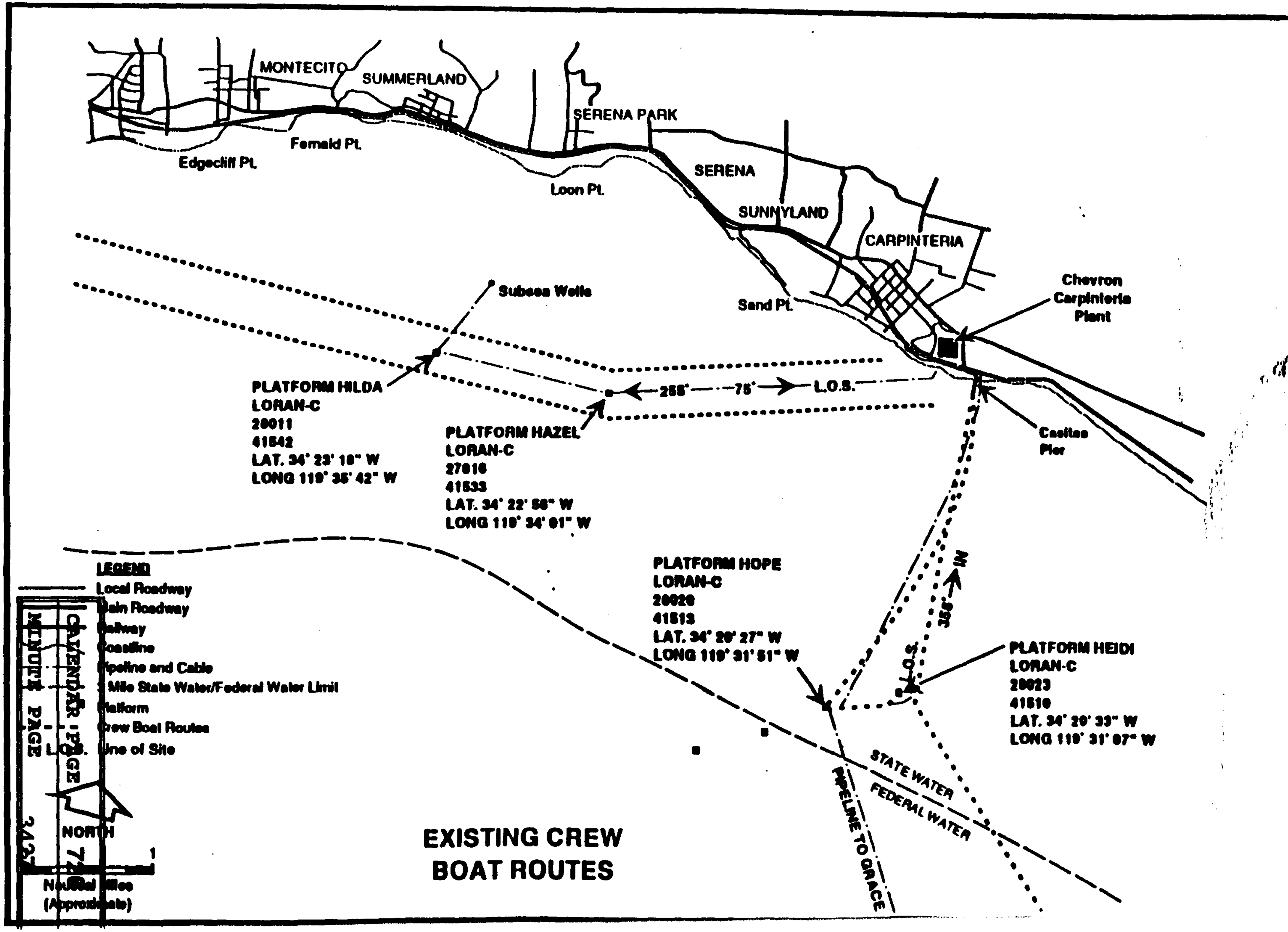


FIGURE 1.12.1-1

MINUTE PAGE 3437

CALENDAR PAGE 72

Local Roads and Existing Traffic Levels

The Casitas Pier facility entrance is located on east-west trending Carpinteria Avenue in eastern Carpinteria. Access from U.S. 101 is reached from the Casitas Pass exit to the north and by the Bailard Avenue exit to the south. Traffic levels at the key intersections of Carpinteria Avenue at Casitas Pass and Bailard Road are presently Level of Service (LOS) C and A, respectively. The intersection of Casitas Pass Road and U.S. 101 is LOS C for the southbound ramp and B for the northbound ramp. The Bailard Avenue intersection at U.S. 101 is at LOS A-B for the northbound and southbound ramps (ATE Analysis for Circulation Element 1989 Update EIR).

Existing Vehicle Trips at the Casitas Facility

Approximately 115 to 125 employees per day use the Casitas Pier facility. Of these, approximately 10 presently work on the project platforms. Assuming a vehicle ridership of 1.2 persons per vehicle, the Casitas facility probably generates approximately 104 trips per day (a trip is "a single or one-directional vehicle movement with either the origin or destination [exiting or entering] inside a study site") (ITE, 1989). Chevron employees designated specifically to the project platforms probably account for between 15 and 17 trips per day.

Parking Provided at Facility

Parking for the Casitas Pier facility is provided in the form of a combination of a paved parking area and a dirt parking lot with a capacity for 160 cars, located on the bluff adjacent to the pier.

Assumptions and General Approach to Impact Analysis

Preparation of this overview has required certain assumptions to be made relative to worker numbers, number of trips, shift times, commuting patterns, and impact importance. For the onshore portion, potential impacts have been analyzed in terms of changes in Level of Service (LOS) at key intersections of concern. The LOS is estimated in terms of the ratio of the volume of traffic across the intersection of interest to its corresponding capacity.

During the course of the platform removal and pipeline abandonment project approximately 69 additional personnel will be required. During the offshore portions of the project, most of these workers will be stationed offshore on 12-hour work shifts, 7 days per week. The majority of workers will not sleep offshore. Rather, they will be rotated to and from shore upon completion of their shifts. In order to reduce the total project length, operations will occur 24 hours per day.

1. Vehicular Movement

Offshore Impacts

The majority of sea vessels, such as the derrick barges, materials barges, and tug boats, will be moored at the platforms for the duration of the project. The crew boat and utility/supply boats will typically be making trips between platforms and to and from the Casitas Pier on a continuous basis. It is difficult to estimate how many trips per day the crew boats will make, but they will likely double over the existing amount for the 3- to 4-month duration of the offshore portion of the project. Total time for removal per platform is estimated at 30 days. Most phases of work will occur concurrently on two platforms at a time (Hope and Heidi, Hazel and Hilda). Therefore, total elapsed time for removal of the four platforms will probably be around 120-130 days.

Portions of the dismantled platforms will be ferried to the salvage yard in Long Beach on two materials barges. After the topside of a platform is dismantled and placed on one of the materials barges, that materials barge will begin the 1.5-day journey to Long Beach for offloading. During this period, the platform jacket of the same rig will be placed onto the second materials barge. As the second materials barge heads to Long Beach with the jacket, the first materials barge will be on its way back to the project area. An additional derrick barge may be needed for offloading upon arrival of the loaded materials barges in Long Beach. Upon return of the materials barge, it will re-moor and prepare to accept another platform topside. This process of staggering the loads of the materials barges will be carried out for the duration of the removal operations.

Project-generated offshore vessel traffic is anticipated to have less than significant impacts to Santa Barbara Channel circulation because all crew boat and utility/supply boat transportation will be conducted within the designated crew boat routes. Derrick and materials barges will be utilizing the shipping lanes located in the Channel when travelling to and from the project area. Adherence to these guidelines will ensure that congestion is minimized throughout the duration of project operations. In addition, a notice describing the project's boundaries and potential hazards to navigation will be sent to the U.S. Coast Guard for publication in the Local Notice to Mariners (see Appendix E). These procedures will ensure that offshore transportation and navigational impacts remain at less than significant levels.

Onshore Impacts

As traffic levels along Carpinteria Avenue near the Casitas Pier facility entrance are low, project-generated traffic is not anticipated to create or add to any congestion impacts. Project vehicular commuting traffic and truck traffic are expected to peak at different times and to have only slight direct interaction. Worker commuter traffic is projected to be highly structured, controlled by the scheduling and duration of work shifts. Due to the long hours of the shifts scheduled for the project, work crew commuter traffic will occur before the AM peak and after the PM peak traffic hours. Other project-generated vehicles such as trucks and equipment operators will enter and exit the Casitas Pier facility at random times. Overall onshore traffic impacts are projected to be less than significant due to the short duration of the project, the random time periods of entrance and exit of most vehicle trips, and the low traffic levels existing within the Carpinteria area.

2. Parking

All parking for project operations will be accommodated within the existing Casitas Facility parking areas. Therefore, project-generated parking impacts will be less than significant.

3. Transportation System

See Offshore and Onshore Impacts above.

4. Circulation

See Offshore and Onshore Impacts above.

5. Traffic

See Offshore and Onshore Impacts above.

6. Traffic Hazards

See Offshore and Onshore Impacts above.

N. Public Services

Offshore and Onshore Setting

In the event of an unforeseen accident, services by public agencies are available from the U.S. Coast Guard, the U.S. Environmental Protection Agency, and the California Office of Emergency Services. The role of each of these entities in the event of an emergency are presented in the Emergency Response Plan. Response capabilities from these agencies would be adequate to address any type of emergency condition that could potentially occur. Aside from the potential, limited use of these agencies, the abandoned platforms will not affect any other public services.

Offshore and Onshore Impacts

In the event of an oil spill during the project, the proposed project may affect the availability of local emergency response vehicles/vessels provided by the U.S. Coast Guard (offshore), the U.S. Environmental Protection Agency (onshore), and the California Office of Emergency Services (offshore/onshore). The magnitude of residual oil that may leak from a break in any portions of the offshore or onshore pipelines is anticipated to be extremely small. These agencies would only be required to oversee Chevron's response to contain and dispose of any leakage that may occur. Aside from the potential, limited use of these agencies, the project will not affect any other public services.

1. Fire Protection

   See "Impacts" paragraph above.

2. Police Protection

   See "Impacts" paragraph above.

3. Schools

   See "Impacts" paragraph above.

4. Parks and Recreation Facilities

   See "Impacts" paragraph above.

5. Maintenance of Public Facilities

   See "Impacts" paragraph above.

6. Government Services

   See "Impacts" paragraph above.

O. Energy

Offshore and Onshore Setting

No significant energy consuming uses are in operation on the platforms and power comes from the existing electrical grid.

Offshore and Onshore Impacts

1. Fuel and Energy Sources

   This oil production platform and pipeline removal/abandonment project is not a long-term energy consuming use. The proposal would not result in a substantial increase in demand upon existing sources of energy or require the development of new sources.

2. Existing Energy Sources

   See #1 above.

P. Utilities

Offshore and Onshore Setting

Existing electricity consumption is not available for each platform. However, the total consumption for Hazel/Hilda and Hope/Heidi are shown below.

Hazel/Hilda	kWh/day
Current Consumption	1,879
Consumption prior to shut-in of Hilda wells (8/92)	2,176
Consumption prior to shut-in of Hazel wells (9/91)	10,382
Hope/Heidi	**kWh/day**
Current Consumption	2,310
Consumption Prior to shut-in of wells	46,182

Offshore and Onshore Impacts

1. Power or Natural Gas

The completion of the project will result in a decrease in utility consumption from current and operational levels. Electricity supply will be severed and consumption will be reduced to zero.

During the platform abandonment project, trash or debris generated offshore will be confined to work vessels in metal trash containers and properly disposed of when the vessels return to port. Trash or debris generated onshore by subcontractors would be properly disposed of offsite by Chevron crews.

Q. Human Health

Offshore and Onshore Setting

The abandoned platforms do not pose a threat to human health. All wells will have been permanently plugged and abandoned prior to the start of the project, thereby reducing the risk of a blowout and/or a hydrogen sulfide leak to nearly zero. All emergency warning systems and lighting are still in place. Exposure of people to platform-related hazards is minimal.

Offshore and Onshore Impacts

1. Health Hazard

   In the event that an oil or diesel leak occurs during project operations, oil spill response equipment will be deployed for immediate cleanup. Potential spill amounts are not anticipated to be great (less than 10 barrels) and would not pose a serious health risk to humans. Measures contained in Chevron's Oil Spill Contingency Plan would mitigate impacts that could result in health impacts from offshore activities. With this mitigation incorporated into the project, it is anticipated that potential health hazards created from offshore activities will be less than significant.

   Since onshore facilities will be abandoned in place, no health hazards will result from the onshore portion of the project.

2. Exposure of People to Health Hazards

   See above.

R. Aesthetics

Offshore and Onshore Setting

The platforms represent man-made obstructions within an otherwise unimpeded view of the Santa Barbara Channel and Channel Islands. While the four platforms in question represent only a portion of the oil platforms located in the Santa Barbara Channel adjacent the Santa Barbara/Summerland/Carpinteria region, they are the closest and most prominent.

Offshore and Onshore Impacts

Removal of the project platforms would result in beneficial aesthetic impacts from all view corridors in which the platforms are currently visible. As Heidi, Hope, Hazel and Hilda are the closest platforms to the Carpinteria and Summerland coastlines, the positive change in the visual character of the local waters will be dramatic.

S. Recreation

Offshore and Onshore Setting

A wide range of active and passive ocean-oriented recreational activities are available in southern Santa Barbara County. Popular beach and ocean activities include swimming, surfing, sunbathing, fishing, camping, biking, ocean viewing, diving, and boating. Section I, Natural Resources, contains a complete discussion of onshore and offshore recreational fishing locations, species taken, and relative abundance.

Principal parks and beaches along the coastline from west to east include Lookout Park, Santa Claus Lane Beach, and Carpinteria City and State Beaches. Present use levels at Santa Barbara County beach areas reflect weekend and holiday use at virtually 100 percent of capacity during the months of April through October (SLC, 1987).

Offshore Impacts

1. Aside from the impacts to the recreational fishing industry, which is discussed earlier in this chapter, Section I, Natural Resources, removal of the project platforms would not have any impact on the quality or quantity of offshore recreational opportunities provided in the region.

Onshore Impacts

As the nearshore segment of the pipelines and power cables will be abandoned in place, there will be no impacts to onshore recreational resources.

T. Cultural Resources

Offshore and Onshore Setting

1. Archaeological Sites

Cultural resources data interpretation for the lease area containing Hope and Heidi (PRC 3150) was performed by McFarlane (1983a). Data quality was judged to be adequate for detecting obvious archaeological resources within the project area.

This area of the Carpinteria offshore shelf is part of a shallow Pleistocene drainage system now filled and covered with a relatively thin veneer of marine sediments over a transgressed erosion surface. Survival of any pretransgressive terriginous soil under marine sediment is unknown.

Hudson (1976) reports a shallow water occurrence of prehistoric artifacts he designates as site "marine-7," located near Carpinteria. This location is only reported; no further scientific surveys or investigations have been conducted.

A beach resort known as Cerca Del Mar, located directly onshore in property presently within the Carpinteria State Beach, featured a pier erected in 1935. This structure, while apparently never finished due to the death of its developer, was popular and heavily used through at least the 1960s (Rouse, 1978). The year of abandonment is unknown. Occasional heavy storm surf exposes rows of piling stubs at this location (Deland, 1985, personal communication, Carpinteria Museum in CSA, 1985).

The project area lies 14.6 km (9 mi) east of the historic Santa Barbara Mission Landing and 26 km (16 mi) northwest of the San Buenaventura Landing. The exact location of the first landing used by local ranches within the Carpinteria Valley vicinity is unclear in the literature. However, a wharf was established just inside the western boundary of the lease tract at La Serena in 1874. This may have previously been a beach landing as well. Called variously Smith's Wharf and Carpinteria Wharf, its date of abandonment is unknown (Rouse, 1980). In 1965, Chevron placed the existing service pier at Casitas Creek.

McFarlane (1983a) reports five watercraft being lost within or near the project area. Four of these are modern smallcraft and are not of cultural significance. A literature search of the Carpinteria Museum of History archives did not provide any additional information as to the location of the remaining shipwreck. While this wreck and others may exist in the project area, there apparently have not been any major beach wrecks along the tract's shoreline during this century (Candaele, 1985, personal communication, Carpinteria Museum of History).

McFarlane (1983a) lists nine data events of unknown cause as occurring on geophysical survey records. Five are unidentified sonar targets, three are low-gama magnetic anomalies and one event, observed on both systems, is indicated as a "possible boat." None are within 300 m (1,000 ft) of any of the platforms.

Offshore and Onshore Impacts

Removal of the proposed platforms and pipelines is not anticipated to interfere with any of the cultural resources identified above. However, if any vestiges of archaeological remains are encountered during any component of the proposed project, all work will cease until a licensed archaeologist has been consulted.

2. Historic Buildings

   See above.

3. Ethnic Cultural Values

   See above.

4. Religious/Sacred Uses

   See above.

U. Mandatory Findings of Significance

1. Environmental Quality Degradation

There will be a short-term disruption of the marine environment in the immediate platform areas and in barge mooring anchor locations. Upon removal of the platforms, it is anticipated that the natural ocean currents driving littoral sediments will restore the disturbed area back to its natural state. Upon completion of the project, the indigenous marine biota will recolonize and fill any voids created during the platform removal/ pipeline abandonment operations.

2. Short-term vs. Long-term Environmental Goals

The physical removal of the platforms will result in temporary minor impacts to marine biota; however, as the proposed project will remove man-made structures and restore the marine environment to its natural state, it will not create an long-term detrimental effects on the environment.

3. Cumulative Impacts

This platform removal/pipeline abandonment project will result in a decrease of mar caused cumulative impacts by restoring the marine environment to its natural state. This project will create temporary, minor impacts over a period of 120 - 130 days.

4. Adverse effects on Human Beings

This project consists of the removal of four offshore oil platforms. There could be some potential minor impacts to human beings as a result of any oil or diesel spill. Responses are addressed in the Critical Operations and Curtailment Plan and Chevron's existing Oil Spill Contingency Plan. Such potential will cease upon completion of the project.

6.0 REFERENCES, LIST OF PREPARERS, AND PERSONS CONTACTED

6.1 REFERENCES

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6.2 LIST OF PREPARERS

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6.3 PERSONS CONTACTED

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6.4 AGENCY CONTACTS

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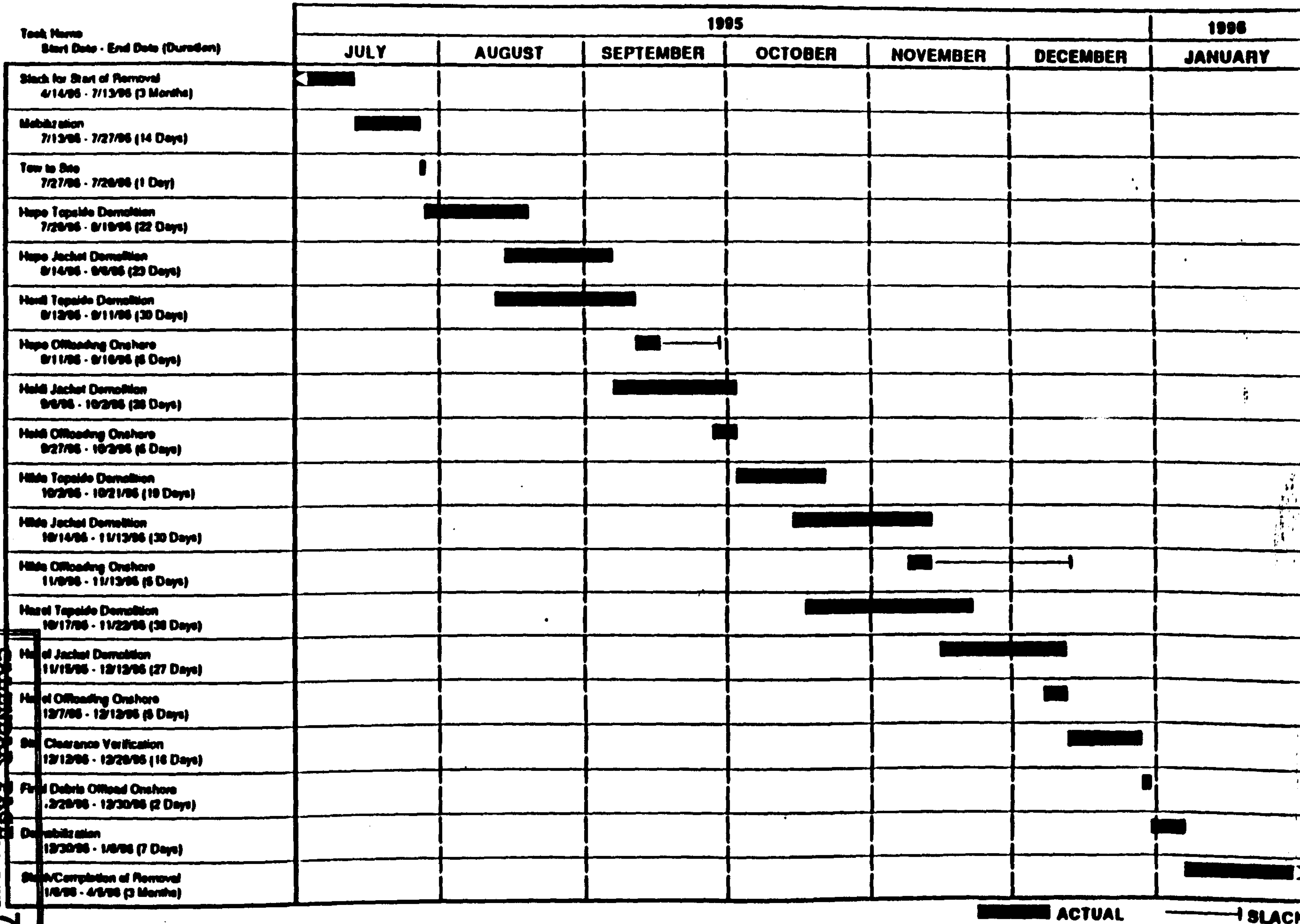
APPENDIX A
PROJECT SCHEDULE



CHEVRON STATE PL[illegible]ORM ABANDONMENTS

APPENDIX B
AIR QUALITY

TABLE 1 - AIR EMISSIONS CALCULATIONS
MOBILIZATION/DEMOBILIZATION

OPERATION	No.	Duration of Use (Days)	Operating Time (hrs/day)	Usage Factor (Percent)	Power Rating (HP)	Fuel Consumption (gal/hr)	Emission Estimates: NOx lbs/day	NOx Total tons	ROC lbs/day	ROC Total tons	PM-10 lbs/day	PM-10 Total tons
Mobilization of Removal Equipment /Demobilization (One operation for all platforms)												
Tug Boat	3	4	10	40	3500	39	171.756	0.344	28.080	0.056	19.876	0.040
Tug Boat	1	4	10	40	2000	32	41.754	0.084	7.680	0.015	5.436	0.011
Derrick Barge 50 ton	1	2	10	100		4	23.638	0.024	1.973	0.002	1.699	0.002
- Generator	1	2	10	10	1300	6	3.546	0.004	0.296	0.000	0.255	0.000
- Compressor	1	2	10	20	200	6	7.091	0.007	0.592	0.001	0.510	0.001
Crew Boat	1	2			800							
(idle)			7			4	3.010	0.003	6.975	0.007	1.189	0.001
(cruise)			3			40	20.084	0.020	2.052	0.002	5.096	0.005
Derrick Barge 500 ton	1	7	10	100		4	23.638	0.083	1.973	0.007	1.699	0.006
- Generator	1	7	10	10	1300	12	7.091	0.025	0.592	0.002	0.510	0.002
- Compressor	1	7	10	20	200	6	7.091	0.026	0.592	0.002	0.510	0.002
Utility Vessel	1	2			1800							
(idle)			7			5	14.686	0.015	0.791	0.001	1.486	0.001
(cruise)			3			50	58.755	0.059	2.520	0.003	6.371	0.006
						TOTAL		0.690		0.098		0.077

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TABLE 2 - AIR EMISSIONS CALCULATIONS
EMISSIONS PER PLATFORM

OPERATION	No.	Duration of Use (Days)	Operating Time (hrs/day)	Usage Factor (Percent)	Power Rating (HP)	Fuel Consumption (gal/hr)	Emission Estimates NOx lbs/day	NOx Total tons	ROC lbs/day	ROC Total tons	PM-10 lbs/day	PM-10 Total tons
Pre-Abandonment												
Survey Vessel	1	2			1200							
(idle)			20			20	148.520	0.149	18.080	0.018	33.976	0.034
(cruise)			4			50	124.620	0.125	3.360	0.003	8.494	0.008
Topside Removal												
Tug Boat	2	21	24	25	3500	39	171.766	1.803	28.080	0.295	19.876	0.209
Tug Boat	1	10	24	25	3500	39	85.878	0.429	14.040	0.070	9.938	0.050
Tug Boat	1	14	24	25	2000	32	62.630	0.438	11.520	0.081	8.154	0.057
Crew Boat	1	21			800							
(idle)			20	•		4	8.600	0.090	19.928	0.209	3.398	0.036
(cruise)			4	•		40	26.752	0.281	2.736	0.029	6.795	0.071
Utility Vessel	1	21			1800							
(idle)			20	•		5	41.960	0.441	2.260	0.024	4.247	0.045
(cruise)			4	•		50	78.340	0.823	3.360	0.035	8.494	0.089
Welding Machine	2	21	24	60	80	12	204.229	2.144	17.045	0.179	14.678	0.154
Derrick Barge 50 ton	1	14	24	100	•	4	56.730	0.397	4.735	0.033	4.077	0.029
- Generator	1	14	24	10	1300	6	8.510	0.060	0.710	0.005	0.612	0.004
- Compressor	1	14	24	20	200	6	17.019	0.119	1.420	0.010	1.223	0.009
Derrick Barge 500 ton	1	10	24	100	•	4	56.730	0.284	4.735	0.024	4.077	0.020
- Generator	1	10	24	10	1300	12	17.019	0.085	1.420	0.007	1.223	0.006
- Compressor	1	10	24	20	200	6	17.019	0.085	1.420	0.007	1.223	0.006
Pile and Conductor Cutter												
Crew Boat	1	16			800							
(idle)			7	•		4	3.010	0.024	6.975	0.056	1.189	0.010
(cruise)			3	•		40	43.200	0.346	2.052	0.016	5.096	0.041
Mechanical Cutter	1	16	10	100	100	15	88.641	0.709	7.398	0.059	6.371	0.051
Jacket Removal												
Tug Boat	3	10	24	25	3500	39	257.634	1.288	42.120	0.211	29.814	0.149
Crew Boat	1	10			800							
(idle)			20	•		4	8.600	0.043	19.928	0.100	3.398	0.017
(cruise)			4	•		40	57.600	0.288	2.736	0.014	6.795	0.034
Dive Support Vessel	1	10			350							
(idle)			23	•		5	11.454	0.057	13.582	0.068	4.884	0.024
(cruise)			1	•		30	8.076	0.040	0.684	0.003	1.274	0.006
Utility Vessel	1	10			1800							
(idle)			20			5	41.960	0.210	2.260	0.011	4.247	0.021
(cruise)			4			50	78.340	0.392	3.360	0.017	8.494	0.042
Welding Machine	2	10	24	60	80	12	204.229	1.021	17.045	0.085	14.678	0.073
Derrick Barge 500 ton	1	10	24	100	•	4	56.730	0.284	4.735	0.024	4.077	0.020
- Generator	1	10	24	10	1300	12	17.019	0.085	1.420	0.007	1.223	0.006
- Compressor	1	10	24	20	200	6	17.019	0.085	1.420	0.007	1.223	0.006

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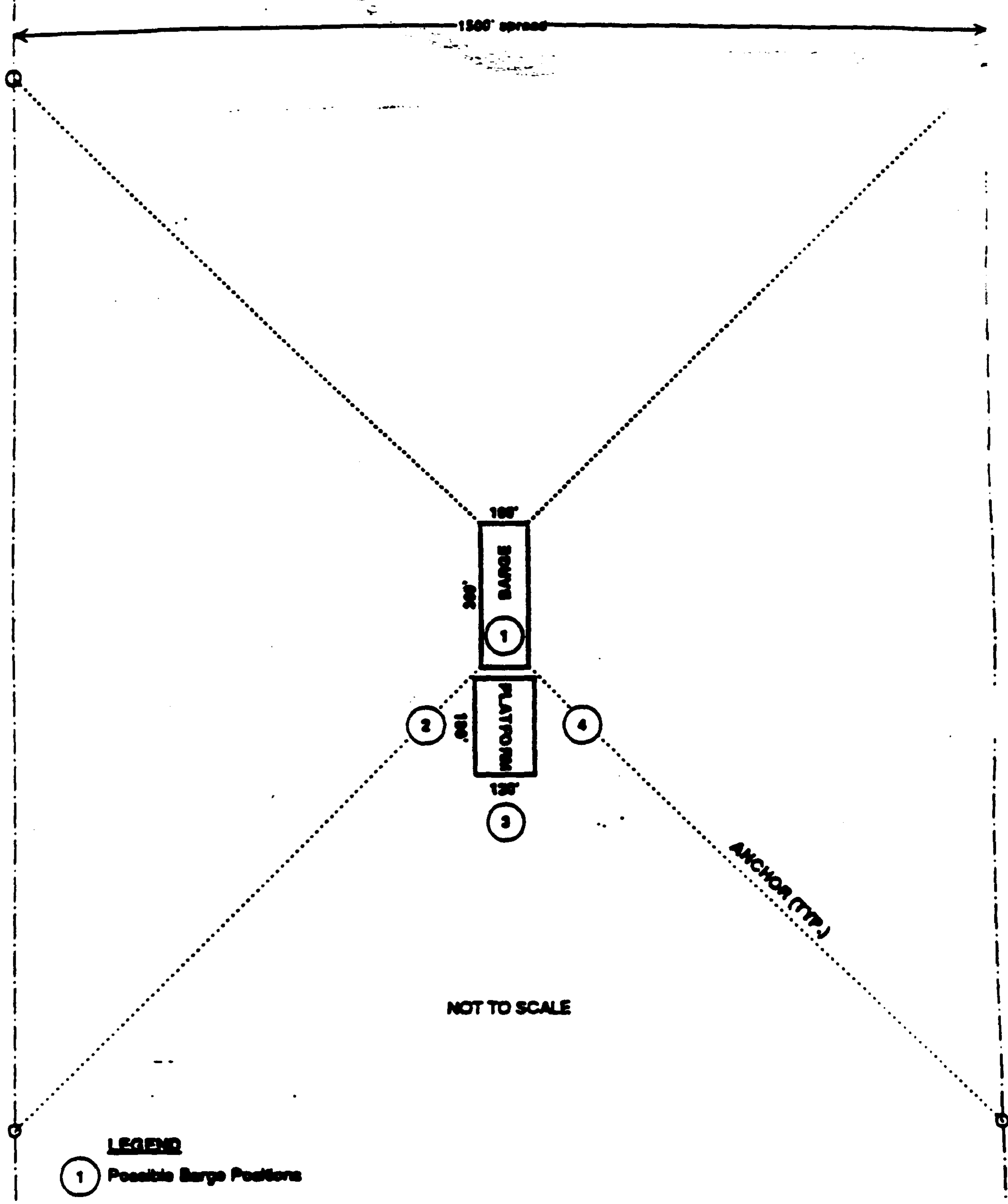
TABLE 2 - AIR EMISSIONS CALCULATIONS (Continued)
EMISSIONS PER PLATFORM

OPERATION	No.	Duration of Use (Days)	Operating Time (hrs/day)	Usage Factor (Percent)	Power Rating (HP)	Fuel Consumption (gal/hr)	Emission Estimates: NOx lbs/day	NOx Total tons	ROC lbs/day	ROC Total tons	PM-10 lbs/day	PM-10 Total tons
Transport to LB/LA												
Tug Boat	1	4	24	100	3500	39	343.512	0.687	56.160	0.112	39.752	0.080
Debris Removal												
Tug Boat	1	5	10	25	3500	39	35.783	0.089	5.850	0.015	4.141	0.010
Tug Boat	1	5	10	25	2000	32	26.096	0.065	4.800	0.012	3.398	0.008
Derrick Barge 50 ton	1	5	10	100		4						
- Generator	1	5	10	10	1300	6	3.546	0.009	0.296	0.001	0.255	0.001
- Compressor	1	5	10	20	200	6	7.091	0.018	0.592	0.001	0.510	0.001
Crew Boat	1	5			800							
(idle)			7			4	3.010	0.008	6.975	0.017	1.189	0.003
(cruise)			3			40	43.200	0.108	2.052	0.005	5.096	0.013
Site Clearance Verification												
Tug Boat	1	2	10	40	1000	25	37.130	0.037	6.000	0.006	4.247	0.004
Dive Support Vessel	1	2			350							
(idle)			7			5	3.486	0.003	4.134	0.004	1.486	0.001
(cruise)			3			30	24.228	0.024	2.052	0.002	3.822	0.004
Utility Vessel	2	2			1800							
(idle)			7			5	29.372	0.029	1.562	0.002	2.973	0.003
(cruise)			3			50	117.610	0.118	5.040	0.005	12.741	0.013
Crew Boat	1	2			800							
(idle)			7			4	3.010	0.003	6.975	0.007	1.189	0.001
(cruise)			3			40	43.200	0.043	2.052	0.002	5.096	0.005
Survey Vessel	1	2			1200							
(idle)			20			20	148.520	0.149	9.040	0.009	16.988	0.017
(cruise)			4			50	124.820	0.125	3.360	0.003	8.494	0.008
Pipeline Abandonment												
Tug Boat	1	2	10	40	2000	32	46.976	0.047	7.680	0.008	5.436	0.005
Crew Boat	1	2			800							
(idle)			7			4	3.010	0.003	6.975	0.007	1.189	0.001
(cruise)			3			40	43.200	0.043	2.052	0.002	5.096	0.005
						TOTAL		14.233		1.928		1.513
						TOTAL PER PLATFORM WITH MOB/DEMOB		14.923		2.025		1.590
						TOTAL FOR TWO PLATFORMS		29.156		3.953		3.103
						TOTAL FOR FOUR PLATFORMS		57.622		7.808		6.130

APPENDIX C
ANCHOR PLAN

The following anchor plan diagram is provided as an example of a typical barge mooring spread. In order to avoid damage to subsea pipelines, cable, and sensitive bottom habitat, the seafloor will be surveyed prior to anchor laying.



TYPICAL PLATFORM REMOVAL
BARGE MOORING SPREAD

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APPENDIX D
EMERGENCY CONTACT LIST

APPENDIX D
EMERGENCY CONTACT LIST

In the event of an emergency situation during abandonment operations, the following agencies will be notified.

Company Notifications	
Senior Land Representative Lee Bafalon (805) 658-4345	Operations Manager Gary Gray, Abandonment Team Leader (805) 658-4360 Greg Sinclair (805) 658-4394 Mike Jennings (805) 658-4458
Required Government Agency Notification	
U.S. Coast Guard National Command Center 2100 2nd Street Southwest, Room 2611 Washington, D.C. 20593 (800) 424-8802 Marine Safety Office 165 North Pico Avenue Long Beach, CA 90802-1096 (213) 499-5555	State of California Office of Emergency Services 2800 Meadowview Road Sacramento, CA 95832 (800) 852-7550 State Lands Commission District Office 200 Oceangate, 12th Floor Long Beach, CA 90802 (310) 590-5201
Government Agency Notification	
Federal U.S. Department of Transportation Information Resource Manager Office of Pipeline Safety Washington, D.C. 20590 Ed Ondak Western Regional Office Lakewood, CO (303) 236-3424 (24-hour) U.S. Department of Interior National Park Service Channel Islands National Park 1901 Spinnaker Drive Ventura, CA 93001	U.S. Army Corps of Engineers Ventura Regulatory Office 2151 Alessandro Drive, Suite 100 Ventura, CA 93001 (805) 641-1121 U.S. Fish and Wildlife Service Field Supervisor, Ecological Services Federal Building, 2400 Avila Road Laguna Niguel, CA 92677 Environmental Protection Agency Region IX 215 Fremont San Francisco, CA 94105

Government Agency Notification (Continued)	
<u>State</u> Division of Oil and Gas District Office 5075 South Bradley Road, Suite 221 Santa Maria, CA 93455 (805) 937-7246 Regional Water Quality Control Board Regional Office 107 South Broadway, Room 4027 Los Angeles, CA 90012 California Department of Parks and Recreation Channel Coast District 24 East Main Street Ventura, CA 93001 Office of State Fire Marshall Pipeline Safety Division (818) 337-9999 (916) 427-4500	California Coastal Commission 925 De la Vina Street Santa Barbara, CA 93101 (805) 963-6871 45 Freemont Street, Suite 2000 San Francisco, CA 94105 (415) 904-5200 Department of Fish and Game Oil Spill Prevention and Response (OSPR) 1700 K Street, Suite 250 Sacramento, CA 94244-2090 (916) 445-0045 (between 6 A.M. and 10 P.M.)
<u>Santa Barbara County</u> County of Santa Barbara Resource Management Department Energy Division 1226 Anacapa Street, Suite 2 Santa Barbara, CA 93101	

APPENDIX E

LOCAL NOTICE TO MARINERS

The notice describing the project's offshore boundaries and hazards to navigation will be sent to the U.S. Coast Guard for publication in the Local Notice to Mariners prior to the start of the proposed project.

APPENDIX F
MITIGATION MONITORING PLAN

EXHIBIT "C"
MITIGATION MONITORING PROGRAM
FOR THE OFFSHORE OIL PLATFORM ABANDONMENT AND REMOVAL
IN THE SANTA BARBARA CHANNEL - CHEVRON PROJECT

OFFSHORE MONITORING

1. Impact: The proposed project may create hazards to navigation caused by the temporary presence of marine equipment offshore.

Project Mitigation:

a) The mooring system of the derrick barge will be marked as orange rubber crown buoys. These markers will delineate the mooring spread.

b) All platforms are presently well lit. The lights will be moved to the legs once the platform decks have been removed.

c) Chevron will file a Local Notice to Mariners with the U.S. Coast Guard which will specify the project boundaries, hazards to navigators, and call signs.

d) All marine vessels utilized in the removal/abandonment operations will use designated vessel traffic corridors and shipping lanes to avoid collisions with other vessels. The crew boats transporting personnel will be using these traffic corridors.

Monitoring:

Staff of the State Lands Commission, while inspecting offshore operations, will periodically monitor the project to assure that the marked orange rubber crowned buoys are in place, the vessels are well lit and highly visible at night, and the Local Notice to Mariners has been filed. Additionally, staff will visually observe the local vessel traffic to assure that the project is in compliance.

2. Impact: This proposed project may result in unsafe working conditions if allowed to operate during rough inclement weather when unsafe sea states occur.

Project Mitigation:

a) The final determination for shutdown of operations will be made by the barge superintendent or vessel captain in conjunction with the removal contractor project manager.

b) The barge superintendent or vessel captain will resume operations when unsafe sea state subside.

Monitoring:

Staff of the State Lands Commission while conducting periodic project inspections, will monitor the project to assure that the shutdown procedures are initiated in the event of unsafe seas, as determined by the barge superintendent or vessel captain.

3. Impact: The proposed project may produce noises from equipment.

Project Mitigation:

a) All equipment will be muffled in compliance with local standards.

Monitoring:

Staff of the State Lands Commission will monitor both onshore and offshore operations and inspect equipment to assure engines are covered and mufflers are in good repair.

4. Impact: This project may produce trash or debris generated by removal crews.

Project Mitigation:

a) Trash and debris generated offshore will be confined to the platforms and moved to the barges in metal trash containers and properly disposed of when the vessel returns to port.

Monitoring:

Staff of the State Lands Commission will periodically visually monitor both onshore and offshore projects to assure that all trash, debris, food containers, etc., generated by the project and the abandonment crews are policed and properly disposed.

5. Impact: Debris may have accumulated on the ocean bottom during the operations of the platforms or from the dismantling operations.

Project Mitigation:

a) Verification of site clearance will be performed as part of the final debris recovery operation utilizing a side scan sonar survey.

b) Suspect targets or debris will be plotted for target verification survey which will be plotted for recovery.

c) Any debris located will be recovered by divers to complete the site clearance verification. Test trawls over the site of the abandoned platforms will be conducted in areas where trawling is legal.

Monitoring:

Staff of the State Lands Commission will periodically visually monitor the site clearance operations and will check the side-scan sonar records.

6. Impact: The oil and gas pipelines for Platform Grace could be damaged during the removal operations of Platform Hope.

Project Mitigation:

a) To prevent damage to the oil and gas pipelines from Platform Grace, no heavy lifts will be made over the pipelines during the removal of Platform Hope.

b) Any lift where safe resetting of the package may be difficult, will be engineered with guidelines installed to control the package movement horizontally for approximately 2 feet of vertical movement.

Monitoring:

Staff of the State Lands Commission will periodically visually monitor the deck removal operations, where difficult lifts may be anticipated, to assure all appropriate safety measures are being employed.

7. Impact Where underwater explosives are used, there will be some mortality among the pelagic and demersal fish within about 100 meters of the detonation point. Additionally, untrained personnel and improperly handling and storage of explosives can result in accidental explosions.

Project Mitigation:

a) Use of explosives will be conducted in accordance with all laws and regulations regarding such activity.

b) A licensed State of California blasting supervisor will direct the work, and will coordinate the clearance of the site prior to making a shot.

c) Explosives will be stored in a safe manner and in well-marked containers. Nitromethane will be used as the main charge, and is not classed as an explosive when stored prior to mixing.

d) Platform removal operations will be timed to avoid critical cetacean migratory periods.

e) Observers located on the abandonment support vessels will monitor the area prior to, during, and after detonation of charges; detonation of charges will be delayed until all marine mammals observed in the area (within 1,000 yards [914 m] are certain to have vacated; detonation will only occur during daylight hours to facilitate visual monitoring; pre and post-detonation surveys by divers, including recovery of any injured or dead fish will be conducted immediately after detonation; and implementation of staggering of detonations which will reduce the maximum pressure generated by the explosions.

d) A killer whale sonic warning system which emits sounds nearly identical to those emitted by "killer whales" will be placed in the waters near the platforms prior to blasting.

Monitoring:

Staff of the State Lands Commission will periodically visually monitor the storage of explosives, detonation monitoring procedures, and the detonation phase of operations to assure all safety mitigation measures described above are being employed.

8. Impact: During the removal of the oil platforms there is always the possibility of a small operational spill from fuel transfers or accidental leaks.

Project Mitigation:

a) Procedures for major and minor spill events are outlined in Chevron's Oil Spill Contingency Plan for State Leases.

b) Should the spill exceed the capacity of the onsite equipment and personnel, additional resources are available through Chevron's local oil spill response organization and Clean Seas Oil Spill Cooperative.

Monitoring:

Staff of the State Lands Commission will be familiar with Chevron's Oil Spill Contingency Plan for State Leases. Staff will periodically visually monitor the removal phase of operations to assure all safety and environment mitigation measures described above are being employed.

9. Impact: There will be emissions created during the abandonment and removal of the four offshore oil and gas platforms.

Project Mitigation:

a) Emissions would be reduced by utilizing the following Santa Barbara County APCD standard measures which are included in the 1991 Air Quality Attainment Plan (AQAP) as control measures N-IC-7:

- Equipment shall be maintained as per manufacturer's specifications;
- Catalytic converters shall be installed on all gasoline-powered equipment (if applicable);
- The fuel injection timing shall be retarded on all gasoline-powered equipment by two (2) degrees from manufacturers recommendations;
- Gasoline-powered equipment shall be substituted for diesel-powered equipment, if feasible;
- Direct injection diesel engines (i.e., Caterpillar D399 of equivalent) shall be used if available;
- Turbocharged diesel engines with inter cooling shall be used if available; and
- Reformulated diesel fuel and high pressure injectors shall be used in all diesel-powered removal and abandonment equipment.

Monitoring:

Staff will be familiar with the Santa Barbara County Air Pollution Control District (APCD) standard measures which are included in the 1991 Air Quality Attainment Plan (AQAP) as control measures N-IC-7 stated above. Staff will periodically visually monitor the removal phase of operations to assure the standard measures stated above are being employed.

10. Impact: There are known kelp beds and hard-bottom areas in the vicinity of the platforms which could be impacted during the deployment of anchors. When the anchors are removed, seafloor scarring may be in excess of prescribed limits.

Project Mitigation:

a) There will be a pre- and post-project surveys conducted within a 1,000 foot radius of the platforms.

1) The pre-operations survey will note all sensitive bottom features, including pipelines, rocky outcrops, and kelp beds observed during the survey. These areas will be noted on applicable navigation charts and no anchors will be placed in these areas.

2) The post-operations project survey will note all anchor scars and record any additional debris to be removed. Any anchor scars exceeding prescribed coastal commission limits will be leveled.

Monitoring:

Staff of the State Lands Commission will periodically monitor the pre- and post-survey operators to ensure proper implementation. Survey reports will be reviewed for completeness and accuracy. Anchor deployment locations will be monitored to ensure compliance.

EXHIBIT "C"

REMOVAL OF OFFSHORE OIL PLATFORMS
HEIDI, HILDA, HOPE AND HAZEL (Project)

The following stipulations are incorporated into the Project:

1. Prior to the start of the Project, Chevron shall verify in writing to the SLC that all personnel involved in the offshore phases of the Project have completed the Western States Petroleum Association Fisheries Training Program.

2. Chevron will employ "independent observers" to monitor the affected areas for marine mammals prior, during, and after the use of explosives during the cutting of platform piles and conductors. Such observers will be hired from a list provided by the California Department of Fish and Game (DFG). A list of the observers retained shall be provided to the SLC and the DFG prior to the start of the Project.

3. Following the completion of the jacket removal operations for the first platform, Platform Hope under the Project schedule currently on file with the SLC, and before the start of jacket removal operations for the next platform (Platform Heidi), Chevron and the contractor shall meet and confer with the SLC and the Responsible Agencies as defined by the CEQA to evaluate the effectiveness of the procedures and mitigation measures in place for the Project. Chevron shall subsequently proceed with the Project as directed by the SLC. The need for a similar meeting following the removal of Platform Heidi shall be determined by the SLC in consultation with Chevron, the contractor and the Responsible Agencies.

4. The derrick and transport barges that are to be used for the removal of Platform Hope shall not be positioned on the east side of the Platform, i.e. the side on which the pipelines are to remain to service Platforms Grace and Gail in the federal OCS.

5. Within 10 working days of the completion of the project, Chevron shall submit a "trawl plan" (Plan) to the SLC for its approval. Such Plan shall provide for test trawls over the debris clearance area at each platform location, specifically the area within a 1, 000 foot radius from each platform. Such Plan shall also provide for the use of conventional trawling gear, i.e., gear without modifications that would allow it to clear seafloor obstructions, comparable to that which would be used by commercial fishermen in the region. The SLC will review such Plan in consultation with the Joint Oil/Fisheries Liaison Office. Chevron shall proceed with the test trawls within thirty (30) days of receiving notification of SLC approval of the Plan and shall notify the SLC upon the successful conclusion of the trawls.

6. All pipelines, cables, and structures abandoned in place in the offshore will be surveyed with an ROV or high resolution side scan sonar to verify that such pipelines and appurtenances buried at the time of abandonment remain buried and that such pipelines and appurtenances that are permitted to remain exposed continue to remain free of excessive spanning or do not present any other potential interference to commercial fishing operations. The beach and surfzone area, within 1,000 feet of the Mean Low Tide Line, through which the pipelines associated with Platform Hazel pass, shall be visually inspected by a diver.

Such surveys shall be conducted: 1) within 30 days following completion of the project; 2) one year thereafter; and 3) upon review of the one-year survey, a determination will be made to schedule a subsequent annual survey or to schedule a survey at a subsequent interval to be determined by SLC staff based on the results of the one year survey. The details of each post-construction survey plan will be submitted to the SLC for review and approval of scope and content prior to the conduct of each survey.

Within 60 days of the completion of each survey, Chevron shall submit a report to the SLC which describes the status of the abandoned facilities.

7. If in the future any portion of a platform related structure or pipeline abandoned in place becomes exposed, Chevron shall, within 90 days of being notified, identify the nature of the exposed material and submit one of the following to the SLC for its review and approval:

a) with respect to the caisson(s) of Platform Hazel, a plan to reduce or eliminate potential conflicts with commercial fishing activities;

b) with respect to an offshore section of a pipeline and its appurtenances, a remediation plan which shall contain an alternative removal procedure; and

c) with respect to the beach and shorezone area described in Stipulation 6, a removal plan.

Upon approval by the SLC, Chevron shall implement the submitted plan on a schedule and in the manner specified by the SLC.

EXHIBIT "D"

FINAL MITIGATION MONITORING PROGRAM FOR THE OFFSHORE OIL PLATFORM ABANDONMENT AND REMOVAL IN THE SANTA BARBARA CHANNEL - CHEVRON PROJECT

OFFSHORE MONITORING

1. Impact: The proposed project may create hazards to navigation caused by the temporary presence of marine equipment offshore.

Project Mitigation:

a) The mooring system of the derrick barge will be marked as orange rubber crown buoys. These markers will delineate the mooring spread.

b) All platforms are presently well lit. The lights will be moved to the legs once the platform decks have been removed.

c) The contractor will file a Local Notice to Mariners with the U.S. Coast Guard which will specify the project boundaries, hazards to navigators, and call signs. Copies of said Notice shall also be provided to the Joint Oil/Fisheries Liaison Office and posted in the offices of the Harbor Master at Santa Barbara, Morro Bay, Port Hueneme, Ventura, Los Angeles, and Long Beach Harbors.

d) All marine vessels utilized in the removal/abandonment operations will use designated vessel traffic corridors and shipping lanes. The crew boats transporting personnel will also utilize such traffic corridors.

Monitoring:

Staff of the State Lands Commission, while inspecting offshore operations, will periodically monitor the project to assure that the marked orange rubber crowned buoys are in place, the vessels are well lit and highly visible at night, and the Local Notice to Mariners has been filed. Additionally, staff will observe the local vessel traffic to assure that the project is in compliance.

2. Impact: This proposed project may result in unsafe working conditions if allowed to operate during rough inclement weather when unsafe sea states occur.

Project Mitigation:

a) The final determination for shutdown of operations will be made by the barge superintendent or vessel captain in conjunction with the removal contractor project manager.

b) The barge superintendent or vessel captain will resume operations when the unsafe sea state is no longer present.

Monitoring:

Staff of the Staff Lands Commission, while conducting periodic project inspections, will monitor the project to assure that the shutdown procedures are initiated in the event of unsafe sea states as determined by the barge superintendent or vessel captain.

3. Impact: This project may produce trash or debris generated by the contractor's crews or subcontractors.

Project Mitigation:

a) Trash and debris generated offshore will be confined to the platforms and moved to the barges in metal trash containers and properly disposed of when the vessel returns to Port.

b) The contractor and subcontractors shall maintain a log of all tools, equipment of other debris that are accidently dropped into the water during the course of demolition operations. The log, a copy of which is to be submitted to the SLC, will record the date, time, a description of the item, and approximate location to facilitate diver recovery during final site clearance.

Monitoring:

Staff of the State Lands Commission will periodically monitor both onshore and offshore projects to assure that all trash, debris, food containers, etc. generated by the project and the contractor's crews are policed and properly disposed.

4. Impact: Debris may have accumulated on the ocean bottom during the operations of the platforms or from the dismantling operations.

Project Mitigation:

a) Verification of site clearance will be performed as part of the final debris recovery operation utilizing a high resolution side scan sonar survey. A description of the survey shall be submitted to the SLC for its review and approval prior to the conduct of such survey.

b) Suspect targets or debris will be plotted for positive verification and recovery.

c) The debris located will be recovered by divers to complete the site clearance verification. A test trawl will be conducted over each site as provided by Stipulation 5 as contained in Exhibit "C" and made a part hereof by this reference.

Monitoring:

Staff of the State Lands Commission will periodically monitor the site clearance operations and will check the side-scan sonar records and the trawl report to verify that all debris has been removed.

5. Impact: The oil and gas pipelines for Platforms Grace and Gail could be damaged during the removal operations of Platform Hope.

Project Mitigation:

a) To prevent damage to the oil and gas pipelines from Platform Grace, no heavy lifts will be made over the pipelines during the removal of Platform Hope.

b) Any lift where safe resetting of the package may be difficult, will be engineered with guidelines installed to control the package movement horizontally for approximately 2 feet of vertical movement.

c) The derrick and transport barges used to remove Platform Hope shall not be positioned on the east side the platform, i.e. the side on which working pipelines are to remain to service Platforms Grace and Gail in the federal OCS.

Monitoring:

Staff of the State Lands Commission will verify the barge location and periodically monitor the deck removal operations where difficult lifts may be anticipated to assure all appropriate safety measures are being employed.

6. Impact: Where underwater explosives are used there will be some mortality among the pelagic and demersal fish within about 100 meters of the detonation point. Additionally, untrained personnel and improperly treated and stored explosives can result in accidental explosions.

Project Mitigation:

a) Use of explosives will be conducted in accordance with all laws and regulations regarding such activity.

b) A licensed State of California blasting supervisor will direct the work, and will coordinate the clearance of the site prior to making a shot.

c) Explosives will be stored in a safe manner and in well-marked containers.

d) Platform removal operations will be timed to avoid critical cetacean migratory periods.

e) Independent observers located on the abandonment support vessels will monitor the area prior to, during and after detonation of charges; detonation of charges will be delayed until all marine mammals observed in the area (within 1,000 yards [914 m]) are certain to have vacated; detonation will only occur during daylight hours to facilitate visual monitoring; pre and post-detonation surveys by divers, including recovery of any injured or dead fish will be conducted immediately after detonation; and implementation of staggering of detonations which will reduce the maximum pressure generated by the explosions.

f) A killer whale sonic warning system which emits sounds nearly identical to those emitted by "killer whales" will be placed in the waters near the platforms prior to blasting.

Monitoring:

Staff of the State Lands Commission will periodically inspect the storage of explosives, detonation monitoring procedures, and the detonation phase of operations to assure all safety mitigation measures described above are being employed.

7. Impact: During the removal of the oil platforms there is always the possibility of a small operational spill from fuel transfers or accidental leaks.

Project Mitigation:

a) Procedures for major and minor spill events are outlined in Chevron's Oil Spill Contingency Plan for State Leases.

b) Should the spill exceed the capacity of the onsite equipment and personnel, additional resources are available through Chevron's local oil spill response organization and Clean Seas Oil Spill Cooperative.

Monitoring:

Staff of the State Lands Commission will be familiar with Chevron's Oil Spill Contingency Plan for State Leases. Staff will periodically monitor the removal phase of operations to assure all safety and environment mitigation measures described above are being employed.

8. Impact: There will be emissions created during the abandonment and removal of the four offshore oil and gas platforms.

Project Mitigation:

a) As determined by the Santa Barbara County APCD, emissions would be reduced by utilizing the following Santa Barbara County APCD standard measures which are included in the 1991 Air Quality Attainment Plan (AQAP) as control measures N-IC-7:

- Equipment shall be maintained as per manufacturer's specifications;
- Catalytic converters shall be installed on all gasoline-powered equipment (if applicable);
- The fuel injection timing shall be retarded on all gasoline-powered equipment by two (2) degrees from manufacturers recommendations;
- Gasoline-powered equipment shall be substituted for diesel-powered equipment if feasible;
- Direct injection diesel engines (i.e. Caterpillar D 399 of equivalent) shall be used if available;
- Turbocharged diesel engines with inter-cooling shall be used if available; and
- Reformulated diesel fuel and high pressure injectors shall be used in all diesel-powered removal and abandonment equipment.

Monitoring:

Staff will be familiar with the Santa Barbara County Air Pollution Control District (APCD) standard measures which are included in the 1991 Air Quality Attainment Plan (AQAP) as control measures N-IC-7 stated above. Staff will periodically monitor the removal phase of operations to assure the standard measures stated above are being employed and advise the APCD of any difficulties.

9. Impact: There are known kelp beds in the vicinity of the platforms which could be impacted during the deployment of anchors. When the anchors are removed, seafloor scarring may occur.

Project Mitigation:

There will be a pre and post-project surveys conducted within a 1, 000 foot radius of the platforms.

1) The pre-operations survey will note all sensitive bottom features, including pipelines, rocky outcrops, and kelp beds observed during the survey. These areas will be noted on applicable navigation charts and no anchors will be placed in these areas.

2) The post-operations project survey will note all anchor scars and record any additional debris to be removed. Anchors, of which no more than four (4) will be used in the barge mooring spread, shall be placed and retrieved vertically.

Monitoring:

Staff of the State Lands Commission will be present at anchor placement and retrieval. Commission staff will periodically monitor the pre and post- survey operations to ensure proper implementation. Survey reports will be reviewed for completeness and accuracy. Anchor deployment locations will be monitored to ensure compliance.

Appendix A2

4H Shell Mounds Chronology

Tables A3-1and A3-2 provide an overview of the various regulatory and other processes that have been completed for development, production, decommissioning, and removal of Platforms Hilda, Hazel, Hope, and Heidi (4H Platforms). Where documents are available for processes shown below, they are linked within the dates listed for each item.

Table A3-1. Timeline of Leases PRC 1824/3150 Actions – Lease Development and Production

Year	Lease Actions
1950s	1/10/1957. California State Lands Commission (SLC) issues California Public Resources Code (PRC) Lease 1824.1 to Standard Oil Company of California (Standard Oil; now Chevron) and Humble Oil and Refining Company (now ExxonMobil) (SLC 1957a). 8/8/1957. SLC approves the location and construction of Platform Hazel. **1958**. Platform Hazel is installed (SLC 1957b).
1960s	3/24/1960. SLC approves the location and construction of Platform Hilda. **1960**. Platform Hilda is installed. 7/28/1964. SLC issues Lease PRC 3150.1 to Richfield Oil Corp. (later Atlantic Richfield Company [ARCO], now BP, PLC) and Standard Oil. 9/24/1964. SLC approves the location and construction of Platform Hope. 5/27/1965. SLC approves the location and construction of Platform Heidi. **1965**. Both Platforms Hope and Heidi are installed. **2/1/1969**. SLC issues a drilling moratorium on state tide and submerged lands following the January 28, 1969, Santa Barbara oil spill in federal waters, pending a complete review of all offshore drilling regulations, techniques, and procedures.
1970s	12/11/1973. SLC adopts proposed platform operating procedures, lifts the moratorium, and permits resumption of drilling operations on a lease-by-lease basis; such resumption was predicated on staff review for compliance with the procedures and upon final approval by SLC. 11/21/1974. SLC approves resumption of drilling operations from existing facilities on PRC 1824 and PRC 3150 (i.e., Platforms Hilda, Hazel, Hope, and Heidi [4H Platforms]). 1/14/1975. SLC rescinds the 1974 approval and determines that the applications for resumption of drilling operations from the 4H Platforms would be considered only upon preparation of an Environmental Impact

Table A3-1. Timeline of Leases PRC 1824/3150 Actions – Lease Development and Production

Year	Lease Actions
	Report (EIR) and in accordance with state policies in effect at the time of such consideration. **7/24/1975.** SLC authorizes the Executive Officer to execute a contract to prepare an EIR for the resumption of production from the 4H Platforms. **August 1976**. SLC publishes Final EIR for Resumption of Drilling in the Santa Barbara Channel from Existing Standard Oil Company of California Platforms (SLC 1976). **9/30/1976.** SLC defers resumption of 4H Platform drilling operations. **10/28/1976.** SLC certifies Final EIR and approves resumption of 4H Platform drilling operations in accordance with lease terms/conditions and SLC rules/regulations. **10/28/1976.** SLC approves assignment of PRC 1824 and PRC 3150 from Standard Oil to a new wholly owned subsidiary company, Chevron, U.S.A. Inc. (Chevron). **11/30/1977.** SLC amends PRC 1824 and PRC 3150 drilling terms to allow only one drilling rig at a time for each of the four platforms. **1979.** Senate Bill 678 (Nejedly; Chapter 197, Statutes of 1979) is signed, amending PRC Section 6873(b) to clarify that state law related to SLC's leasing of tide or submerged lands "does not prohibit the deposit on or passage into the waters of the ocean or any bay or inlet thereof of drill cuttings or drilling mud which are free of oil and materials that are deleterious to marine life if such activities are under authorization of a regional water quality control board." Given that drilling muds and cuttings are not free of the materials noted in the Senate Bill, subsequent drilling operations at the 4H Platforms did not deposit drilling cuttings or muds on the sea floor and instead collected and transported them for onshore disposal. **10/29/1979.** SLC approves pipeline connections from Federal Platform Grace through Platforms Hope and Heidi to shore pursuant to an EIR certified on April 12, 1979, by the County of Santa Barbara and South Central Coast Regional Commission (SCH No. 79882322).[1]
1980s	Production of the 4H wells continued through the 1980s, with no notable actions taken by the SLC or other agencies.

1 Commercial fishermen later claimed that the Platform Grace-to-Hope pipelines unduly interfered with trawl fishing operations, resulting in Chevron's establishment of

a Roller Net Assistance Program. From 1992 to 1995, Chevron settled $432,649.08 in claims with 19 commercial fishermen.

Table A3-2. Timeline of Leases PRC 1824/3150 Actions – Platform Decommissioning and Removal

Date	Platform Decommissioning and Removal Actions
1990s	**2/5/1992**. California State Lands Commission (SLC) approves Chevron's proposed abandonment of the 24 individual wells at Platform Hazel. All other wells associated with Platforms Hilda, Hazel, Hope, and Heidi (4H Platforms) were shut in by September 1992. **8/3/1994**. SLC adopts a Mitigated Negative Declaration (MND) (SCH No. 94051016; SLC MND No. 652) and approves the Chevron 4H Platform Removal Project (Appendix A1). SLC adopts stipulations and mitigation measures as part of its approval, for example to require Chevron to conduct trawl tests, and does not require removal of the shell mounds below the platforms. **10/17/1995**. SLC certifies a Final Environmental Impact Report (EIR) (SCH No. 94121042; SLC EIR No. 663) and approves the Subsea Well Abandonment and Rig Sharing Program to abandon subsea structures on PRC 1824 and other leases. **1996.** 4H Platforms removed. **August–December 1996**. After SLC and other agency approval of Chevron's trawl plan, Chevron conducts trawl tests, but trawl nets snag repeatedly on the shell mound surfaces. **10/28/1996**. SLC consents to the assignment of a portion of PRC 3150 from ARCO and Chevron to Carone Petroleum Corporation (the assigned portion of PRC 3150 was renamed PRC 7911). **June–July 1997.** Fugro West Inc., under contract to Chevron, conducts two additional phases of trawl tests using roller nets at the abandoned 4H Platform sites. The roller nets snagged 11 times at the former platform sites: Hilda (3 times), Hazel (5), Hope (2), and Heidi (1). **1/14/1998**. SLC Executive Officer directs Chevron to "immediately set and maintain one (1) [temporary] spar buoy with a radar reflector at the center of each mound site … until final disposition of the mounds can be determined." **10/6/1998 and 1/26/1999.** Chevron submits requests to SLC staff to bring closure to the 4H Platform Removal Project pursuant to an October 1998 agreement to install differential global positioning system (DGPS) navigational equipment on trawler vessels. The agreement was negotiated

Table A3-2. Timeline of Leases PRC 1824/3150 Actions – Platform Decommissioning and Removal

Date	Platform Decommissioning and Removal Actions
	in coordination with the Joint Oil/Fisheries Liaison Office and supported by members of the Southern California Trawlers Association. **12/3/1999.** During public comment on a staff report on the status of the 4H shell mounds, commercial trawlers voice concerns about the reliability of marker buoys placed by Chevron at the shell mound sites. SLC discusses compensating fishermen whose equipment was damaged on the mounds; requests information on the appropriateness of requiring Chevron to provide DGPS navigational equipment to trawlers who operate in the shell mound vicinity; directs Chevron to address these issues; and authorizes staff to execute a contract for and supervise an offshore geological survey to characterize the structure and contents of the shell mounds, determine their habitat value, and explore techniques for removal.
2000s	**2/8/2000**. SLC consents to subsurface-only assignment of 100% of Chevron's 50% interest in PRC 3150 from Chevron to Venoco Inc. **9/17/2001**. SLC authorizes the Executive Officer to execute a contract to prepare environmental documentation to evaluate a range of potential modifications to Chevron's 4H Platform Removal Project to address the inability of commercial fishermen to trawl in the area of the 4H shell mounds. **1/30/2002**. SLC authorizes a permit to conduct a new offshore geological survey at the former sites of the 4H Platforms to include drill core holes to characterize the structure and content of the 4H shell mounds. **12/2003**. SLC releases a Draft Program EIR/Environmental Assessment (EA) analyzing various alternatives, including leaving the mounds in place, removing the mounds, and others. Public hearing held and comments received. **2003–2008.** SLC staff meet with various regulatory agencies to discuss feasibility of shell mound removal, alternatives to removal, and how to properly address and resolve Stipulation No. 5 from the 1994 Project approval. Agencies disagree as to shell mound disposition, and some agencies indicate an inability to approve permits for shell mound removal. The Draft Program EIR/EA is not finalized, and the process is ultimately paused.
2010s	**2/22/2013**. SLC authorizes the Executive Officer to execute a contract to prepare environmental documentation to evaluate Chevron's proposal to fulfill 4H Platform Removal Project requirements, leave the shell mounds in place, enhance a portion of the Carpinteria Salt Marsh, and fund

Table A3-2. Timeline of Leases PRC 1824/3150 Actions – Platform Decommissioning and Removal

Date	Platform Decommissioning and Removal Actions
	additional habitat improvements. A Notice of Preparation is prepared and a scoping meeting held. **2013–2015.** SLC staff determine that the SLC has no subsequent action to take that requires (or even allows) preparation of an EIR or similar environmental document, and ceases preparation of the EIR. SLC directs its contractor, AMEC Earth & Environmental Inc., to prepare a brief assessment summarizing the potential effects of leaving the mounds in place, a working draft of which is completed in 2015 before the process is paused.
2020s	**2022–2024.** Upon renewed application by Chevron to terminate the PRC leases, SLC staff restart the assessment process that was paused in 2015. SLC directs consultant team led by Dudek to conduct a new survey of the 4H shell mounds using a remotely operated vehicle and a new mussel study consistent with the approach of the study conducted in 2003 and complete the assessment document last updated in 2015 (this Review, including Appendix C3). The independent non-profit organization Ocean Science Trust convenes a scientific peer review panel of the Review document (Appendix C4).

References

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Appendix B

Assessment of Full Removal of 4H Shell Mounds

APPENDIX B:
ASSESSMENT OF FULL REMOVAL OF THE 4H SHELL MOUNDS

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WORKING DRAFT, AUGUST 2022

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1 INTRODUCTION

As an appendix to the *Staff Assessment for State Oil & Gas Lease PRC 1824 & PRC 3150 Terminations and Disposition of 4H Shell Mounds* (Assessment), this analysis provides an overview of potential effects of full removal of all four 4H shell mounds currently remaining on the seafloor of the Santa Barbara Channel offshore Santa Barbara County. This analysis of full removal of the shell mounds is intended to allow for comparison to the ongoing and potential future effects on the existing local setting with leaving the shell mounds in place as described in the body of Assessment. For qualitative information purposes, this analysis discusses the potential effects to public trust resources and values associated with removing the shell mounds by dredging from the seafloor on the surface of State Oil and Gas Leases PRC 1824 and 3150 prior to the finalization of Lease Termination Agreements between the California State Lands Commission (Commission or CSLC) staff and Chevron Environmental Management Company and its partners (Chevron).

This assessment was not prepared pursuant to the California Environmental Quality Act (CEQA), Public Resources Code Section 21000 et seq., and is not intended as a CEQA analysis. The presence of the 4H shell mounds is an existing physical condition which would not be altered if the Commission decides to allow the mounds to remain in place. Removal of the shell mounds would result in changes to the existing physical environment and therefore would constitute a project subject to CEQA. A decision by the Commission to require shell mound removal would require the appropriate level of CEQA review.

The following analysis builds from the existing setting descriptions and background information provided in Section 1 through Section 4 of the Lease Termination Report. Accordingly, reviewers of this appendix should consider the existing setting and issue area assessments in Sections 1-4 regarding abandonment of the shell mounds in place prior to review of this appendix.

This appendix is organized by issue areas relevant to the discussion:

- Commercial and Recreational Fishing (Section 2.1)
- Geologic Hazards (Section 2.2)
- Marine Water Quality (Section 2.3)
- Marine Biological Resources (Section 2.4)
- Additional Assessments (Section 2.5)
    a. Recreation and Public Access (Section 2.5.1)
    b. Air Quality and Greenhouse Gases (Section 2.5.2)
    c. Coastal Processes and Sea Level Rise (Section 2.5.3)
    d. Cultural and Paleontological Resources (Section 2.5.4)
    e. Environmental Justice (Section 2.5.5)

f. Navigation, Transportation, and Traffic (Section 2.5.6)
g. Noise (Section 2.5.7)
h. Public Health and Safety Hazards (Section 2.5.8)
i. Scenic Resources (Section 2.5.9)

1.1 BACKGROUND

As described in Section 3, *Chronology*, of the Assessment, the terms of Leases PRC 1824 and PRC 3150 required the removal of the 4H Platforms at lease termination. Additionally, the Commission retained an option to order Chevron U.S.A. Inc (Chevron) to "remove such structures, fixtures and other things as have been put on the leased lands by the Lessee and otherwise restore the premises" prior to lease termination (Lease PRC 3150.1, Section 14. Lease PRC 1824, Section 14, contains similar language.).

In preparation for the removal of the 4H Platforms and abandonment of the leased land, Chevron submitted an Abandonment Plan to the Commission in 1993. In 1994, the Commission adopted a Mitigated Negative Declaration (MND) that analyzed potential impacts of removing the 4H Platforms (CSLC 1994) and approved the Abandonment Plan. The MND contained several references to the shell mounds and drill muds and cuttings within the mounds, including statements that the "cuttings mounds accumulated at the base of the platforms will likely remain largely intact" (page 5-10), "cuttings piles will not likely be heavily resuspended by platform removal operations" (page 5-28), and impacts to encrusting organisms existing on the accumulation of shells atop the cuttings piles "would be confined to localized regions". The Commission did not include or analyze removal of the shell mounds as part of its 1994 approval of 4H Platform removal and approved abandonment of the 4H Platforms without removal of the shell mounds. As a result of the MND and Abandonment Plan adoption, Commission staff subsequently determined that the Commission has no subsequent action to take that requires preparation of an Environmental Impact Report (EIR) or similar environmental document for removal of the shell mounds.

However, ongoing interest from the public and agencies, including the California Coastal Commission (CCC) and the County of Santa Barbara, in potential removal of the shell mounds has led the CSLC to conduct a preliminary assessment of potential impacts to public trust resources and values associated with full removal of the shell mounds as an alternate scenario to leaving the shell mounds in place for final disposition. This appendix to the Assessment provides analysis of this alternate scenario.

1.2 DESCRIPTION OF FULL REMOVAL SCENARIO

To facilitate comparison of the effects of leaving the shell mounds in place against an alternate scenario in which the shell mounds are fully removed by dredging and the soft bottom seafloor is restored, this section describes a reasonably foreseeable scenario for the full removal of the shell mounds. Under this full removal scenario, a minimum of 12 to

14 marine vessels would be used to remove the majority of the 45,500 cubic yards (cy) of shell mound material using a clamshell bucket dredge that would be operated from a derrick barge (supported by two tugboats). In addition, approximately 16,300 cy of additional non-shell mounds soft-bottom material would be expected to be dredged incidentally to the process to ensure the fullest possible cleanup. Dredged material would then be loaded into hopper barges for transport to a receiving harbor. A minimum of four barges (3,000-cy capacity) would likely be required per shell mound, each with a support tugboat and working simultaneously to load/transport/unload the dredge material.

Shell mound materials recovered using clamshell dredging are expected to contain approximately 35 percent water by volume, including excess "free" water and the moisture content of the materials. When the barge is full, free water that rises to the top of the dredged material in the barge would be filtered and subject to chemical and precipitation treatment onsite and pumped off (decanted) back to the ocean. Discharges to the ocean of the decanted effluent would require a National Pollutant Discharge Elimination System (NPDES) permit or waste discharge requirement (WDR) from the Regional Water Quality Control Board (RWQCB) containing specific effluent discharge limitations and/or receiving water limits that are consistent with numerical or descriptive criteria in the 2019 California Ocean Plan (COP). Compliance with these limits would require monitoring of the effluent and/or receiving waters. Based on the expected constituents in the decanted water and expected discharge guidelines, a treatment scheme was developed for a barge-based treatment system that would include:

- Pressure filtration for initial suspended solids removal;
- Chemical precipitation of dissolved metals as metal sulfides and iron/metal co-precipitates;
- Filtration for removal of fine suspended solids; and
- Granular activated carbon adsorption for organics and trace metals.

A barge-based treatment system with a capacity to treat 700 gallons (2,650 liters) per minute (gpm; maximum flow rate) would require an area of approximately 7,000 square feet (sf) (650 meter [m]^2), which could be accommodated by a 50 foot by 150 foot (15 by 46 m) flat barge. The barge supporting the water treatment system would also have a tug and would be separate from the barge used to hold and transport the dewatered dredged materials.

Removal of the four caissons remaining in place at the Hazel shell mound would involve the use of mechanical cutting technologies such as wire cutting methods, cable cutters, abrasive water jet cutting devices and casing cutters that would be used to sever the concrete caisson shells into pieces small enough to allow for subsequent lifting to the surface. Recovery of the caisson pieces would be completed using a derrick barge and materials barge supported by ROV or divers. .

Shell mounds materials would be transported on the barges via tugboat to the Ports of Los Angeles/Long Beach (POLA/POLB) for preparation for transport and upland disposal. The Hazel caissons also would be transported by barge to the POLB, potentially to the SA Recycling Company at Pier T and unloaded for onshore disposal/recycling at a permitted facility. In addition, marine vessels would likely be mobilized from the POLA/POLB region to the shell mounds sites.

The seafloor underlying the shell mounds material would also be restored to soft bottom habitat through the use of dredgers to redistribute sediments. Removal of residual debris and final site smoothing, following removal of the major portions of the shell mound, could be performed with a heavy trawl net. Final seafloor restoration would level/ smooth the contours of the shell mound sites to approximately match the contours of the surrounding seafloor.

Additional details for the removal scenario are provided below:

1.2.1 Initial Activities

Dredging is excavation of underwater materials, including sediments, sands, and muds. Dredging is a highly specialized discipline that has unique equipment not typically available to land-based operations. Equipment suitable to work in open ocean environments is even more specialized due to U.S. Coast Guard (USCG) requirements and other regulations governing seaworthiness and qualifications for operational personnel. As a result, there are very few pieces of equipment that are suitable for these types of operations. Depending on the location of these unique vessels and crew, as well as their ongoing work activities, the mobilization costs routinely exceed the cost to dredge the material when smaller volumes of material are involved. The set-up time can require a substantial period depending on the ultimate disposal location/offloading area. For this reason, the entire process must be considered including the available work window due to weather, sensitive species, equipment availability, disposal site, and constraints on dredging operations.

1.2.2 Available/Feasible Methods and Techniques of Dredging

A range of equipment and operations would be potentially available for dredging operations. Types of dredging equipment can include mechanical or hydraulic/pneumatic measures. Mechanical removal can vary from divers manually ‘shoveling’ material into a basket to clamshell dredges with large buckets. Hydraulic/pneumatic measures include hopper dredges, cutter suction dredges, or devices dropped to the ocean floor with manipulation by divers or a suction device lowered to the sea floor and directed with jets. However, as discussed below, the open ocean location, depth, and composition of the shell mounds limit suitable technologies.

Due to the relatively large volume of material, hand excavation by divers would be impractical and time-consuming for full removal of the shell mounds. The combination of materials encased within the shell mounds, especially combined with drilling muds that are very stiff clay, make the use of hydraulic/pneumatic dredging extremely challenging. In addition, suction devices tend to also generate large quantities of water along with the dredged materials, which would add water treatment requirements that would make that removal option impractical, time-consuming, and costly as well.

There are currently no available in-water disposal locations available for this material. One potential option would be to permit a separate activity to dig an ocean pit, place the shell/drilling mud within the pit, and cap this material with some of the pit material. However, this option is not considered as part of this analysis due to potential secondary impacts, extensive required permitting and low probability of regulatory approval.

1.2.3 Recommended Dredging Technology and Equipment Used

The most reasonable scenario for dredged removal of the shell mounds would be to mobilize an ocean-going clamshell dredge and barges to the site. A clamshell dredge consists of a barge mounted crane with bucket(s). An enclosed bucket or a modified conventional clamshell bucket has been considered, however the presence of debris in the mounds would make closure of the bucket ineffective resulting in further loss of dredge material. This equipment can accommodate deeper dredging with some modifications and can more readily handle difficult materials, such as drill muds, with a range of clamshell bucket configurations. A barge would need to be anchored on site to receive the materials excavated by the clamshell dredge, typically in a six- to eight-anchor configuration during a fairly benign weather window. Attendant plant includes an A-frame boat to assist in anchor positioning, survey boat, ocean-going tugboat, and barges. The barges can vary in capacity from 2,000 to 10,000 cy each, with 5,000 cy being a more standard size. For the purposes of this analysis, it is assumed that a minimum of four barges with a 3,000-cy capacity would be used and a clamshell bucket with a capacity of 24 cy would be employed at each shell mound.

Once the material is loaded by clamshell dredge onto the barge, the materials would require onsite dewatering, and treatment and discharge of the dewatering effluent. Dewatering effluent released into the barge during dredging would be pumped to an adjacent barge, where it would be treated to the extent needed to meet discharge limitations, and then discharged back into the ocean. The barges can then be towed via tugboat to the offloading location at POLA/POLB. Since the material will not be discharged back into the ocean, and no current in-water disposal options exist, the barges would need to be offloaded at an open wharf area in the POLA/POLB. Once offloaded from the barge the materials would then be loaded into trucks for final disposal at an upland location.

For the landside operations, the area would require a wharf or mooring dolphins to tie the barges alongside, landside crane, surge pile area to offload the material, front end loader to load the trucks, and several (10 to 15) dump trucks. Material would be removed incrementally via truck from the dock to a permitted landfill for final disposal.

1.2.4 Area Affected

Dredge tolerances in open ocean waters would require approximately a 10- to 15 foot-wide swath around the perimeter of each shell mound, which would add about 5 to 6 percent to the affected area. The tolerance in the vertical dimension would be in the order of 3 feet (i.e., if 100 percent of the mound would require removal, the volumes would need to account for a 'hole' that would be 15 feet in diameter larger and 2 feet (on average) lower than the footprint of the mound).

Anchoring of the barge extends up to 500 feet beyond the edge of the barge. Each barge is approximately 300 feet by 100 feet in size.

The turbidity drift from the dredging activities would extend for several hundred feet from the lightest sediments at the top of the ocean floor. While not as mobile as the seafloor sediments, the disturbed drilling muds would be dispersed over a relatively larger area in the vicinity of each mound. The shell hash would be confined to the dredge footprint since these heavier materials would fall directly to the ocean floor rather than becoming suspended in the water column.

1.2.5 Containment Technologies, Debris Removal, and Pollution Prevention

The internal portions of the shell mounds contain contaminated materials (e.g., drill muds) and various types of debris, such as pipes and concrete ballast, as well as obstructions, including caissons at the Hazel location and capped wellheads. During shell mounds removal, a variety of technologies would be employed to control release of contamination into surrounding waters and minimize adverse effects beyond the immediate vicinity of the shell mounds. Prior to the start of dredging, detailed bathymetric and magnetometer surveys would be conducted using precision navigation at each shell mound in order to map the locations of any debris or legacy infrastructure. Detailed dredging and anchoring/mooring plans and an Oil Spill Contingency Plan (OSCP) and Critical Operations and Curtailment Plan (COCP) would be prepared and implemented. The anchoring/mooring plan would include best management practices to minimize disturbance of the seafloor and avoid sensitive features, including active oil pipelines. Measures would include attaching a crown line leading to a spherical surface buoy to the head of each anchor; the crown line would be used to lower each anchor to, and pull each anchor from, the sea floor vertically with minimal disturbance. The pipeline locations would be entered into applicable work/support vessels navigation systems to provide a real-time display of the pipeline locations in reference to the dredging activities and anchoring locations to avoid pipelines. Additional specifications regarding the adjacent pipelines and the avoidance plan would be presented in the OSCP and COCP.

Turbidity would occur in any dredging scenario, especially for the fine grained lightweight material recently deposited on top of the ocean floor. Typical turbidity control measures used in dredge activities include options such as silt curtains, bubble curtains, and environmental buckets. However, open ocean environments are not conducive to silt curtains or bubble curtains. Silt fences around the shell mound would also be ineffective since ocean currents and the act of dredging would overcome these measures. Due to the presence of debris in the mounds, the use of an environmental bucket is not feasible.

1.2.6 Construction Schedule

Once a contractor is identified, a contract is signed, and a notice to proceed is issued, the following tasks would be necessary for a shell mounds removal and disposal scenario:

- Modify equipment in preparation for deep-ocean dredging. (1-2 months)
- Identify and prepare dockside transfer location at the shore. This can be concurrent with equipment preparation. (1-2 months)
- Mobilize to site. (Assume west coast dredge) (3 weeks)
- Dredge shell mound, load to barges. (3-4 weeks/site)
- Remobilize between shell mounds. (1-2 weeks)
- Offload barges and truck materials to upland disposal. (2-3 weeks)

The overall schedule from early preparation for the dredging operation to demobilization would be approximately 15 months (steps 1-6 above), though this could be interrupted by inclement weather, which would require the dredge to demobilize and then remobilize.

1.3 EXISTING SETTING

The shell mounds are remnant masses of accumulated materials that formed over time around four former offshore oil drilling platforms. The four former platform mounds are named Hilda, Hazel, Hope, and Heidi, located from 1.5 to 2.6 miles offshore of the communities of Summerland and Carpinteria and approximately 100 to 140 feet beneath the ocean in the Santa Barbara Channel (SBC). Each shell mound comprises a combination of sediments, drill cuttings, drill muds, and debris encased within a one- to seven-inch thick layer of shell hash that accumulated from shells and other debris from organisms (e.g., mussels) that sloughed from the platform structures between installation in 1958 to removal in 1994. The shell mounds contain contaminants from past oil activity currently trapped within a mixture of drilling mud cast-offs, sediments, and shell hash. The mounds range from 200 to 250 feet in diameter at the top, 650 to 700 feet at the base, rise 25 to 28 feet above the original seafloor, and contain a total of about 45,500 cy of material ranging from 7,000 to 14,000 cy at each location.

Waves and currents in the vicinity of the shell mounds vary by season. Significant wave heights/periods during storm conditions can vary from 8 to 16 feet at 8 to 9 seconds from local storms to longer period swells at 3 feet and 12 seconds. Summer periods are typically calmer while winter storms can be expected from late October through early April. These storm conditions can significantly affect dredge activities.

In addition to the setting descriptions provided in Sections 4.1 through 4.5 of the Assessment, full removal of the shell mounds would affect the following additional areas other than the shell mounds vicinity due to removal activities and dredged material disposal.

- **Port of Los Angeles/Port of Long Beach (POLA/POLB)**. The POLA/POLB is located within the southernmost portion of the Los Angeles Basin. Surrounding land uses include containerized cargo and dry- and liquid-bulk goods terminals and various industrial/commercial uses.
- **Vessel Transportation Routes**. Removal of the shell mounds would require dredged materials to be transported approximately 90 nautical miles (nm) from the shell mounds sites to POLA/POLB through the southeastern reaches of the SBC to Santa Monica Bay and San Pedro Bay. The SBC is the primary offshore vessel corridor in the vicinity of the shell mound sites and is heavily traveled. This vessel transportation route navigates open waters with few obstructions. The southeastern end of the SBC is approximately 9.5 nm wide. Offshore traffic flow of large cargo ships and tanker vessel traffic is controlled by the USCG, while smaller vessels are controlled by local jurisdictions/harbor patrol.
- **Coastwise Shipping Lanes/USCG Vessel Traffic Separation Scheme (VTSS)**. Designated coastwise shipping lanes traverse the California coast from near Point Arguello, in western Santa Barbara County, through the SBC, and continuing southeast, including POLB. These shipping lanes are used by oil tankers, container ships, and other large commercial vessels. The shipping lanes in the vicinity of the 4H shell mounds are 14 to 15 nm offshore. The shell mounds are approximately 12 to about 13.5 nm from the shipping lanes (Table 5-2).

Table D-1. Distances to Harbors, Ports, Traffic Lanes, and Shore.

Shell Mound Site	**Distance to Santa Barbara Harbor** (nm)	**Distance to POLA/POLB** (nm)	**Distance to Coastwise Traffic Lanes** (nm)	**Distance to Shore** (nm)
Hilda	4.5	92.7	13.5	1.5
Hazel	6.0	91.2	13.4	1.5
Hope	8.4	88.5	11.7	2.6
Heidi	9.2	88.0	11.8	2.5

- **Small Boat Harbor**. Vessel traffic for full removal of the shell mounds could utilize the Santa Barbara Harbor to stage marine activities. Santa Barbara Harbor is located 4.5 nm to 9.2 nm northwest of the shell mound sites.
- **Ground Transportation**. Regional access to the shell mounds would be provided by a network of freeways and arterial roadways.
  - Regional access to POLA/POLB is via a network of freeway and arterial facilities, including the Terminal Island Freeway (State Routes 47/103), which connects directly with I-110 in the vicinity of the POLB. Both I-110 and I-710 provide direct access to several other interstate highways (I-405, I-105, I-10, I-5, and I-210) in the greater metropolitan Los Angeles area. The arterial street network serving POLA/POLB includes Ocean Boulevard.
  - Transportation of the dredged material to a Class I landfill in the Taft/Bakersfield area would occur via transportation routes (Interstate 710, 405 and 5) between LA County and Kern County (for shell mound material) or within the LA Basin (for Hazel caissons). Based on the estimated volume of dredge materials, it is estimated that approximately 19,650 truck trips would be required to transport these materials from the POLA/POLB to disposal sites.
  - General personnel access to the shell mound sites could be via crew boats boarded at the Casitas Pier in Carpinteria, California or out of Santa Barbara Harbor in Santa Barbara, California. U.S. Highway 101 provides regional access to the Casitas Pier and Santa Barbara Harbor.
- Upland Disposal Site. Due to the presence of PCB contamination in some of the shell mound materials, disposal of these materials will be a Class I landfill located in Kern County. Surrounding land uses are predominantly agricultural and undeveloped properties.

1.4 AGENCY APPROVALS

If the shell mounds were to be removed, other agency approvals would be required, as shown in Table D-2.

Table D-2. Other Agencies with Review/Approval over Shell Mound Removal

Permitting Agency		Anticipated Approvals/Regulatory Requirements
Federal	U.S. Army Corps of Engineers (USACE)	Clean Water Act (CWA) Section 404 (under Nationwide Permit No. 12)
	U.S. EPA	Clean Water Act (CWA) Hazardous Materials Disposal Requirements
	U.S. Fish and Wildlife Service (USFWS)	Section 7 Consultation under Federal Endangered Species Act (if necessary)
	National Marine Fisheries Service (NMFS)	
State	California Coastal Commission (CCC)	Coastal Development Permit

	Central Coast Regional Water Quality Control Board (RWQCB)	Section 401 Water Quality Certification and National Pollutant Discharge Elimination System (NPDES) permit; Extension of Central Coast RWQCB (Clean Water Act [CWA] Section 401 Certification (September 3, 2004)
Local	Santa Barbara County Air Pollution Control District (SBCAPCD)	Authority to Construct Permit

2 ISSUE AREA ASSESSMENT (FULL REMOVAL OF SHELL MOUNDS)

This section provides analysis of the range of effects full removal of the shell mounds would potentially have on public trust resources and values. Each section defers to the description of the resource setting provided in Section 4 of the Assessment and analyzes the effects of the shell mounds removal by dredging in the context of each resource setting.

2.1 COMMERCIAL AND RECREATIONAL FISHING

The removal of the shell mounds would require dredging machinery and vessels to be onsite and transiting within and outside the SBC for approximately 6 to 7 months. Mound removal may take longer if inclement weather and unforeseen issues delay vessel operations.

Dredging would release the contaminants encased within the shell mounds (see Section 2.2, *Marine Water Quality)*. These contaminated materials would likely cause short-term exceedances of water quality standards or objectives during operations within 500 feet or less of the shell mounds. Dredging would likely kill or dislodge seafloor fish and invertebrates in and on the mounds and disturb the sediments in a small portion of the designated Essential Fish Habitat (EFH) areas. Demolition of the Hazel caissons would also require the use of mechanical cutting equipment to cut and remove the caisson materials from the seafloor. Initially, and for many years after shell mound removal, the seafloor bottom would be a different grain size than the surrounding natural area (see Section 4.3.3, *Marine Biological Resources* of the Assessment). In areas, up to 1 miles upcoast and downcoast of the shell mounds (see calculations in Section 2.2 in regard to the area affected by settling particles), fish habitat would likely be less diverse until gradual mixing and natural sedimentation transformed the affected area to the natural seafloor. Over time, soft sediment organisms would recolonize the former hard-bottom mound areas.

Midwater fish would be disturbed and many would avoid the area due to physical disturbance and noise. Fish that do not leave would be exposed to suspended sediments, die, or lose their ability to forage. Mound area fish colonies would change from those associated with reefs (like lobsters and rockfish) to those associated with sandy, soft bottom (like halibut) following removal of the shell mounds and restoration of the soft-bottom habitat.

Fishing operators would likely be required to retain up to a 1 nm buffer between their activities and mound removal operations. This exclusion zone would force commercial fishing operators and anglers to move into areas that may already be fished, potentially causing crowding and overfishing in those areas.

2.1.1 Commercial Fisheries

During dredging operations, commercial fisheries would experience short-term temporary displacement of approximately one nautical mile around each mound. Commercial fishing operations could be temporarily displaced for one to two seasons, depending on the shell mound removal schedule and weather. It is most likely that removal would be scheduled during months with typically milder weather, usually late April to late October, which would overlap by about 4 months with the 9-month halibut season and about 1 month of the lobster season. Year-round fisheries would overlap with the dredging operations for about 6 months. Scheduling can and most likely would change due to bad weather, equipment availability or failure, and operational adjustments. Therefore, fishing operators should expect to avoid the shell mounds areas for part of one season and displacement could last into a second season.

Habitat disturbance and harm to fish would occur during removal of the shell mounds and would be limited geographically to areas within 1 mile radius of the mounds. Dredging would result in the displacement or permanent loss of all invertebrates and some fish residing on or near the shell mounds, such as crabs, lobsters, and sea cucumbers. Any extant species on the shell mounds would be removed by the dredge and their habitat would be destroyed. During mound removal, fish and habitat would also be disturbed and individual fish may die as a result of dredging activities, increased turbidity and water contamination, and vessel anchoring.

Dredging equipment and vessels could transit over stationary fishing gear (traps and lines), conflict with other fishing operations, and cause boating accidents possibly triggering oil/fuel spills and sinking of debris. Use of existing oil and gas established corridors between the mound sites and Casitas Pier and Santa Barbara Harbor would limit vessel and fishing gear conflicts between the mound sites and Santa Barbara County shore. There are no corridors accessing POLA/POLB other than the VTSS lanes.

Following removal of the shell mounds and restoration of the soft-bottom habitat, commercial fisheries would experience an increase in soft-bottom species, such as halibut, with permanent loss of low-quality artificial reef-type habitat for hard-bottom species, such as rockfish. After removal is complete, the halibut trawl fishery would slowly recover in the vicinity of the shell mounds. Shell mound removal would allow the possibility of trawling in the area not currently accessible to the fishery. Commercial trap fisheries that target species, such as crabs and lobsters, on and near the shell mounds would lose about 4 acres of low quality habitat, and the trawl fishery would slowly gain about 1,000 acres over many years. The quality of halibut and possibly sea cucumber habitat would depend on how well the disturbed area recovered.

Shell mound removal would dispose of contaminated materials currently encased within the shell mounds. However, residual contamination dispersed during dredging may cause limited toxicity to commercially important species. There would be a small potential for fish and shellfish consumption of residual materials and accumulation of contaminants in tissues. While these levels would not be substantial and would decrease over time as natural sedimentation and mixing disperses, dilutes, and degrades contaminated materials on the seafloor, the area surrounding the shell mounds may be closed to fishing until monitoring indicates that contamination levels are within accepted limits. Additionally, if oil contamination occurs from release of the encased drilling muds, closure of the area to facilitate response and cleanup would occur commensurately and may require several months of coordinated response from local and State agencies.

2.1.2 Recreational Fishing

As with commercial operators, recreational anglers would be required to avoid the shell mounds area for one to two seasons, experience permanent loss of low quality hard bottom reef-type habitat over the long term and have more opportunities for fishing for halibut and other soft bottom fish following restoration of the shell mounds area.

Removal operations would likely occur during 5 months of the rockfish season, likely during 4 months of the scorpionfish season, and about half the year, overall. Scheduling changes could extend into a second rockfish and scorpionfish season. Boat anglers and commercial charters could be disrupted by unmanaged removal operations and boats and barges transiting between the mounds and area piers and harbors. Habitat disturbance and harm to fish would occur as described above for commercial fishing. Similarly, the area surrounding the shell mounds may be closed to fishing until monitoring indicates that contamination levels are within accepted limits. Additionally, if oil contamination occurs from release of the encased drilling muds, closure of the area to facilitate response and cleanup would occur commensurately and may require several months of coordinated response from local and State agencies.

Recommended Measures to Address Potential Effects of the Shell Mounds Removal

Several actions would address shell mounds removal effects on fishing activities and the resource, including addressing potential space use conflicts and fish habitat issues.

1. **Removal Operations Scheduling** -- Work with fishing interests to schedule removal operations with the goals of causing the least amount of disruption during fishing seasons, minimizing the amount of area for vessel/equipment staging and standby in the mounds removal area, and maintaining safe operations to avoid damage to fishing equipment.
2. **Space Use Conflicts** -- Minimize dropping debris overboard and anchor scarring. Conduct post-removal surveys to locate and pick-up dropped equipment/debris and smooth the seafloor. Provide at least a 30-day advance notice of pending activities to the Joint Oil Fisheries Liaison Office (JOFLO) and post the notice at Harbor Masters offices in Morro Bay, Avila, Santa Barbara, Ventura, Channel Islands, and Port Hueneme. Provide the information to the Eleventh Coast Guard District for posting in the Local Notice to Mariners. Include a description of the proposed action, a map of the project and disposal sites, exclusion zone parameters, and an estimate of the expected duration of project activities.

3. **Vessel Conflicts** -- Use existing vessel traffic corridors established through a cooperative vessel traffic corridor program administered by the JOFLO. Working cooperatively with fishing fleets operating in the areas, identify, establish if necessary, and use corridors or routes for vessels transiting between the shell mounds and the POLA/POLB to help manage project-related vessel traffic accessing POLA/POLB.
4. **Habitat and Fishery Resources** -- Monitor contaminant levels in representative species before and after removal operations to determine whether mound removal results in significant changes in tissue contaminant concentrations. If the post-removal contaminant levels exceed human health regulatory action levels, commercial and recreational fishing in this area could be restricted until levels decline below the risk threshold. Prepare and abide by an approved OSCP. Monitor long-term seabed recovery in dredged areas.

2.2 MARINE WATER QUALITY

Effects to water quality due to shell mound removal would likely result from resuspension of shell mound materials and natural bottom sediments, contaminant remobilization, redeposition of residual mound materials and associated contaminants, and discharges of dewatering effluent.

All dredging projects generate residuals, which refers to the contaminated sediments found on the post-dredging surface, either within or adjacent to the dredging footprint (USACE 2008). The dredge process deliberately stirs up the material being removed. Some small portions of the material stick to the outside of the bucket and fall off during the raising of the bucket. There are always some residual remnants of the material in the lower portions of the dredge area where the previous bottom sediments mix slightly with the upper materials. No amount of dredging can completely remove that residual component.

During shell mounds removal, fine-grained material would immediately go into suspension during the lowering of the bucket onto the ocean floor, during dredging, and during the raising of the bucket. Even if maximum feasible care is taken with the dredging operations, the limitations of dredging under open ocean conditions would result in dispersal of approximately 10 percent of the shell mound material into the water column and onto the surrounding seafloor (Palermo 2004, cited in Chevron 2005). Depending on the current velocity, this small amount of material can end up several hundred feet away from the dredge area. While this is a small component of the dredge material, this could constitute up to 6,180 cy of potentially contaminated material dispersed into the water column. This material could remain in suspension for several hours. However, the majority of the material would likely fall within the dredge footprint.

The transfer of the material to the barge could also generate a small amount of material if it falls from the bucket into the water as it is reaches the surface. This would also be impossible to capture since some of the material is sticky enough that it would not fall until the buoyant weight changes when it reaches the surface.

Residual shell mound materials that are redeposited following dredging would represent a short-term (weeks to months) source of sediment quality degradation. As discussed above, particle-bound contaminants associated with materials that are resuspended or spilled during dredging and smoothing of the seafloor are expected to be dispersed by local currents and eventually settle and accumulate on the bottom. Larger cutting particles would settle close to the original mound footprint, whereas the smaller diameter, drilling mud particles would be dispersed over a relatively larger area. Consequently, the area of the footprint associated with settling particles could be considerably larger after dredging and seafloor smoothing than the original footprint of the shell mound, although the thickness of this layer of settled particles would likely be small. The settled particles would not become resuspended given the depth of the seafloor and ongoing natural sedimentation that would gradually bury the residuals.

The area affected by settling particles can be estimated from the settling rate of particles and the mean current velocity. Assuming a maximum water depth of 130 feet (40 m), a current velocity of 0.3 feet per second (feet/s) (10 centimeters per second [cm/s]), and a particle settling rate of 0.0046 feet/s (0.14 cm/s) (for coarse silt-sized particles), shell mound particles would settle within 2 miles (3.2 kilometers [km]) of the site, primarily at the same depth of the mound up- and down-coast from the site. Larger particles, such as sand and gravel-sized cuttings would settle closer to the original mound site. Similarly, sediments suspended from the bottom during smoothing would settle closer to their origin than similar-sized material spilled at the surface. Some of the larger particles and residual debris would be removed and/or mixed and diluted with the natural bottom sediments during final site smoothing. Consequently, the thickness of the residual shell mound layer accumulating within a particular area of the seafloor is expected to be small, and residual materials would not be expected to cause substantial changes to the texture (grain size). However, there is no current method for accurately predicting post-dredging residual concentrations (USACE 2008) and no sediment quality criteria exist as the basis for objectively defining sediment quality degradation.

Dredging the shell mounds, loading dredged materials onto barges, and restoring the soft-bottom habitat area would result in elevated suspended sediment and contaminant concentrations near the dredging site. Since sediments within the shell mounds contain elevated concentrations of chemical contaminants, dredging operations are expected to release both particulate- and soluble-phase contaminants to the water column, which could result in short-term exceedances of water quality standards or objectives. Also, the shell mounds contain petroleum hydrocarbons that could rise to the water surface and form an oily sheen. Some of the contaminants present in the shell mounds have the potential for causing acute toxicity and/or bioaccumulation in the tissues of exposed organisms. Subsequent deposition and accumulation of natural sediments and mixing of residuals with existing sediments would progressively reduce the extent of any changes in sediment texture or sediment quality related to the presence of residual shell mound materials. However, while such releases may not affect marine water quality over the long-term, they may be expected to result in the temporary shutdown of commercial and recreational fisheries and direct loss in marine habitats and species (*see* Section 2.1*. Commercial and Recreational Fisheries* and Section 2.3, *Marine Biological Resources*).

Maximum water column concentrations of chemical contaminants associated with dredging operations at the shell mounds are estimated and compared to the instantaneous and average water quality standards contained in the 2019 COP (Table 3, formerly Table B, *Water Quality Objectives*) and U.S. Environmental Protection Agency (USEPA) water quality criteria. The water column concentrations were estimated using the concentrations measured in the mound core samples (AMEC 2002b) and the assumptions that all contaminants would be associated with the particulate phase that would be characterized by suspended solids concentrations of 300 mg/L near the dredging site and 100 mg/L at a distance of 330 feet (100 m) from the dredging site. Chemical analyses of samples from each shell mound demonstrated the presence of elevated contaminant concentrations at all four of the shell mounds of barium, chromium, lead, zinc, nickel, vanadium, and petroleum hydrocarbons (de Wit 2001; AMEC 2002b). At the Heidi shell mound, these comparisons indicate that concentrations of chromium and zinc may be expected to exceed the COP daily maximum values, and copper may exceed the USEPA acute toxicity values. At the Hazel, Hilda, and Hope shell mounds, these comparisons indicate that concentrations of copper, chromium, zinc, PCBs, and, at the Hazel shell mound site only, PAHs, may be expected to exceed COP and/or USEPA acute toxicity values. At a distance of 330 feet (100 m) from each dredging site, PCB concentrations may exceed the COP limits at the shell mound sites, and chromium, copper, and PAHs may exceed the objectives at the Hazel shell mound site only.

Additionally, the presence of debris in the shell mounds could result in higher concentrations of suspended solids due to incomplete closing of the dredge bucket. Under these conditions, estimated contaminant concentrations (assuming three-fold higher suspended sediment concentrations) would be proportionally higher, and the frequency and magnitude of exceedances would increase.

Releases during dredging shell mound materials that contained free product (oil) could generate a slick or sheen on the water surface in the vicinity of the dredging site. The spatial extent and persistence of the slick would depend on the amount of material released and local weather and sea conditions. Under calm conditions, a surface slick would be expected to persist for a relatively greater period of time, whereas strong winds with wind-induced surface turbulence (such as wind chop) would rapidly disperse the slick. Rapid losses to the atmosphere of volatile aromatic hydrocarbons would minimize the potential for toxicity to aquatic organisms. Although the oil slick would not be expected to substantially degrade water quality, formation of an oil sheen would potentially violate California Department of

Fish and Wildlife (CDFW) Office of Spill Prevention and Response (OSPR) and USCG regulations and require response and clean up from local and State agencies. Because the exposed interior of the shell mounds would be a continuing source of the soluble oil sheen, any attempt to mitigate the losses from the dredge bucket by slowing the dredging process would be counterproductive. Depending on the size of the surface slick and the conditions, closure of the area to facilitate response and cleanup would occur commensurately and may require several months of coordinated response from local and State agencies.

Following completion of dredging operations, suspended sediment plumes would disperse and contaminant concentrations would decrease rapidly to levels below the water quality objectives. The terms and conditions of the dredging permit and Waste Discharge Requirements (WDR), including the applicability of COP and/or USEPA water quality standards, and allowance for and size of a mixing zone for determining compliance with receiving water limits, are uncertain. Given the possible variations in these factors, removal could cause conditions that violate water quality standards or waste discharge requirements.

Excess water from the dredged shell mound materials would be treated and discharged at the dredging site. Based on an estimated volume of 45,500 cy for the shell mounds plus the estimated overdredge volume of 16,300 cy and moisture content of 30 percent by volume (not including the volume of water in the dredge bucket), the approximate volume of the dewatering effluent discharge would be 18,549 cy (3.74 million gallons).

The dewatering effluent would be treated using a barge-based treatment system and then discharged at the dredging site in accordance with a WDR issued by the RWQCB. The settleable solids and contaminant concentrations in the discharged decant waters would be expected to meet the effluent limits specified in the WDR. The RWQCB typically assigns maximum settleable solids concentrations for decant waters of 1 ml/L, but generally assumes that the plume will mix to background within a 330-foot (100 m) radius of the dewatering barge. Daily monitoring of the effluent would be required to demonstrate that the effluent limits are not exceeded.

The discharge plume from the dewatering treatment process would mix and dilute rapidly with site waters. With the implementation of a water treatment system to meet the WDR limits, impacts to marine water quality from dewatering effluent discharges would not be substantial. However, because treatment and discharges of the dewatering effluent would occur simultaneously with, and in the vicinity of, the dredging operation, it is possible that the plume from the effluent discharge could overlap with suspended sediment plumes generated by dredging, thereby contributing to exceedances of water quality objectives. Additionally, if a spill were to occur of untreated decanted water, effects on water quality would be elevated in the vicinity of the spill and may require response and cleanup from local and State agencies.

In summary, removal of the shell mounds would release contaminants to site waters at concentrations that could temporarily exceed federal and State water quality objectives.

Mechanical dredging operations also could cause the formation of a surface sheen of oil. Although these impacts would be temporary, non-recurring, and likely to occur only within a limited portion (depth range) of the water column and within an approved mixing zone, as defined by a WDR and dredging permit, as a worst-case scenario they could exceed water quality standards and significantly degrade water quality from transport and disposal of dredged materials, vessel anchoring, seafloor restoration, and discharges of dewatering effluent. While such degradation would be short term (e.g., weeks to months), during this period the area may be closed to commercial and recreational fishing and other beneficial uses.

Recommended Measures to Address Potential Effects of Removing the Shell Mounds

Potential effects on marine water quality from removal of the shell mounds can be reduced with the following conditions of approval for Chevron:

1. Chevron shall have in place, prior to beginning operations, an approved, project-specific OSCP addressing spill prevention and spill response measures for any accidental release of hydrocarbons. The plan shall identify key points of contact, vessels and equipment to be used in the project, contractors, schedules, and procedures. The plan shall be prepared and submitted to the CSLC and CDFW, and OSPR, Marine Safety Branch, for approval.
2. Ensure the OSCP addresses potential oil spill containment and management, including monitoring for the occurrence of an oil slick from released drilling muds.
3. Use dredging practices for contaminated sediments that minimize: (1) resuspension of bottom sediments, (2) leakage/spillage of dredged solids and entrained water through bucket seals and vents during retrieval, and (3) overflow from barges.
4. Sixty (60) days prior to commencement of dredging, Chevron shall submit a Plan for implementing Best Management Practices (BMPs) to reduce suspended sediment levels in site waters to ensure that Total Suspended Solids (TSS) concentrations do not exceed 100 mg/L at a distance of 330 ft (100 m) from the barge.
5. Chevron shall provide an onsite response team with equipment (e.g., booms and skimmers) capable of containing and removing an oil slick formed near the shell mound sites.

2.3 MARINE BIOLOGICAL RESOURCES

Full removal of the shell mounds would involve dredging, anchoring, seafloor restoration, effluent discharges, and caisson removal operations at the Hazel shell mound that would result in short-term and localized changes in water quality and noise that could interfere with the movements of resident and migratory species. Limited adverse impacts to sensitive resources would occur with implementation of full removal of the shell mounds. No designated critical habitats occur in the vicinity of the shell mounds, the mounds do not provide suitable habitat to sustain endangered species, such as black or white abalone, and no listed fish species occur on or adjacent to the shell mounds. Most construction-related impacts to sensitive wildlife (if present in the vicinity) would be adverse. There is a low potential for vessel collision with marine mammals or sea turtles, and the potential for significant contaminant release during dredging or transport of dredged materials.

The process of removing the shell mounds would disturb the marine environment in several ways. Disturbance of the shell mound sediments by dredging would kill or dislodge the benthic organisms that currently inhabit the mounds and immediately surrounding soft bottom habitat, create turbidity, and release contaminants to the environment.

All of the benthic invertebrates that live in or on the shell mound sediments would be displaced or destroyed by dredging of the mounds. Following shell mounds removal, the disturbed area would be recolonized over time by soft-bottom seafloor organisms rather than reef-dwelling organisms because the sea floor would no longer be a high relief feature and would not provide hard surfaces for attachment. The seafloor substrate remaining after the removal of the shell mounds would be of a different grain size and nature than the natural soft bottom sediments and would contain elevated levels of contaminants. Therefore, the benthic community that would develop in the location of the shell mounds and the immediately surrounding area (up to 1 mile upcoast and downcoast of the shell mound sites) would be different than and probably less diverse than the natural soft bottom community.

Over time, as natural processes of sedimentation and mixing occur, the sediments in the location of the shell mounds would gradually become similar to the natural soft bottom and the benthic community would resemble natural soft bottom communities in the area. However, this process would be expected to take many years. The 2005 Habitat Equivalency Assessment (HEA) and the 2012 HEA Update assumes that after 70 years, 4 inches of sediment would accumulate over the shell mounds, and that the shell mounds would have a similar habitat value to soft-bottom habitats (Dunford et al. 2005; 2012). The USEPA accepts that 4 inches of sediment represents the biologically active zone, where the majorities of sediment dwelling organisms live, feed, and/or reproduce.

Fishes within the proposed dredging area would be disturbed by the dredging operations. Many fishes may be able to avoid the dredging areas, but some fishes would likely be subjected to suspended sediment from the dredge (see Section 2.1, *Commercial and Recreational* Fishing and Section 2.2, *Marine Water Quality*). Fishes exposed to suspended sediments in the laboratory have been shown to suffer mortality as well as sublethal signs of stress (Soule and Oguri 1976; O'Conner et al. 1977). Although fishes in the natural environment would probably leave the dredging area before turbidity became lethal, sublethal effects, such as reduced foraging, would be likely to occur. In addition to the turbidity, the noise and disturbance associated with the dredging could cause fishes to avoid the dredging area.

Fishes, such as rockfishes, associated with rocky reefs would permanently lose the 4 acres of hard-bottom habitat provided by the shell mounds. Because reef habitat is limited in the SBC, it is unknown whether they would be able to become established in reef habitat elsewhere in the area. In addition, the turbidity from dredging and the physical presence of the dredge could interfere with foraging by seabirds and marine mammals.

Based on the analysis in Section 2.2, *Marine Water Quality*, dredging would be expected to release both particulate and soluble-phase contaminants to the water column, which could result in short-term exceedances of water quality standards or objectives. The analysis estimates concentrations of copper, chromium and zinc, PCBs and, at the Hazel shell mound only, PAHs, may exceed water quality standards in the immediate vicinity if the dredge sites. At a distance of 330 feet (100 m) from the dredging, contaminant levels may exceed COP objectives.

Dredging the shell mounds is expected to take 3 to 4 weeks per site. Following completion of dredging operations, suspended sediment plumes would disperse and contaminant concentrations would decrease rapidly to levels below water quality objectives. Therefore, during dredging, water column organisms would briefly be exposed to elevated levels of contaminants at concentrations that could have adverse effects. This exposure would be limited to the period of dredging and the area within 500 feet or less of each shell mound.

Vessel traffic during dredging or transport of materials to POLA/POLB poses a risk of collision with marine mammals or sea turtles. However, since marine mammals and sea turtles are infrequently observed in the project area, this risk is extremely low.

Underwater noises generated from dredges, barges, and support vessels have the potential to disturb marine wildlife. For example, Richardson et al. (1995) noted that whales may be able to detect dredge noises above ambient levels as far away as 12 to 15.5 miles (19 to 25 km) and may avoid areas due to noise sources. Sound characteristics of bucket dredging and barge loading include both impulse and longer-duration noises because of the repetitive sequence of sounds generated by winches, bucket impact with the substrate, bucket closing, and bucket emptying. Sound exposure data available from dredging operations studies indicate that underwater dredging sounds are typically low-intensity (i.e., sound pressure levels [SPLs] <190 decibels [dB] re 1μPa at 1 meter) and non-impulsive, with frequencies below 1,000 kHz. Dredging sound exposure characteristics, in terms of SPLs and frequencies, are similar to sounds emanating from commercial ship traffic. Based on the observations of dredge-induced sound effects on marine mammals, the available data indicate that dredging sounds do not pose a significant risk to direct injury or mortality to aquatic biota (McQueen et al., 2019). Dredging noise levels could be reduced further provided the equipment is well-maintained and lubricated. Also, use of marine wildlife monitors and the implementation of a Safety Zone during dredging operations will help avoid impacts to biological resources (see Measure No. 4 below).

Recommended Measures to Address Potential Effects of Removing the Shell Mounds

Potential effects on marine biological resources from removal of the shell mounds can be reduced with the following conditions of approval for Chevron:

1. Chevron shall have in place, prior to beginning operations, an approved, project-specific OSCP addressing spill prevention and spill response measures for any accidental release of hydrocarbons. The plan shall identify key points of contact, vessels and equipment to be used in the project, contractors, schedules, and procedures. The plan shall be prepared and submitted to the CSLC and CDFW, OSPR, Marine Safety Branch, for approval.
2. Ensure the OSCP addresses potential oil spill containment and management, including monitoring for the occurrence of an oil slick from released drilling muds.
3. The clamshell bucket dredge shall be well maintained and lubricated to minimize dredging sounds.
4. To minimize potential impacts on large cetaceans and sea turtles, marine wildlife monitors would be present and shall employ the following operational procedures daily:
    a. During vessel transit:
        - Make every effort to maintain the appropriate separation distance from sighted whales and sea turtles;
        - Do not cross directly in front of (perpendicular to) migrating whales or sea turtles;
        - When paralleling whales, the vessels will operate at a constant speed that is not faster than that of the whales;
        - Care will be taken to ensure that female whales are not to be separated from their calves; and
        - If a whale engages in evasive or defensive action, the vessels will reduce speed or stop until the animal calms or moves out of the area.

    b. During dredging operations: The marine wildlife observer will establish avoidance Safety Zones around the primary work area for the protection of whales and sea turtles. A 1,000-foot (304.8-meter) radius avoidance Safety Zone will be implemented for large whales and sea turtles. The Safety Zone will be based on the radial distance from the center of the work area. If the marine wildlife observer should observe whales or sea turtles within the Safety Zone, the behavior of marine animal will be monitored, and the Field Supervisor or Project Manager will be alerted of the potential for an imminent shut down. If the whales or sea turtles within the Safety Zone displays abnormal behaviors or distress, the marine wildlife observer will immediately report that observation to the Field Supervisor who will shut-down operations, if deemed necessary by the marine wildlife observer, unless those actions will jeopardize the safety of the vessel or crew.

5. In the unlikely event that a marine mammal is injured, the vessel operator shall notify the Stranding Network Coordinator at NOAA Fisheries in Long Beach and the Channel Islands Marine & Wildlife Institute so that a rescue effort may be initiated.

2.4 GEOLOGIC HAZARDS

Geologic hazards, such as seismically induced slope failure, would not occur at the four shell mounds because the shell mounds would be removed. Therefore, seismic impacts to the shell mounds would not occur under full removal.

Offloading of dredge materials at the POLA/POLB will not result in any new facility construction and will result in only temporary activities within the port. Accordingly, full removal is not expected to have any effects on geological resources with respect to sediment disposal.

Removing the shell mounds would not preclude access to any known geologic/mineral borrow sites or oil and gas reserves beneath the mounds. Petroleum reserves beneath the shell mounds could be accessed from remote locations using directional (or slant) drilling techniques. Therefore, impacts to mineral resources would not occur.

In the event that a seismic event occurred prior to or during removal of the shell mounds, geologic hazards and related effects would be similar to those described in Section 5.4, *Geologic Hazards* of the Assessment.

2.5 ADDITIONAL RESOURCES

2.5.1 Recreation and Public Access

<u>Public Access and Land Use</u>

The proposed removal, dredging, and disposal activities would not preclude the public's right to access to coastal areas and would not occur in an environmentally sensitive habitat. The shell mounds are not located within a designated Marine Protected Area (MPA) and all in-water activities would be short-term and concentrated at the shell mound sites at distances of several miles from existing MPAs. Shell mound removal would be reviewed by the CCC for consistency with the California Coastal Act (CCA). The removal project would be sited, designed, and constructed consistent with the guidelines stipulated in CSLC regulations governing the surrender of lands previously leased for oil and gas operations. The shell mounds and the Hazel caissons would be removed in a phased approach which is estimated to require up to 16 weeks (3 to 4 weeks per mound) for direct removal activity with equipment mobilization activities extending for several weeks between each mound removal. As necessary, an adaptive management approach would be used that would apply the results from each removal operation to improve the efficiency of the dredging or dewatering operations or reduce impacts with subsequent removal operations. As discussed below, removal of the shell mounds would result in limited direct impacts to recreation, although potential short-term to mid-term closure of the areas affected by contaminant releases may limit recreational activity within affected areas.

Recreation

Dredging and construction monitoring equipment (clamshell dredge, hopper barges/scows, tugboats, and monitoring vessels) would be active in the SBC to support proposed in-water activities for up to 16 weeks (approximately 4 weeks per mound). In addition, demolition of the Hazel caissons would be conducted using mechanical cutting devices. A 3,000-foot hazard safety zone would be established around the Hazel shell mound site during caisson removal activities, with proposed activities occurring over a 45-day period. Recreational vessels would be temporarily precluded from the shell mound sites during these removal activities. Specifically, recreational boats would be restricted from within a ¼-mile radius of dredge and barge anchorage areas. All construction areas would be listed in the Local Notice to Mariners, along with the projected schedule.

In addition, dispersal of contaminants release during mound removal of more than 3 million gallons of decanted water would create turbidity and declines in water quality which may affect recreational fishing and boating. Depending upon the degree of contaminant release and agency responses, waters surrounding the shell mounds may be closed to recreational activities over the short to midterm until monitoring demonstrates that contaminant levels are within acceptable limits.

Transport and offloading of the shell mound material at the POLA/POLB would require the use of approximately six barges/tugboats to transport dredged material from the shell mound sites. Barges/tugboats would be active within the port waterways and would likely transit within the same corridors used by recreational boaters. Standard existing safety precautions governing POLA/POLB navigation would apply to all barges traveling through harbor waters. Therefore, the short-term presence of these vessels in the vicinity of recreational boaters during disposal of the shell mound materials is unlikely to adversely affect marine recreation opportunities.

The shell mounds vicinity is used primarily for commercial/industrial shipping activities, such that interference with pleasure craft traffic located in the immediate construction area would be nominal. However, because recreational vessels would be temporarily precluded during removal activities, shell mound removal would adversely affect recreation.

2.5.2 Air Quality and Greenhouse Gases

Emissions from removal of the shell mounds and transport to POLA/POLB could affect air quality and greenhouse gas emissions in one or more of the following air basins: the Santa Barbara County and Ventura County portions of the South Central Coast Air Basin (SCCAB), the South Coast Air Basin (SCAB) and the San Joaquin Valley Air Basin (SJAB). Air quality within these basins is regulated by the Santa Barbara County Air Pollution Control District (SBCAPCD), Ventura County Air Pollution Control District (VCAPCD), South Coast Air Quality Management District (SCAQMD) and San Joaquin Valley Air Pollution Control District (SJVAPCD), respectively.

For shell mounds removal, emissions would occur within the following areas: (1) at the shell mound sites offshore Santa Barbara County during removal or material placement activities, (2) between these sites and the POLA/POLB due to the transport of materials by vessels, (3) between the POLA/POLB and Kern County to transport the materials by truck, and (4) between the Casitas Pier Facility in Carpinteria and the shell mounds. Since the only proposed activities in Ventura County would be associated with vessel transport, transportation through Ventura County coastal waters would be regulated by the California Air Resources Board (ARB), rather than the VCAPCD.

Activities that would generate emissions include (1) marine equipment (tugs, barges, cranes) used to remove and transport dredged materials to a disposal site; (2) terrestrial equipment (excavator, loader) used to load and transport dredged material; and (3) vehicles used to provide supplies and materials.

The SBCAPCD regulates stationary sources of air pollution in the County, develops guidelines to determine the significance of air quality impacts, and develops plans to bring the County into attainment of California and National Ambient Air Quality Standards (AAQS). The SBCAPCD developed the 2013 Clean Air Plan (SBC 2015) to update the attainment planning process. In addition, the SBCAPCD has adopted the 2019 Ozone Plan to address the County's nonattainment of State's ozone standard.

The SCAQMD regulates stationary emission sources within its jurisdiction and has developed the Final 2016 Air Quality Management Plan (SCAQMD 2016) to bring the region into attainment of the California and National AAQS. The SCAQMD also adopts rules and regulations, as needed, to implement its air quality plans and to control emissions from stationary sources located in the District. Currently, the District is completing an update to the AQMP to address changes to the National AAQS.

The SJVAPCD regulates stationary sources of emissions within the San Joaquin Valley Air Basin. The SJVAPCD has developed rules and air quality attainment plans designed to reduce emissions to a level will bring the region into attainment of the State and Federal ambient air quality standards. The District has developed plans to address Particulate Matter (2018), Ozone (2016) and Carbon Monoxide (2004).

Air quality impacts associated with shell mounds removal could affect air quality in more than one air basin and corresponding air jurisdiction. Factors used to derive source emission rates were obtained from the following sources: (1) the ARB EMFAC2007 on-road mobile source emissions model (ARB 2006a); (2) the ARB OFFROAD2007 Model (ARB 2006b); and (3) special studies on vessel emissions (POLB 2007).

Shell mound material removal and transport activities in the Santa Barbara County region would generate emissions from quasi-stationary sources (clamshell bucket dredge and auxiliary extraction equipment, such as cranes and winches) and mobile sources (tugboats and dive/support vessels). The majority of sources would be diesel-powered. Emissions would occur at the shell mounds sites and along barge routes between these sites and the POLA/POLB.

In accordance with VCAPCD guidelines, the emissions occurring within VCACPD areas would remain substantial but would not be significant as they would be short-term construction emissions.

Activities within the SCAB would generate emissions from diesel-powered tugboats used to transport materials from the SCAB boundary (the Los Angeles/Ventura County line) to the POLA/POLB and from mobile equipment and trucks used to handle and transport the caisson material from the POLA/POLB to an upland recycling facility as well as trucking of dredge materials to Kern County.

Finally, truck trips from Los Angeles County to Kern County would generate diesel emissions within Kern County and the SJVAPCD jurisdiction.

Construction activities for the Full Removal (including removing the shell mounds and the Hazel caissons, transporting materials to the POLA/POLB, handling and dewatering materials onshore, and transporting materials from the POLA/POLB to a disposal site in Kern County) would generate substantial amounts of air emissions including NO_X and reactive organic gases (ROG), two precursors of harmful ozone pollution.

	Air pollutants: Total English Tons			
Phase	**NOx**	**ROG**	**PM10**	**CO**
Dredging	39.46	3.20	1.91	12.54
Hazel Caisson Removal	21.77	1.78	1.05	7.00
Dewatering/Physical Stabilization	1.21	0.14	0.06	1.47
Offshore Water Treatment	0.02	0.01	0.00	0.04
Post Site Survey/Leveling	0.83	0.07	0.04	0.27
Construction Monitoring	6.50	0.72	0.36	2.62
Disposal	3.34	0.14	0.06	1.49
Total	**73.14**	**6.06**	**3.49**	**25.43**

Projected NOX emissions associated with activities in the South Coast Air Basin and Santa Barbara County would greatly exceed the construction emissions thresholds established by the SCAQMD and the SBCAPCD, respectively. ROG emissions in the South Coast would also exceed the SCAQMD's thresholds.

Combined with projected regional traffic growth and other projects, truck transportation of dredged material from the POLA/POLB to a Kern County disposal facility would contribute to a significant cumulative health risk from emissions of PM_{10}, a contaminant in truck exhaust, within the South Coast Air Basin. Moreover, onshore dewatering of the shell mound material would generate strong, objectionable odors that could impact port workers, users, and residents downwind of the dewatering site.

Even accounting for feasible mitigation measures, emissions from the Full Removal of the 4H shell mounds would exceed applicable significance criteria on both a project-specific and cumulative basis.

Activities within all project regions combined would generate a total of 7,613 tons of CO_2E emissions. Sources considered in these emission estimates are the same as those analyzed for criteria pollutants. This results in a net increase in GHG emissions and potentially would conflict with the State goal (SB 32) of reducing GHG emissions in California to 40% below 1990 levels by 2030. In addition, Executive Order S-3-05, signed June 1, 2005, established a GHG reduction target of 80% below 1990 levels by 2050 and the California Air Resources Board's 2022 Scoping Plan establishes a target of carbon neutrality in California by 2045. The total GHG emissions from activities would not exceed the significance threshold of 10,000 metric tons per year of CO_2E.

Phase	GHG: Total Metric Tons			
	N2O	CH4	CO2	CO2E
Dredging	0.104	0.048	2316.4	2346.2
Hazel Caisson Removal	0.057	0.026	1272.3	1288.7
Dewatering/Physical Stabilization	0.006	0.011	240.7	242.6
Offshore Water Treatment	0.000	0.001	14.0	14.1
Post Site Survey/Leveling	0.002	0.001	48.9	49.5
Construction Monitoring	0.017	0.011	394.3	399.4
Disposal	0.306	0.026	3188.6	3272.8
Total	**0.494**	**0.124**	**7475.2**	**7613.4**

Recommended Measures to Address Potential Effects of Removing the Shell Mounds

As emissions could cause an exceedance of thresholds in Santa Barbara County and in the SCAQMD, the following measures should be implemented to reduce emissions:

1. Chevron shall use construction equipment that meets USEPA Tier 4 or, if not available, Tier 3 non-road engine standards.

2.5.3 Coastal Processes and Sea Level Rise

Although full removal of the shell mounds would temporarily suspend material and sediment from the mounds in the water column, removal would not affect ongoing littoral transport, wave action, or other coastal processes. After shell mound removal, littoral transport would continue to deposit natural sediments in the area at a rate of 0.04 to 0.08 inches per year. For a discussion of temporary sediment suspension and eventual deposition, please see Section 2.4*, Marine Water Quality*. Full removal of the shell mounds would not affect coastal processes.

The shell mounds currently lie under 100 to 140 feet of water. By 2030, sea level is projected to rise by approximately 0.98 feet (Ocean Protection Council [OPC] 2018). Although the GHG emissions associated with full removal would incrementally contribute to processes that cause sea level rise, the GHG emissions would not exceed the significance threshold of 10,000 metric tons per year of CO2e. Therefore, the adverse effects on climate change and associated sea-level rise would be nominal.

2.5.4 Cultural and Paleontological Resources

Any shipwreck remains or prehistoric offshore cultural material in the shell mound areas would have been disturbed by the installation of the 4H Platforms and no historically significant event has occurred since installation. Additionally, the POLA/POLB area is highly developed and is located largely on modern fill (POLB 2009). Proposed dredge materials offloading and transfer to trucks will not require construction or modification to existing port facilities. Therefore, no prehistoric or historic onshore cultural material would be affected by dredging.

2.5.5 Environmental Justice

The CSLC's Environmental Justice Policy aims to analyze and reduce impacts on environmental justice communities and to identify and increase benefits resulting from the CSLC's actions in those communities. The following section discusses the potential effects of removal of the shell mounds on environmental justice communities.

The shell mounds are located distant from any onshore population centers. As the shell mounds are located offshore, there are no populations in the vicinity of the shell mounds and thus removal itself would not result in disproportionately high or adverse health or environmental effects on minority and low-income populations. Likewise, impacts to subsistence fishing associated with changes in water quality and biological resources (from potential contamination and bioaccumulation) would not result in disproportionate impacts on minority and low-income populations. Most subsistence fishing likely occurs in shoreline areas because of the added cost of boating. Short term closure of waters surrounding the mounds due to contaminant releases may affect commercial or recreational fishing. However, mound removal would be unlikely to substantially interfere with commercial or recreational fishing over the long term by increasing the exposure of fished species to toxic or bioaccumulative substances and would not cause substantial losses of fished species or their habitats. Therefore, there would not be disproportionate impacts on minority and low- income populations associated with subsistence fishing or commercial or recreational fisheries.

However, onshore transport and disposal of the dredged material has the potential to impact disadvantaged communities, as defined in the CSLC Environmental Justice Policy, due to the existing pollution burden at the POLA and POLB, and along the route to disposal sites in the Taft/Bakersfield area. Under SB 353 (De Leon, 2012), the POLA and POLB and the communities along I-710 are designated Disadvantaged Communities. According to CalEnviroScreen 4.0, the communities in the environs around the POLA/POLB have an overall CalEnviroScreen Score of nearly 100%. In particular, along the I-710 transportation corridor, communities are burdened by significant exposure to toxic releases from facilities, diesel particulate matter, and PM2.5. These communities also rank in the 90-100 percentile for population characteristics, which reflects a high concentration of poverty, linguistic isolation, educational attainment deficits, and housing burdens.

As described in the Environmental Justice and Tribal Resources chapter of the Revised Draft Port Master Plan Update for the POLB (Jan. 2022),

> "Goods movement activities at the Port generate air pollution, including DPM, NOx, and SOx, from ships, trucks, trains, tugboats, and cargo handling equipment, thus contributing to regional air quality issues and local health risk. . . . Disadvantaged communities adjacent to the Port experience higher rates of pollution and generally consist of a higher proportion of minority and low-income populations. Air pollution sources in these disadvantaged communities generally include Port operations and goods movement activities."

As discussed in the Air Quality Section, the total NOx emissions for shell mound removal would exceed the daily construction emissions and quarterly emissions thresholds established by the SCAQMD for NOx emissions within the South Coast Air Basin during removal activities. With the absence of any identifiable offsets, mound removal will likely have an adverse impact on disadvantaged communities in the POLA and POLB area and the I-710 transportation corridor.

Additionally, disadvantaged communities around the POLA/POLB could be impacted by objectionable odors from the dewatering of shell mound materials. The dredged shell mound material is expected to be transported to an area within the POLA/POLB for further onshore handling prior to disposal, which has the potential to generate objectionable odors. Vibracore samples taken from the shell mounds contained strong petroleum odors. Other strong odors will result from the decay of organic matter within the shell mounds after removal. These odors could create a nuisance to receptors such as port workers and port residents/users located in close proximity to the shell mound material. Depending on the concentration of organic matter within the shell mound material, surrounding receptors may experience an adverse impact. Implementation of mitigation measures may help reduce objectionable odors after the shell mound material has been dewatered and during transport to upland disposal sites. However, the potential exists for adverse impacts from objectionable odors to disproportionately affect local disadvantaged communities during the dewatering phase.

Transportation and disposal of the dredged material in the Class I landfills in the Taft/Bakersfield area could also potentially impact disadvantaged communities. According to CalEnviroScreen 4.0, the route to the Taft/Bakersfield area from the POLA or POLB has some of the highest concentrations of diesel particulate matter and PM2.5 in California. Thus, transport of the dredged material could result in environmental justice impacts. Additionally, disposal of the waste at the landfill could impact disadvantaged communities within the Taft/Bakersfield area. For example, the census tract surrounding Taft (Census Tract: 6029003304) has an overall CalEnviroScreen 4.0 score of 81%. This census tract also scores in the 70th percentile for poverty and 88th percentile for unemployment. It has a pollution burden score of 96% and scores above 86% for cleanup sites, groundwater threats, hazardous waste, and solid waste. Waste transport and disposal facility operations in California are subject to extensive regulatory requirements which would help reduce impacts from transport and disposal of shell mound material. However, the potential exists for upland disposal of the dredged material to disproportionately affect disadvantaged communities.

2.5.6 Navigation, Transportation, and Traffic

<u>Vessel Transportation</u>

Removal of the shell mounds would require that dredged material be transported to the POLA/POLB. An estimated 41 round trips from the shell mound sites to the harbor complex, using up to 4 tugs, would be required to transport the dredged material. It is anticipated that vessel traffic between the shell mound sites and the POLA/POLB would use existing vessel traffic lanes to the maximum extent feasible. Specifically, support vessels would use established separation schemes while exiting the POLA/POLB and would enter the coastwise shipping lanes as soon as feasible after clearing the port breakwaters. Transit between the shipping lanes and the shell mounds sites would be accomplished by proceeding in a manner that minimizes transit outside the shipping lanes. The use of marine vessels for these alternatives would be short-term and would not involve ongoing (i.e., long-term) vessel use within the POLA/POLB region. This construction activity would not substantially contribute to offshore vessel traffic conditions.

Equipment required for removal of the Platform Hazel caissons would be similar to that used for dredging activities including: one derrick barge with two support tugs and two flat barges, each with one support tug. Caisson removal activities would occur over a 45-day period. The caisson material would be placed into a flat barge and transported to the POLA/POLB for subsequent disposal/recycling at an onshore facility. One additional trip is assumed necessary to transport removed caisson materials. However, this construction activity would not substantially contribute to offshore vessel traffic conditions.

Removal of remaining debris and final restoration/smoothing of the seafloor would be accomplished by trawling with a heavy-duty trawl net. It is estimated that the duration of this final smoothing operation could vary from a few days to several weeks. The addition of this vessel traffic is not expected to impede existing vessel traffic patterns.

As many as 25 marine vessels are expected to be mobilized from the POLA/POLB region to the shell mound sites in association with shell mound removal activities. The vessels would be demobilized at the conclusion of project activities and would transit back to the POLA/POLB region. Assuming a worst-case scenario, these marine vessels may all be mobilized or demobilized in one day. This maximum one-day vessel operation would result in 25 vessel trips between the POLA/POLB and the shell mounds on that day. However, the addition of this vessel traffic is minor given existing operations and is not expected to impede existing vessel traffic patterns.

It is anticipated that one crew boat would make two trips from Casitas Pier to the shell mounds sites with marine support equipment each workday during dredging and for the former Platform Hazel caisson removal activities. This vessel would use existing oil and gas transportation corridors established for transport to the platforms, and a Local Notice to Mariners would be posted prior to the commencement of construction activities. As such, the additional two trips per day to and from the Casitas Pier using the existing oil and gas transit corridors to the shell mound sites would not affect offshore vessel traffic.

Construction monitoring would require as many as six monitoring vessels operating offshore for approximately 64 days. It is anticipated that these vessels would be staged out of Santa Barbara Harbor and would be required to transit between the harbor and the shell mounds sites daily. Because a Local Notice to Mariners would be posted prior to the commencement of project alternative activities, the additional trips per day to and from the harbor and the shell mounds sites would not affect offshore vessel traffic.

Ground Transportation

Approximately 15 workers would transit daily to the Casitas Pier for crew boat service to the shell mound sites for a period of 16 weeks. Access to the Casitas Pier would be from U.S. Highway 101, exiting at Casitas Pass Road or Bailard Avenue, and then proceeding along Carpinteria Avenue to Dump Road. The additional 15 vehicle trips during morning or afternoon peak hours have the potential to add to the existing congestion during these peak hour traffic periods.

Construction monitoring would require as many as three monitoring vessels operating offshore several weeks. It is anticipated that these vessels would be staged out of Santa Barbara Harbor and would be required to transit between the harbor and the shell mounds sites daily. As such, an estimated nine individuals involved in the monitoring program would be required to transit to Santa Barbara Harbor each work day that monitoring was required. The additional nine vehicle trips during morning or afternoon peak hours have the potential to add to the existing congestion during these peak hour traffic periods.

Vehicular traffic requiring access to the POLA/POLB area would use I-710 and the Terminal Island Freeway. Dredged shell mound and caisson materials would be offloaded at POLA/POLB and would be transported offsite to a disposal/recycling facility either in the LA Basin (caissons) or Kern County (shell mound material). Based on the estimated volume of dredge materials, it is estimated that approximately 19,650 truck trips would be required to transport these materials from the POLA/POLB to disposal sites. Such truck trips will contribute to existing port area traffic congestion as well as transportation routes (Interstate 710, 405 and 5) between LA County and Kern County.

<u>Recommended Measures to Address Potential Effects of Removing the Shell Mounds</u>

As construction and monitoring traffic could cause additional vehicle congestion on area roadways, the following measures should be implemented to address effects:

- Chevron shall develop and implement a Traffic Management Plan. The Traffic Management Plan shall provide measures to reduce potential impacts to local traffic during peak hours as well as regional transportation routes.

2.5.7 Noise

The shell mounds are approximately 1.5 nm to 2.6 nm offshore of Carpinteria. Ambient noise levels at the shoreline in the vicinity of Casitas Pier range from about 54 decibels (dBA) to about 66 dBA. The Carpinteria Bluffs recreation site has the lowest daytime average noise level at 58.3 dBA, thereby representing the most conservative ambient receptor location based on ambient noise measurements taken for the Venoco Paredon EIR at locations near the Casitas Pier (See *Draft Environmental Impact Report, Venoco, Inc. Paredon Oil and Gas Development Project*, June 2007). Equipment necessary to conduct the dredging operation that would be a noise source would likely consist of a crane, an air compressor, generator, and pump. While a support tug would be necessary to assist with mooring the derrick barge and positioning the receiving barge, it would not likely be operating at the same time as the crane and other derrick barge equipment. Therefore, no support vessel noise is included in the worst-case hour estimates. This combination of equipment is estimated to generate noise levels of 86.5 dB at 50 feet (15 m) from the source. With attenuation over the distance to shore, the total noise combining ambient background and project-generated noise is estimated to be 54.1 to 54.3 dB and would not exceed the 70 dB criterion.

Noise at the POLA/POLB mainly is from bulk vessel loading facilities, shipping container handling equipment, truck traffic, train movements, and other industrial activities. All sources contribute to the ambient noise levels at the port. The nearest noise sensitive receptors are residences located approximately one mile to the north of the port. Industrial noise that reaches residential neighborhoods is heard as a constant, low background sound interrupted by occasional horns and whistle sounds from ships and trains (URS 2004). No other sensitive receptors are in the vicinity of activities in the POLA/POLB area. Impacts associated with noise from the transport of dredged material would be temporary. Therefore, noise effects due to full removal would be short-term and minor.

2.5.8 Public Safety and Hazards

The wells on the platforms were shut-in prior to September 1992. All of the platforms, except for four caissons at the Platform Hazel site, were removed in 1996 in accordance with California Geologic Energy Management Division (CalGEM), and CSLC requirements and procedures. The closed wells remain beneath the mounds at an approximate depth of 5 feet (1.5 m) below the natural mudline. The shell mound sites have remained unused and largely intact since 1996. The shell mounds appear relatively resistant to disturbance by natural processes and by the fishing activities and scientific studies that have occurred since the platforms were removed.

There is a certain amount of risk in any major offshore construction including possibility of collision with other vessels, fire, and mechanical failure of equipment, fuel spills, and sudden storms that could swamp the equipment. Safeguards are put into place to minimize these types of risk through statutory regulations. State and local agencies with hazardous material responsibilities for the project vicinity include the USCG, CDFW, and Santa Barbara County (emergency response and evacuation). Applicable regulations include the Clean Water Act (section 311[c][2]) and the Shipboard Oil Pollution Emergency Procedure. Project activities must comply with all applicable state and local agency regulations and guidelines.

Dredging activities could affect public health and safety, specifically including the use of hazardous materials, risk of spills, and diving operations. Effects on safety/hazards/risk of upset would include release of hazardous substances. Shell mound removal would require the use of vessels and equipment powered by diesel fuel and lubricated with oil and other mechanical fluids, which are considered hazardous substances and are susceptible to spills. Accidental releases of such substances (e.g., spills arising from leakage of fuel, motor oil, or hydraulic fluid during operation and/or equipment maintenance) could occur.

Construction activities could result in potential release of hydrocarbons from existing wells, which could affect public health and safety. Dredging could impact the existing wells, causing a release of oil and/or gas from the wells. Construction activities could result in potential release of hydrocarbons from active pipelines that could affect public health and safety. There are currently two active pipelines, located approximately 200 to

400 feet (60 to 120 m) east of the Hope shell mound, which transport oil and gas from Platform Grace in Federal waters to the processing facility in Carpinteria. These pipelines are expected to become idle by 2023, following the completion of well abandonment operations on Platforms Grace and Gail. These pipelines could potentially be damaged by project vessel anchors, shell mound removal operations, and/or final site smoothing with a heavy-duty trawl net.

An accidental release of contaminants during dredging or transport of shell mound materials could potentially indirectly impact public health through contamination of offshore waters and marine species consumed by the public. Because most released contaminated sediments would settle to the ocean floor, contamination of offshore waters are likely to be of short duration, although some limited potential exists for public consumption of contaminated marine species that are caught through either recreational or commercial fishing. Although authorities would likely close waters affected by a spill of contaminated materials to recreational and commercial fishing, an unknown potential exists for human exposure or marine species inhabiting or passing through contaminated waters to be consumed by the public. However, sustained consumption of contaminated catch is unlikely, reducing the potential long-term consequences to public health.

Underwater operations present risks to personnel safety during diving operations. All diving operations would be conducted using surface-supplied air diving techniques, in accordance with Occupational Safety and Health Administration (OSHA) regulations at 29 Code of Federal Regulations, Ch. XVII.

Recommended Measures to Address Potential Effects of Removing the Shell Mounds

Potential hazards from removal of the shell mounds may be reduced with the following conditions of approval for Chevron:

1. Chevron shall have in place, prior to beginning operations, an approved, project-specific OSCP addressing spill prevention and spill response measures for any accidental release of hydrocarbons. The plan shall identify key points of contact, vessels and equipment to be used in the project, contractors, schedules, and procedures. The plan shall be prepared and submitted to the CSLC and CDFW, OSPR, Marine Safety Branch, for approval.
2. All oceangoing vessels shall maintain, throughout operations, emergency response plans, equipment, and supplies for implementation in the event of a spill, in compliance with State and federal regulations. The emergency response plans shall identify key points of contact, vessels and equipment to be used in the project, contractors, schedules, and procedures. The plan shall be prepared and submitted to the CSLC and OSPR, Marine Safety Branch, for approval.

3. Dredging and anchoring/mooring plans would be prepared and approved prior to implementation to avoid all existing oil and gas infrastructure, in accordance with CalGEM, and State Lands Commission requirements and procedures.
4. Monitoring of water quality and seafloor conditions to ensure contaminated materials do not remobilize following completion of dredging and restoration activities shall be provided for up to one year.

2.5.9 Scenic Resources

Offshore

Dredging and construction monitoring equipment (clamshell dredge, hopper barges/scows, tugboats, and monitoring vessels) would be active in the SBC to support proposed in-water removal activities. These activities would occur within public views from individuals traveling on vessels within the project region and distant views of these activities would be available from public beaches in Carpinteria and Summerland; however, these activities would be temporary and visually compatible with existing vessel activity in the channel. Although construction equipment/activities would be potentially visible from public vantage points on Santa Cruz Island and mainland coastal areas, these activities would not be discernable due to the distance of these viewpoints from the shell mound sites.

In addition to standard daylight hours of operation, proposed dredging activities would potentially occur during evening hours, generating additional night lighting (e.g., equipment headlights) that could contribute to impacts on nighttime views from surrounding public viewpoints. However, the duration of lighting during the evening and nighttime hours would be short-term (maximum of 4 weeks per mound); all other in-water activities (i.e., seafloor restoration, post-removal surveying) would occur during the daytime. Construction equipment would be required to comply with the lighting provisions stipulated in U.S. Title 33. Furthermore, due to the distance of the viewer from the shell mound sites, construction activities would not create a new source of substantial glare that would adversely affect nighttime views in the area. Therefore, effects on offshore scenic resources would be minor.

Onshore

Transport and transfer to trucks of the shell mound material at the POLA/POLB would require the use of barges/tugboats to transport dredged material from the shell mounds site.

As noted for offshore locations, dredged material disposal activities would potentially occur during the evening hours, generating additional night lighting (e.g., equipment headlights) that could contribute to impacts on nighttime views from surrounding public viewpoints. However, the duration of lighting during the evening and nighttime hours would be short-term and incidental to the current use of the SBC and shipping lanes. Furthermore, due to the distance of the viewer from the CDF site, proposed activities would not create a new source of substantial glare that would adversely affect nighttime views in the area. Therefore, effects on onshore scenic resources would be minor.

3 CONCLUSION

Removal of the shell mounds appears feasible using clamshell dredging techniques. Depending on the disposal site availability, the project could be completed within approximately 15 months. Localized turbidity would be encountered with the finer grained materials, especially the uppermost recently deposited silts and clays and the encased drilling muds. Residual contamination would remain after the completion of the dredging work. Removal of the shell mounds would have substantial short-term effects on water and sediment quality with associated adverse effects on fisheries, marine biology and habitats, and public safety and hazards. In the event of a spill of contaminated materials, including sediments, oil products, or decanted water, a major response and cleanup would be required by local and State agencies.

Table D.3 Summary of Potential Effects of Shell Mounds Removal by Dredging

Issue Area	Summary of Range of Effects
Commercial and Recreational Fishing	Short-term closure of fisheries in vicinity of shell mounds. Displacement and permanent loss of fish and invertebrate species, such as lobster, crab, and sea cucumber. Limited residual effects related to elevated levels of contaminated material on seafloor and in water column.
Marine Water Quality	Short-term resuspension of shell mound materials and natural bottom sediments, contaminant remobilization, redeposition of residual mound materials and associated contaminants, and discharges of dewatering effluent.
Marine Biological Resources	Short-term and localized changes in water quality and noise interference with the movements of resident and migratory species Displacement and permanent loss of fish and invertebrate species, such as lobster, crab, and sea cucumber.
Geologic Hazards	Seismic effects would not occur as a result of the full removal of the shell mounds. If a seismic event occurred prior to or during removal of the shell mounds, geologic hazards and related effects would be similar to those described in Section 5.4, *Geologic Hazards* of the Assessment.
Recreation, and Public Access	Access to the shell mounds vicinity may be limited up to 15 months. Potential short-term to mid-term closure of the areas affected by contaminant releases may limit recreational activity with affected areas.
Air Quality and Greenhouse Gases	NOx emissions would exceed local significance thresholds. Other emissions, including greenhouse gas emissions, would not be expected to exceed local significance criteria.
Coastal Processes and Sea-Level Rise	No effect on coastal processes or sea level rise would occur from shell mound removal given the depth and location of the sites.
Cultural and Paleontological Resources	No prehistoric or historic onshore cultural material would be affected by dredging.

Issue Area	Summary of Range of Effects
Environmental Justice	No vulnerable populations would be affected by dredging of the shell mounds since the shell mounds and the POLA/POLB are located distant from any onshore population centers. However, impacts associated with onshore treatment and transport would affect vulnerable populations in the vicinity of POLA/POLB and on the route to landfill disposal sites.
Navigation, Transportation, and Traffic	Dredging activity would not substantially contribute to offshore vessel traffic conditions. Dredging activity may increase roadway traffic from trucks carrying dredge materials to upland disposal sites.
Noise	Noise generated offshore from dredging and transportation activities would not exceed local criteria for ambient noise levels or substantially change the existing noise environment.
Public Safety and Hazards	Dredging activities could cause spills of diesel fuel or other vessel related materials.
	Dredging activities could disturb existing closed wells, causing spills.
Scenic Resources	Dredging and transport activities would occur within public views from individuals traveling on vessels within the project region and distant views of these activities would be available from public beaches in Carpinteria and Summerland; however, these activities would be temporary and visually compatible with existing vessel activity.

FULL REMOVAL ALTERNATIVE - DREDGING

OFF-ROAD SOURCES

					Pounds/BHP-Hour [1]							Pounds/Day					English Tons				Metric Tons			
Source	Fuel	BHP	Number	Hours/Day	NOx	ROG	PM_{10}	CO	N_2O	CH_4	CO_2	NOx	ROG	PM10	CO	Days	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Derrick Barge - Crane	Diesel	1650	1	17	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	203.6	19.1	9.0	83.3	43	4.38	0.41	0.19	1.79	0.0115	0.0060	252.2	255.5
Derrick Barge - Main Generator	Diesel	500	1	17	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	61.7	5.8	2.7	25.2	43	1.33	0.12	0.06	0.54	0.0035	0.0018	76.4	77.4
Derrick Barge - Auxiliary Generator	Diesel	245	1	7	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	12.5	1.2	0.5	5.1	43	0.27	0.03	0.01	0.11	0.0007	0.0004	15.4	15.6
Derrick Barge - Anchor Winch	Diesel	213	2	8	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	24.7	2.3	1.1	10.1	43	0.53	0.05	0.02	0.22	0.0014	0.0007	30.6	31.0
Support Tug - Main Engine	Diesel	1250	4	20	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	1148.0	89.0	57.0	331.0	43	24.68	1.91	1.23	7.12	0.0644	0.0273	1421.7	1440.0
Support Tug - Generator	Diesel	250	4	4	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	29.0	2.7	1.3	11.9	43	0.62	0.06	0.03	0.26	0.0016	0.0009	36.0	36.4
Support Tug - Main Engine	Diesel	1250	2	6	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	172.2	13.4	8.6	49.7	43	3.70	0.29	0.18	1.07	0.0097	0.0041	213.2	216.0
Support Tug - Generator	Diesel	250	2	18	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	65.3	6.1	2.9	26.7	43	1.40	0.13	0.06	0.57	0.0037	0.0019	80.9	82.0
Crew Boat - Main Engine	Diesel	800	1	4	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	20.5	1.6	1.0	6.0	43	0.44	0.03	0.02	0.13	0.0011	0.0005	25.4	25.7
Survey Vessel - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - ROV generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Main Engine	Diesel	300	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Generator	Diesel	70	0	0	0.00685	0.00178	0.00065	0.00549	0.000021	0.000029	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Dewatering Pump	Diesel	100	2	3	0.00104	0.00008	0.00008	0.00221	0.000011	0.000023	0.3521	0.6	0.0	0.1	1.3	43	0.01	0.00	0.00	0.03	0.0001	0.0003	4.1	4.2
Air Compressor	Diesel	362	2	3	0.00013	0.00006	0.00001	0.00067	0.000011	0.000023	0.3521	0.3	0.1	0.0	1.5	43	0.01	0.00	0.00	0.03	0.0005	0.0010	14.9	15.1
Generator	Diesel	325	2	3	0.00032	0.00011	0.00001	0.00079	0.000011	0.000023	0.3521	0.6	0.2	0.0	1.5	43	0.01	0.00	0.00	0.03	0.0004	0.0009	13.4	13.5
Welding Machine	Diesel	63	0	0	0.00390	0.00061	0.00016	0.00463	0.000011	0.000023	0.5639	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Diver's Air Compressor	Diesel	50	0	0	0.00316	0.00069	0.00017	0.00360	0.000011	0.000023	0.3914	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crane-onshore	Diesel	230	0	0	0.00220	0.00020	0.00009	0.00115	0.000011	0.000023	0.3350	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Front-end loader	Diesel	170	0	0	0.00176	0.00022	0.00010	0.00263	0.000011	0.000023	0.4198	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Scraper	Diesel	200	0	0	0.00354	0.00037	0.00019	0.00358	0.000011	0.000023	0.5651	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Backhoe	Diesel	85	0	0	0.00188	0.00018	0.00009	0.00283	0.000011	0.000023	0.4304	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Transfer Conveyor	Diesel	59	0	0	0.00419	0.00079	0.00029	0.00463	0.000011	0.000023	0.5400	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Forklift	Diesel	30	0	0	0.00340	0.00062	0.00018	0.00366	0.000011	0.000023	0.5203	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Travel to Mound Sites from POLA/POLB - 57% in SCAQMD, 32% VCAPCD, 11% SBCAPCD																								
Support Tug - Main Engine	Diesel	1250	6	24	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	2066.4	160.2	102.6	595.8	2	2.07	0.16	0.10	0.60	0.0054	0.0023	119.0	120.6
TOTAL												**3805.6**	**301.7**	**186.8**	**1149.1**		**39.46**	**3.20**	**1.91**	**12.49**	**0.1039**	**0.0480**	**2303.3**	**2333.0**

ON-ROAD SOURCES

Running Emissions			Grams/Mile [2]							Pounds/Day				Days	English Tons				Metric Tons			
Source	Miles/Trip	Trips/Day	NOx	ROG	PM10	CO	N2O	CH4	CO2	NOx	ROG	PM10	CO		NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Light-Duty Trucks (LDT2)	100	72	0.07414	0.01223	0.00122	0.92327	0.01070	0.00366	303.84	1.177	0.194	0.019	14.655	6	0.0035	0.0006	0.0001	0.0440	0.0005	0.0002	13.1	13.3

Evaporative Running Losses (ROC)

Source	Daily Miles	Hours/Day	ROC g/hour	ROC lb/day	Days	ROC Tons
Light-Duty Trucks (LDT2)	7200	131	0.885	0.26	6	0.00077

Off-Road & On-Road Total

Pounds/Day				English Tons				Metric Tons			
NOx	ROG	PM10	CO	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
3806.73	302.15	186.78	1163.76	39.46	3.20	1.91	12.54	0.1044	0.0482	2316.4	2346.2

Notes:

[1] Emission factors from OFFROAD 2021 (ver 1.0.1) for Santa Barbara County, except diesel vessel factors from San Pedro Bay Ports Emissions Inventory

[2] Emission factors from EMFAC 2021 for Santa Barbara County year 2023 annual emissions

FULL REMOVAL ALTERNATIVE - HAZEL CAISSON REMOVAL

OFF-ROAD SOURCES

					Pounds/BHP-Hour [1]							Pounds/Day					English Tons				Metric Tons			
Source	Fuel	BHP	Number	Hours/Day	NOx	ROG	PM_{10}	CO	N_2O	CH_4	CO_2	NOx	ROG	PM10	CO	Days	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Derrick Barge - Crane	Diesel	1650	1	6	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	71.9	6.7	3.2	29.4	45	1.62	0.15	0.07	0.66	0.0042	0.0022	93.1	94.4
Derrick Barge - Main Generator	Diesel	500	1	10	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	36.3	3.4	1.6	14.9	45	0.82	0.08	0.04	0.33	0.0021	0.0011	47.0	47.7
Derrick Barge - Auxiliary Generator	Diesel	245	1	14	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	24.9	2.3	1.1	10.2	45	0.56	0.05	0.02	0.23	0.0015	0.0008	32.3	32.7
Derrick Barge - Anchor Winch	Diesel	213	2	4	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	12.4	1.2	0.5	5.1	45	0.28	0.03	0.01	0.11	0.0007	0.0004	16.0	16.2
Support Tug - Main Engine	Diesel	1250	2	3	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	86.1	6.7	4.3	24.8	45	1.94	0.15	0.10	0.56	0.0051	0.0021	111.6	113.0
Support Tug - Generator	Diesel	250	2	21	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	76.2	7.1	3.4	31.2	45	1.72	0.16	0.08	0.70	0.0045	0.0024	98.8	100.1
Support Tug - Main Engine	Diesel	1250	2	20	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	574.0	44.5	28.5	165.5	45	12.92	1.00	0.64	3.72	0.0337	0.0143	743.9	753.5
Support Tug - Generator	Diesel	250	2	4	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	14.5	1.4	0.6	5.9	45	0.33	0.03	0.01	0.13	0.0009	0.0004	18.8	19.1
Crew Boat - Main Engine	Diesel	800	1	1.5	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	7.7	0.6	0.4	2.2	45	0.17	0.01	0.01	0.05	0.0004	0.0002	10.0	10.1
Survey Vessel - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - ROV generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Main Engine	Diesel	300	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Generator	Diesel	70	0	0	0.00685	0.00178	0.00065	0.00549	0.000021	0.000029	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Dewatering Pump	Diesel	100	0	0	0.00104	0.00008	0.00008	0.00221	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Air Compressor	Diesel	362	1	2	0.00013	0.00006	0.00001	0.00067	0.000011	0.000023	0.3521	0.1	0.0	0.0	0.5	45	0.00	0.00	0.00	0.01	0.0002	0.0003	5.2	5.3
Generator	Diesel	325	0	0	0.00032	0.00011	0.00001	0.00079	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Welding Machine	Diesel	63	1	4	0.00390	0.00061	0.00016	0.00463	0.000011	0.000023	0.5639	1.0	0.2	0.0	1.2	45	0.02	0.00	0.00	0.03	0.0001	0.0001	2.9	2.9
Diver's Air Compressor	Diesel	50	1	6	0.00316	0.00069	0.00017	0.00360	0.000011	0.000023	0.3914	0.9	0.2	0.1	1.1	45	0.02	0.00	0.00	0.02	0.0001	0.0001	2.4	2.4
Crane-onshore	Diesel	230	0	0	0.00220	0.00020	0.00009	0.00115	0.000011	0.000023	0.3350	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Front-end loader	Diesel	170	0	0	0.00176	0.00022	0.00010	0.00263	0.000011	0.000023	0.4198	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Scraper	Diesel	200	0	0	0.00354	0.00037	0.00019	0.00358	0.000011	0.000023	0.5651	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Backhoe	Diesel	85	0	0	0.00188	0.00018	0.00009	0.00283	0.000011	0.000023	0.4304	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Transfer Conveyor	Diesel	59	0	0	0.00419	0.00079	0.00029	0.00463	0.000011	0.000023	0.5400	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Forklift	Diesel	30	0	0	0.00340	0.00062	0.00018	0.00366	0.000011	0.000023	0.5203	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Travel to Mound Sites from POLA/POLB - 57% in SCAQMD, 32% VCAPCD, 11% SBCAPCD																								
Support Tug - Main Engine	Diesel	1250	4	24	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	1377.6	106.8	68.4	397.2	2	1.38	0.11	0.07	0.40	0.0036	0.0015	79.3	80.4
TOTAL												**2283.6**	**181.1**	**112.1**	**689.1**		**21.76**	**1.78**	**1.05**	**6.97**	**0.0570**	**0.0261**	**1261.4**	**1277.6**

ON-ROAD SOURCES

Running Emissions			Grams/Mile [2]							Pounds/Day				Days	English Tons				Metric Tons			
Source	Miles/Trip	Trips/Day	NOx	ROG	PM10	CO	N2O	CH4	CO2	NOx	ROG	PM10	CO		NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Light-Duty Trucks (LDT2)	100	60	0.07414	0.01223	0.00122	0.92327	0.01070	0.00366	303.84	0.981	0.162	0.016	12.213	6	0.0029	0.0005	0.0000	0.0366	0.0004	0.0001	10.9	11.0

Evaporative Running Losses (ROC)

Source	Daily Miles	Hours/Day	ROC g/hour	ROC lb/day	Days	ROC Tons
Light-Duty Trucks (LDT2)	6000	109	0.885	0.21	6	0.00064

Off-Road & On-Road Total

Pounds/Day				English Tons				Metric Tons			
NOx	ROG	PM10	CO	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
2284.59	181.47	112.08	701.33	21.77	1.78	1.05	7.00	0.0574	0.0262	1272.3	1288.7

Notes:

[1] Emission factors from OFFROAD 2021 (ver 1.0.1) for Santa Barbara County, except diesel vessel factors from San Pedro Bay Ports Emissions Inventory

[2] Emission factors from EMFAC 2021 for Santa Barbara County year 2023 annual emissions

FULL REMOVAL ALTERNATIVE - DEWATERING/PHYSICAL STABILIZATION

OFF-ROAD SOURCES

					Pounds/BHP-Hour [1]							Pounds/Day					English Tons				Metric Tons			
Source	Fuel	BHP	Number	Hours/Day	NOx	ROG	PM_{10}	CO	N_2O	CH_4	CO_2	NOx	ROG	PM10	CO	Days	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Derrick Barge - Crane	Diesel	1650	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Main Generator	Diesel	500	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Auxiliary Generator	Diesel	245	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Anchor Winch	Diesel	213	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crew Boat - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - ROV generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Main Engine	Diesel	300	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Generator	Diesel	70	0	0	0.00685	0.00178	0.00065	0.00549	0.000021	0.000029	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Dewatering Pump	Diesel	100	0	0	0.00104	0.00008	0.00008	0.00221	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Air Compressor	Diesel	362	0	0	0.00013	0.00006	0.00001	0.00067	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Generator	Diesel	325	1	12	0.00032	0.00011	0.00001	0.00079	0.000011	0.000023	0.3521	1.2	0.4	0.1	3.1	37	0.02	0.01	0.00	0.06	0.0007	0.0015	23.0	23.3
Welding Machine	Diesel	63	0	0	0.00390	0.00061	0.00016	0.00463	0.000011	0.000023	0.5639	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Diver's Air Compressor	Diesel	50	0	0	0.00316	0.00069	0.00017	0.00360	0.000011	0.000023	0.3914	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crane-onshore	Diesel	230	1	12	0.00220	0.00020	0.00009	0.00115	0.000011	0.000023	0.3350	6.1	0.6	0.3	3.2	37	0.11	0.01	0.00	0.06	0.0005	0.0011	15.5	15.7
Front-end loader	Diesel	170	2	12	0.00176	0.00022	0.00010	0.00263	0.000011	0.000023	0.4198	7.2	0.9	0.4	10.7	71	0.26	0.03	0.01	0.38	0.0014	0.0030	55.2	55.6
Scraper	Diesel	200	2	12	0.00354	0.00037	0.00019	0.00358	0.000011	0.000023	0.5651	17.0	1.8	0.9	17.2	71	0.60	0.06	0.03	0.61	0.0017	0.0036	87.4	87.9
Backhoe	Diesel	85	2	12	0.00188	0.00018	0.00009	0.00283	0.000011	0.000023	0.4304	3.8	0.4	0.2	5.8	71	0.14	0.01	0.01	0.21	0.0007	0.0015	28.3	28.5
Transfer Conveyor	Diesel	59	1	12	0.00419	0.00079	0.00029	0.00463	0.000011	0.000023	0.5400	3.0	0.6	0.2	3.3	37	0.05	0.01	0.00	0.06	0.0001	0.0003	6.4	6.5
Forklift	Diesel	30	1	12	0.00340	0.00062	0.00018	0.00366	0.000011	0.000023	0.5203	1.2	0.2	0.1	1.3	37	0.02	0.00	0.00	0.02	0.0001	0.0001	3.1	3.2
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
TOTAL												**39.5**	**4.8**	**2.0**	**44.5**		**1.21**	**0.14**	**0.06**	**1.40**	**0.0053**	**0.0111**	**218.9**	**220.7**

ON-ROAD SOURCES

Running Emissions			Grams/Mile [2]							Pounds/Day				Days	English Tons				Metric Tons			
Source	Miles/Trip	Trips/Day	NOx	ROG	PM10	CO	N2O	CH4	CO2	NOx	ROG	PM10	CO		NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Light-Duty Trucks (LDT2):Part A	50	8	0.07414	0.01223	0.00122	0.92327	0.01070	0.00366	303.84	0.065	0.011	0.001	0.814	37	0.0012	0.0002	0.0000	0.0151	0.0002	0.0001	4.5	4.5
Light-Duty Trucks (LDT2):Part B	50	16	0.07414	0.01223	0.00122	0.92327	0.01070	0.00366	303.84	0.131	0.022	0.002	1.628	71	0.0046	0.0008	0.0001	0.0578	0.0006	0.0002	17.3	17.4

Evaporative Running Losses (ROC)

Source	Daily Miles	Hours/Day	ROC g/hour	ROC lb/day	Days	ROC Tons
Light-Duty Trucks (LDT2):Part A	400	7	0.885	0.01	37	0.00026
Light-Duty Trucks (LDT2):Part B	800	15	0.885	0.03	71	0.00101

Off-Road & On-Road Total

Pounds/Day				English Tons				Metric Tons			
NOx	ROG	PM10	CO	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
39.72	4.85	2.05	46.96	1.21	0.14	0.06	1.47	0.0061	0.0113	240.7	242.6

Notes:

[1] Emission factors from OFFROAD 2021 (ver 1.0.1) for Santa Barbara County, except diesel vessel factors from San Pedro Bay Ports Emissions Inventory

[2] Emission factors from EMFAC 2021 for Santa Barbara County year 2023 annual emissions

FULL REMOVAL ALTERNATIVE -OFFSHORE WATER TREATMENT

OFF-ROAD SOURCES

					Pounds/BHP-Hour [1]							Pounds/Day					English Tons				Metric Tons			
Source	Fuel	BHP	Number	Hours/Day	NOx	ROG	PM_{10}	CO	N_2O	CH_4	CO_2	NOx	ROG	PM10	CO	Days	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Derrick Barge - Crane	Diesel	1650	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Main Generator	Diesel	500	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Auxiliary Generator	Diesel	245	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Anchor Winch	Diesel	213	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crew Boat - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - ROV generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Main Engine	Diesel	300	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Generator	Diesel	70	0	0	0.00685	0.00178	0.00065	0.00549	0.000021	0.000029	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Dewatering Pump	Diesel	100	0	0	0.00104	0.00008	0.00008	0.00221	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Air Compressor	Diesel	362	0	0	0.00013	0.00006	0.00001	0.00067	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Generator	Diesel	325	1	6	0.00032	0.00011	0.00001	0.00079	0.000011	0.000023	0.3521	0.6	0.2	0.0	1.5	37	0.01	0.00	0.00	0.03	0.0004	0.0008	11.5	11.6
Welding Machine	Diesel	63	0	0	0.00390	0.00061	0.00016	0.00463	0.000011	0.000023	0.5639	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Diver's Air Compressor	Diesel	50	0	0	0.00316	0.00069	0.00017	0.00360	0.000011	0.000023	0.3914	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crane-onshore	Diesel	230	0	0	0.00220	0.00020	0.00009	0.00115	0.000011	0.000023	0.3350	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Front-end loader	Diesel	170	0	0	0.00176	0.00022	0.00010	0.00263	0.000011	0.000023	0.4198	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Scraper	Diesel	200	0	0	0.00354	0.00037	0.00019	0.00358	0.000011	0.000023	0.5651	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Backhoe	Diesel	85	0	0	0.00188	0.00018	0.00009	0.00283	0.000011	0.000023	0.4304	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Transfer Conveyor	Diesel	59	0	0	0.00419	0.00079	0.00029	0.00463	0.000011	0.000023	0.5400	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Forklift	Diesel	30	1	6	0.00340	0.00062	0.00018	0.00366	0.000011	0.000023	0.5203	0.6	0.1	0.0	0.7	37	0.01	0.00	0.00	0.01	0.0000	0.0001	1.6	1.6
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
TOTAL												**1.2**	**0.3**	**0.1**	**2.2**		**0.02**	**0.01**	**0.00**	**0.04**	**0.0004**	**0.0008**	**13.1**	**13.2**

ON-ROAD SOURCES

Running Emissions			Grams/Mile [2]							Pounds/Day				Days	English Tons				Metric Tons			
Source	Miles/Trip	Trips/Day	NOx	ROG	PM10	CO	N2O	CH4	CO2	NOx	ROG	PM10	CO		NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Light-Duty Trucks (LDT2)	100	6	0.07414	0.01223	0.00122	0.92327	0.01070	0.00366	303.84	0.098	0.016	0.002	1.221	5	0.0002	0.0000	0.0000	0.0031	0.0000	0.0000	0.9	0.9

Evaporative Running Losses (ROC)

Source	Daily Miles	Hours/Day	ROC g/hour	ROC lb/day	Days	ROC Tons
Light-Duty Trucks (LDT2)	600	11	0.885	0.02	5	0.00005

Off-Road & On-Road Total

Pounds/Day				English Tons				Metric Tons			
NOx	ROG	PM10	CO	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
1.33	0.35	0.06	3.41	0.023	0.006	0.001	0.044	0.0004	0.0008	14.0	14.1

Notes:

[1] Emission factors from OFFROAD 2021 (ver 1.0.1) for Santa Barbara County, except diesel vessel factors from San Pedro Bay Ports Emissions Inventory

[2] Emission factors from EMFAC 2021 for Santa Barbara County year 2023 annual emissions

FULL REMOVAL ALTERNATIVE - POST SITE SURVEY/LEVELING

OFF-ROAD SOURCES

					Pounds/BHP-Hour [1]							Pounds/Day					English Tons				Metric Tons			
Source	Fuel	BHP	Number	Hours/Day	NOx	ROG	PM_{10}	CO	N_2O	CH_4	CO_2	NOx	ROG	PM10	CO	Days	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Derrick Barge - Crane	Diesel	1650	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Main Generator	Diesel	500	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Auxiliary Generator	Diesel	245	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Anchor Winch	Diesel	213	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crew Boat - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - Main Engine	Diesel	800	1	12	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	61.5	4.8	3.1	17.9	20	0.62	0.05	0.03	0.18	0.0016	0.0007	35.5	35.9
Survey Vessel - ROV generator	Diesel	250	1	12	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	21.8	2.0	1.0	8.9	20	0.22	0.02	0.01	0.09	0.0006	0.0003	12.5	12.7
Monitoring Vessel - Main Engine	Diesel	300	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Generator	Diesel	70	0	0	0.00685	0.00178	0.00065	0.00549	0.000021	0.000029	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Dewatering Pump	Diesel	100	0	0	0.00104	0.00008	0.00008	0.00221	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Air Compressor	Diesel	362	0	0	0.00013	0.00006	0.00001	0.00067	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Generator	Diesel	325	0	0	0.00032	0.00011	0.00001	0.00079	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Welding Machine	Diesel	63	0	0	0.00390	0.00061	0.00016	0.00463	0.000011	0.000023	0.5639	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Diver's Air Compressor	Diesel	50	0	0	0.00316	0.00069	0.00017	0.00360	0.000011	0.000023	0.3914	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crane-onshore	Diesel	230	0	0	0.00220	0.00020	0.00009	0.00115	0.000011	0.000023	0.3350	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Front-end loader	Diesel	170	0	0	0.00176	0.00022	0.00010	0.00263	0.000011	0.000023	0.4198	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Scraper	Diesel	200	0	0	0.00354	0.00037	0.00019	0.00358	0.000011	0.000023	0.5651	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Backhoe	Diesel	85	0	0	0.00188	0.00018	0.00009	0.00283	0.000011	0.000023	0.4304	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Transfer Conveyor	Diesel	59	0	0	0.00419	0.00079	0.00029	0.00463	0.000011	0.000023	0.5400	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Forklift	Diesel	30	0	0	0.00340	0.00062	0.00018	0.00366	0.000011	0.000023	0.5203	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
TOTAL												**83.3**	**6.8**	**4.0**	**26.8**		**0.83**	**0.07**	**0.04**	**0.27**	**0.0021**	**0.0010**	**48.0**	**48.6**

ON-ROAD SOURCES

Running Emissions			Grams/Mile [2]							Pounds/Day				Days	English Tons				Metric Tons			
Source	Miles/Trip	Trips/Day	NOx	ROG	PM10	CO	N2O	CH4	CO2	NOx	ROG	PM10	CO		NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Light-Duty Trucks (LDT2)	100	10	0.07414	0.01223	0.00122	0.92327	0.01070	0.00366	303.84	0.163	0.027	0.003	2.035	3	0.0002	0.0000	0.0000	0.0031	0.0000	0.0000	0.9	0.9

Evaporative Running Losses (ROC)

Source	Daily Miles	Hours/Day	ROC g/hour	ROC lb/day	Days	ROC Tons
Light-Duty Trucks (LDT2)	1000	18	0.885	0.04	3	0.00005

Off-Road & On-Road Total

Pounds/Day				English Tons				Metric Tons			
NOx	ROG	PM10	CO	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
83.48	6.90	4.03	28.80	0.833	0.068	0.040	0.271	0.0022	0.0010	48.9	49.5

Notes:

[1] Emission factors from OFFROAD 2021 (ver 1.0.1) for Santa Barbara County, except diesel vessel factors from San Pedro Bay Ports Emissions Inventory

[2] Emission factors from EMFAC 2021 for Santa Barbara County year 2023 annual emissions

FULL REMOVAL ALTERNATIVE - CONSTRUCTION MONITORING

OFF-ROAD SOURCES

					Pounds/BHP-Hour [1]							Pounds/Day					English Tons				Metric Tons			
Source	Fuel	BHP	Number	Hours/Day	NOx	ROG	PM_{10}	CO	N_2O	CH_4	CO_2	NOx	ROG	PM10	CO	Days	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Derrick Barge - Crane	Diesel	1650	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Main Generator	Diesel	500	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Auxiliary Generator	Diesel	245	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Anchor Winch	Diesel	213	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crew Boat - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - ROV generator	Diesel	250	1	12	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	21.8	2.0	1.0	8.9	120	1.31	0.12	0.06	0.53	0.0034	0.0018	75.3	76.2
Monitoring Vessel - Main Engine	Diesel	300	3	12	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	69.2	5.4	3.5	20.1	120	4.15	0.32	0.21	1.21	0.0106	0.0047	239.4	242.5
Monitoring Vessel - Generator	Diesel	70	3	12	0.00685	0.00178	0.00065	0.00549	0.000021	0.000029	0.4609	17.3	4.5	1.6	13.8	120	1.04	0.27	0.10	0.83	0.0029	0.0040	63.2	64.1
Dewatering Pump	Diesel	100	0	0	0.00104	0.00008	0.00008	0.00221	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Air Compressor	Diesel	362	0	0	0.00013	0.00006	0.00001	0.00067	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Generator	Diesel	325	0	0	0.00032	0.00011	0.00001	0.00079	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Welding Machine	Diesel	63	0	0	0.00390	0.00061	0.00016	0.00463	0.000011	0.000023	0.5639	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Diver's Air Compressor	Diesel	50	0	0	0.00316	0.00069	0.00017	0.00360	0.000011	0.000023	0.3914	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crane-onshore	Diesel	230	0	0	0.00220	0.00020	0.00009	0.00115	0.000011	0.000023	0.3350	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Front-end loader	Diesel	170	0	0	0.00176	0.00022	0.00010	0.00263	0.000011	0.000023	0.4198	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Scraper	Diesel	200	0	0	0.00354	0.00037	0.00019	0.00358	0.000011	0.000023	0.5651	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Backhoe	Diesel	85	0	0	0.00188	0.00018	0.00009	0.00283	0.000011	0.000023	0.4304	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Transfer Conveyor	Diesel	59	0	0	0.00419	0.00079	0.00029	0.00463	0.000011	0.000023	0.5400	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Forklift	Diesel	30	0	0	0.00340	0.00062	0.00018	0.00366	0.000011	0.000023	0.5203	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
TOTAL												**108.3**	**11.9**	**6.1**	**42.8**		**6.50**	**0.72**	**0.36**	**2.57**	**0.0169**	**0.0105**	**377.9**	**382.8**

ON-ROAD SOURCES

Running Emissions			Grams/Mile [2]							Pounds/Day				Days	English Tons				Metric Tons			
Source	Miles/Trip	Trips/Day	NOx	ROG	PM10	CO	N2O	CH4	CO2	NOx	ROG	PM10	CO		NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
Light-Duty Trucks (LDT2)	25	18	0.07414	0.01223	0.00122	0.92327	0.01070	0.00366	303.84	0.074	0.012	0.001	0.916	120	0.0044	0.0007	0.0001	0.0550	0.0006	0.0002	16.4	16.6

Evaporative Running Losses (ROC)

Source	Daily Miles	Hours/Day	ROC g/hour	ROC lb/day	Days	ROC Tons
Light-Duty Trucks (LDT2)	450	8	0.885	0.02	120	0.00096

Off-Road & On-Road Total

Pounds/Day				English Tons				Metric Tons			
NOx	ROG	PM10	CO	NOx	ROG	PM10	CO	N2O	CH4	CO2	CO2E
108.34	11.95	6.06	43.75	6.501	0.717	0.363	2.625	0.0175	0.0107	394.3	399.4

Notes:

[1] Emission factors from OFFROAD 2021 (ver 1.0.1) for Santa Barbara County, except diesel vessel factors from San Pedro Bay Ports Emissions Inventory

[2] Emission factors from EMFAC 2021 for Santa Barbara County year 2023 annual emissions

FULL REMOVAL ALTERNATIVE - DISPOSAL

OFF-ROAD SOURCES

Source	Fuel	BHP	Number	Hours/Day	Pounds/BHP-Hour [1] NOx	ROG	PM_{10}	CO	N_2O	CH_4	CO_2	Pounds/Day NOx	ROG	PM10	CO	Days	English Tons NOx	ROG	PM10	CO	Metric Tons N2O	CH4	CO2	CO2E
Derrick Barge - Crane	Diesel	1650	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Main Generator	Diesel	500	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Auxiliary Generator	Diesel	245	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Derrick Barge - Anchor Winch	Diesel	213	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crew Boat - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - Main Engine	Diesel	800	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Survey Vessel - ROV generator	Diesel	250	0	0	0.00726	0.00068	0.00032	0.00297	0.000021	0.000011	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Main Engine	Diesel	300	0	0	0.00641	0.00050	0.00032	0.00186	0.000018	0.000008	0.4073	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Monitoring Vessel - Generator	Diesel	70	0	0	0.00685	0.00178	0.00065	0.00549	0.000021	0.000029	0.4609	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Dewatering Pump	Diesel	100	0	0	0.00104	0.00008	0.00008	0.00221	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Air Compressor	Diesel	362	0	0	0.00013	0.00006	0.00001	0.00067	0.000011	0.000023	0.3521	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Generator	Diesel	325	4	12	0.00032	0.00011	0.00001	0.00079	0.000011	0.000023	0.3521	5.0	1.7	0.2	12.3	71	0.18	0.06	0.01	0.44	0.0055	0.0116	176.9	178.7
Welding Machine	Diesel	63	0	0	0.00390	0.00061	0.00016	0.00463	0.000011	0.000023	0.5639	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Diver's Air Compressor	Diesel	50	0	0	0.00316	0.00069	0.00017	0.00360	0.000011	0.000023	0.3914	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Crane-onshore	Diesel	230	0	0	0.00220	0.00020	0.00009	0.00115	0.000011	0.000023	0.3350	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Front-end loader	Diesel	170	4	12	0.00176	0.00022	0.00010	0.00263	0.000011	0.000023	0.4198	14.4	1.8	0.8	21.4	71	0.51	0.06	0.03	0.76	0.0029	0.0060	110.3	111.3
Scraper	Diesel	200	0	0	0.00354	0.00037	0.00019	0.00358	0.000011	0.000023	0.5651	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Backhoe	Diesel	85	0	0	0.00188	0.00018	0.00009	0.00283	0.000011	0.000023	0.4304	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Transfer Conveyor	Diesel	59	0	0	0.00419	0.00079	0.00029	0.00463	0.000011	0.000023	0.5400	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Forklift	Diesel	30	0	0	0.00340	0.00062	0.00018	0.00366	0.000011	0.000023	0.5203	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
Support Tug - Main Engine	Diesel	1250	0	0	0.01148	0.00089	0.00057	0.00331	0.000033	0.000014	0.7289	0.0	0.0	0.0	0.0	0	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0	0.0
TOTAL												**19.4**	**3.4**	**1.0**	**33.7**		**0.69**	**0.12**	**0.04**	**1.20**	**0.0084**	**0.0176**	**287.2**	**290.0**

ON-ROAD SOURCES

Running Emissions

Source	Miles/Trip	Trips/Day	Grams/Mile [2] NOx	ROG	PM10	CO	N2O	CH4	CO2	Pounds/Day NOx	ROG	PM10	CO	Days	English Tons NOx	ROG	PM10	CO	Metric Tons N2O	CH4	CO2	CO2E
Light-Duty Trucks (LDT2)	25	8	0.07414	0.01223	0.00122	0.92327	0.01070	0.00366	303.84	0.033	0.005	0.001	0.407	71	0.0012	0.0002	0.0000	0.0145	0.0002	0.0001	4.3	4.4
Heavy-Duty Trucks: SCAQMD	172	100	1.21207	0.01030	0.01097	0.12490	0.14960	0.00420	1457.27	45.960	0.391	0.416	4.736	71	1.6316	0.0139	0.0148	0.1681	0.1827	0.0051	1779.6	1829.6
Heavy-Duty Trucks: SJVAPCD	108	100	1.21207	0.01030	0.01097	0.12490	0.14960	0.00420	1457.27	28.859	0.245	0.261	2.974	71	1.0245	0.0087	0.0093	0.1056	0.1147	0.0032	1117.4	1148.8

Evaporative Running Losses (ROC)

Source	Daily Miles	Hours/Day	ROC g/hour	ROC lb/day	Days	ROC Tons
Light-Duty Trucks (LDT2)	200	4	0.885	0.01	71	0.00025

Off-Road & On-Road Total

Pounds/Day NOx	ROG	PM10	CO	English Tons NOx	ROG	PM10	CO	Metric Tons N2O	CH4	CO2	CO2E
94.21	4.06	1.67	41.84	3.344	0.144	0.059	1.485	0.3060	0.0260	3188.6	3272.8

Notes:

[1] Emission factors from OFFROAD 2021 (ver 1.0.1) for Santa Barbara County, except diesel vessel factors from San Pedro Bay Ports Emissions Inventory

[2] Emission factors from EMFAC 2021 for Santa Barbara County year 2023 annual emissions

FULL REMOVAL ALTERNATIVE - TOTALS

Phase	Air pollutants: Total English Tons				GHG: Total Metric Tons			
	NOx	ROC	PM10	CO	N2O	CH4	CO2	CO2E
Dredging	39.46	3.20	1.91	12.54	0.104	0.048	2316.4	2346.2
Hazel Caisson Removal	21.77	1.78	1.05	7.00	0.057	0.026	1272.3	1288.7
Dewatering/Physical Stabilization	1.21	0.14	0.06	1.47	0.006	0.011	240.7	242.6
Offshore Water Treatment	0.02	0.01	0.00	0.04	0.000	0.001	14.0	14.1
Post Site Survey/Leveling	0.83	0.07	0.04	0.27	0.002	0.001	48.9	49.5
Construction Monitoring	6.50	0.72	0.36	2.62	0.017	0.011	394.3	399.4
Disposal	3.34	0.14	0.06	1.49	0.306	0.026	3188.6	3272.8
Total	**73.14**	**6.06**	**3.49**	**25.43**	**0.494**	**0.124**	**7475.2**	**7613.4**

Peak Day Emissions

Phase	Air pollutants: Pounds			
	NOx	ROC	PM10	CO
Dredging	3806.7	302.2	186.8	1163.8
Hazel Caisson Removal	2284.6	181.5	112.1	701.3
Dewatering/Physical Stabilization	39.7	4.8	2.0	47.0
Offshore Water Treatment	1.3	0.4	0.1	3.4
Post Site Survey/Leveling	83.5	6.9	4.0	28.8
Construction Monitoring	108.3	12.0	6.1	43.7
Disposal	94.2	4.1	1.7	41.8

Appendix C1

Tissue Concentrations in Resident Organisms at the 4H Shell Mounds

TISSUE CONCENTRATIONS IN RESIDENT ORGANISMS AT THE 4H SHELL MOUNDS

Submitted to:
California State Lands Commission
Department of Environmental Planning and Management
100 Howe Ave., Suite 100-South
Sacramento, CA 95825-8202

Submitted by:
Amec Foster Wheeler Environment & Infrastructure, Inc.
104 West Anapamu St., Suite 204A
Santa Barbara, CA 93101

March 2015

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ACRONYMS AND ABBREVIATIONS

AET	Apparent Effects Thresholds
AMEC	AMEC Environment & Infrastructure, Inc.
°C	Degrees Centigrade
°F	Degrees Fahrenheit
CSLC	California State Lands Commission
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
ERL	Effects Range Low
ERM	Effects Range Median
ESA	Endangered Species Act
FDA	Food and Drug Administration
GPS	Global Positioning System
knot	Nautical Mile per Hour
m	Meter
mg/kg	Milligrams per Kilogram
NaOH	Sodium Hydroxide
$NaHCO_3$	Sodium Bicarbonate
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
ppm	Parts per Million
SCCWRP	Southern California Coastal Water Research Project
SCUBA	Self Contained Underwater Breathing Apparatus
TRPH	Total Recoverable Petroleum Hydrocarbons
µg/kg	micrograms per kilogram
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WAAS	Wide Area Augmentation System

1 INTRODUCTION

1.1 Study Purpose

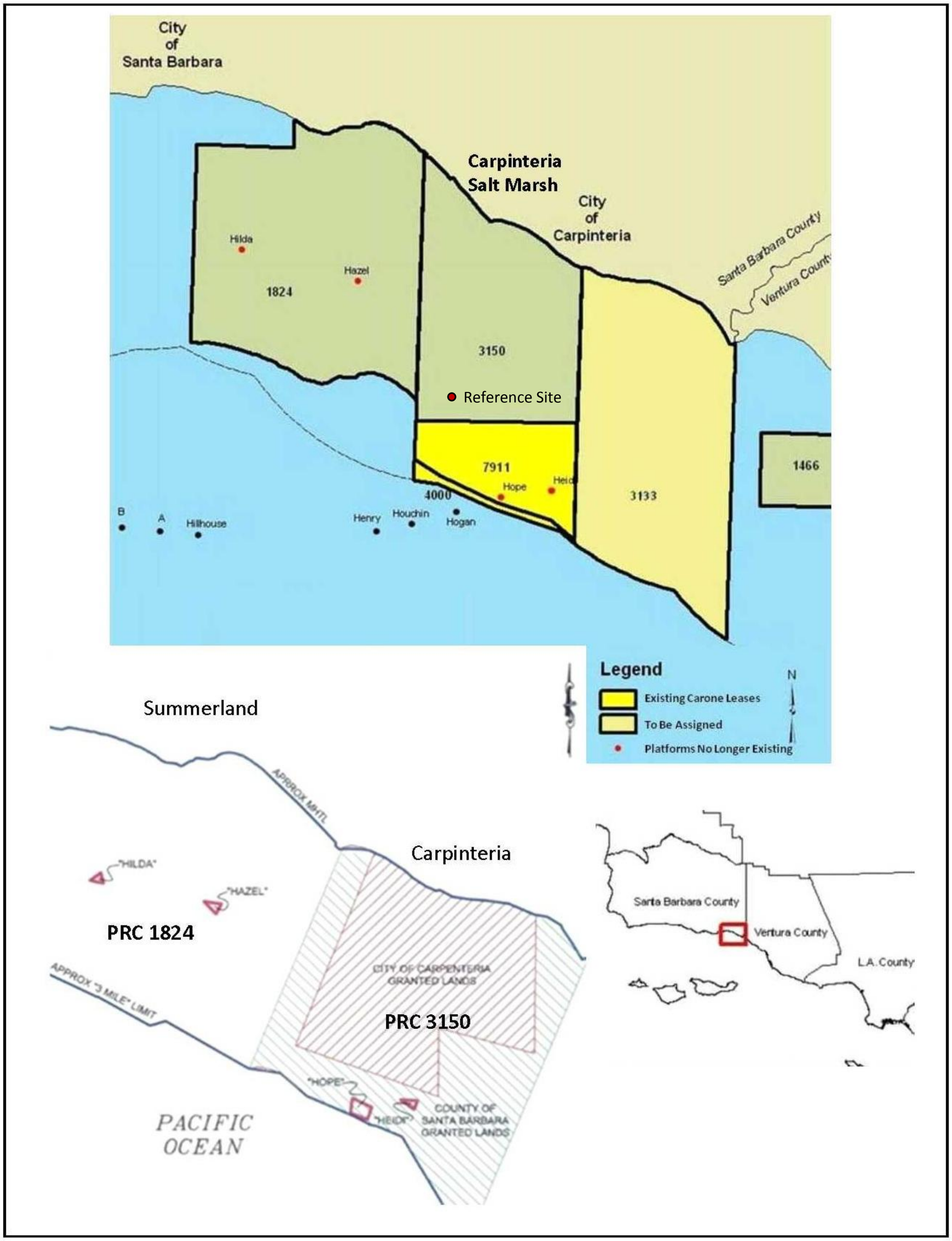
This report presents the results and findings of a study, conducted in November and December, 2013, by AMEC Environment & Infrastructure (AMEC) under contract to the California State Lands Commission (CSLC), of resident organisms on and near the "shell mounds" located at the former sites of State Oil and Gas Platforms Hilda, Hazel, Hope, and Heidi offshore Santa Barbara County, California. (Figure 1 shows the location of the shell mounds as well as a reference reef used as a control for this study. The Platforms, which were known collectively as the "4H Platforms," are listed from northwest to southeast.) The purpose of this study was to obtain updated information on potential contaminant levels in the tissues of organisms associated with the shell mounds to help inform the CSLC as it considers the final disposition of the shell mounds. Fieldwork associated with this study also allowed general assessment of the present value of the shell mounds as biological habitats.

The shell mounds, which remained on the seafloor after the 4H Platforms were removed in 1996, consist of drilling discharges covered by shells that fell from the platforms. The Hilda and Hazel mounds are on the surface of State sovereign land approximately 1.5 miles offshore Summerland. The Hope and Heidi mounds are located approximately 2.5 miles offshore Carpinteria on the surface of land owned by Santa Barbara County, in trust for the State of California pursuant to Chapter 846, Statutes of 1931, as amended. The mounds, which lie in approximately 100 to 140 feet of water and are 25- to 28-feet-tall with diameters ranging from 180 to 266 feet, consist of a central core of drill muds and cuttings from platform discharges encased by a 1- to 7-foot-thick shell hash layer of mussel, clam, and barnacle shells that developed from encrusting organisms that fell from the platforms to the seafloor. (See Table 1.)

Table 1. Location, Depth and Substrate of Shell Mounds and Reference site.

Site	*Coordinates*	*Water Depth*	*Substrate Description*
Hilda	34°23.313'N, 119°35.766'W	110 feet	Silty-clay mixed with shells
Hazel	34°22.993'N, 119°34.083'W	100 feet	Silty-clay mixed with shells
Hope	34°20.445'N, 119°31.908'W	140 feet	Silty-clay mixed with shells
Heidi	34°20.543'N, 119°31.181'W	130 feet	Silty-clay mixed with shells
Reference Site	34°21.510'N, 119°32.749'W	120 feet	Rock outcropping surrounded by silty-clay sediment

Figure 1. Project Location



Laboratory analyses were performed for metals, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and organochlorine pesticides. Results for tissues collected from the shell mounds were compared to the results for tissues collected from a nearby reference site, which comprised a rock outcropping surrounded by silty-clay sediment, and to results reported from prior tissue analyses of organisms and sediment samples collected from or near the 4H shell mounds (de Wit 1999, 2001; AMEC 2002; MEC Analytical Systems [MEC] 2002; SAIC 2003; Page et al. 2005).

1.2 Background

The 4H Platforms were constructed between 1958 and 1965. Platform Hazel was constructed in 1958, Platform Hilda in 1960, and Hope and Heidi in 1965 (SAIC 2003). Up until 1969, drill muds and cuttings were discharged from the platforms and accumulated beneath them. Drill cuttings consist of fragments of the native subsurface rock through which a well is drilled. Drilling fluids are used to cool and lubricate the drill bit, stabilize the borehole, remove drill cuttings, maintain hydrostatic pressure, and prevent pipe corrosion. The drill muds typically consist of weighting agents (barite), gelling and suspending agents (bentonite clays and acrylic polymers), deflocculants and filtration control agents (lignosulfonates and lignites), pH and ion-control substances (sodium hydroxide [NaOH], sodium bicarbonate [$NaHCO_3$]), bactericides and corrosion inhibitors (formaldehyde), lubricants (fuel or vegetable oils) and defoaming agents (aluminum stearate).

While the platforms were standing, their structures became covered with a dense growth of sessile organisms, including large mussels (*Mytilus californianus)*. Some of this growth became unstable and fell to the bottom. In addition, the growth on the platforms was scraped periodically by divers. Following the 1969 Santa Barbara oil spill, the State of California imposed a moratorium on offshore oil drilling on State lands (SAIC 2003). When the moratorium was lifted in 1976, drill muds and cuttings from additional drilling were barged to shore and hauled to land disposal sites, but the sessile organisms on the structures continued to fall to the bottom covering the piles of mud and cuttings. All of the wells on the 4H Platforms were shut-in prior to September 1992 and the platform structures were removed in 1996. The shell mounds remained in place.

1.3 Previous Studies of Chemical Contaminants in and Marine Life at the 4H Shell Mounds

In 1975, the Southern California Coastal Water Research Project (SCCWRP) studied the marine life associated with Platforms Hilda and Hazel (Bascom, Mearns and Moore 1976; McDermott-Ehrlich and G.A. Alexander 1978). Sediment and animals were taken from both platforms and compared to hard bottom and soft bottom reference sites. Sediment samples from all collection sites were analyzed for copper, zinc, volatile solids, and hexane extractable materials. In the cutting piles immediately below the platforms, the concentrations of all four materials were higher than levels in sediments surrounding the platforms and the soft bottom control site. The analysis of contaminants in crabs and rockfishes showed no evidence of contamination by petroleum hydrocarbons. Of the 11 trace metals studied, only the vanadium in rockfish livers varied significantly with the collection site. Vanadium was significantly higher in the livers of rockfishes collected at Platforms Hilda and Hazel compared to the hard bottom control site.

Ray de Wit (1999, 2001) conducted two studies of the 4H shell mounds after the platforms had been removed. The 1999 study described the marine life associated with the shell mounds. The 2001 study was a more detailed survey of the physical, chemical, and biological characteristics of the mounds. Sediment samples were collected by vibracore. The vibracore samples showed that the shell mounds consisted of three strata.

- Stratum 1, the shell hash stratum, was 1- to 7-feet-thick and consisted of mussel, clam, and barnacle shells up to several inches in diameter with variable amounts of black clay infilling.
- Stratum 2, the drill cuttings stratum, was 0- to 18-feet-thick and consisted of inter-layered sandy clay and clayey to silty sand with variable amounts of gravel-sized siltstone rock fragments with pockets of oil sheen/petroleum odor.
- Stratum 3 was natural sea floor sediments composed of fairly uniform clay.

Sediment chemistry analyses were conducted on samples from each stratum from each platform and from sediment taken from a reference site in the same depth range as the shell mound sites. Elutriate testing was completed on composite cores on the same strata as the sediment testing and elutriate bioassay tests were completed on Strata 1 and 2 at each of the four shell mounds. Testing of the de Wit (2001) samples yielded the following results.

- The highest concentrations of all of the heavy metals, Total Recoverable Petroleum Hydrocarbons (TRPH), and PAH within all of the strata, including the natural sediments underlying the shell mound material, exceeded the reference site sediments.
- The lowest values of antimony, barium, copper, chromium, lead, tin, and zinc in all three strata exceeded the levels in the reference sediment.
- The lowest values of nickel and PAH in Strata 2 and 3 also exceeded the values in the reference sediment.
- The levels of silver and TRPH in Stratum 2 were higher than the reference values.

- The Effects Range Median (ERM) concentration, the concentration at which biological effects are probable, for nickel was exceeded in the Strata 1 and 2 sediments at one or more sites and for PCB in Stratum 1 at one site (Hazel).
- The Hazel shell mound sediments exceeded the Effects Range Low (ERL) concentration (at which effects are possible) or ERM concentrations for more chemicals than all the other sites. The Hilda shell mound sediments were second.
- The results of the elutriate bioassay testing indicated that only the shell mound material at the Hazel shell mound site was toxic to the test organism, a mysid shrimp *Mysidopsis bahia.*

De Wit (2001) noted that the relative abundance of bat stars and rockfish on the 4H shell mounds in 2000 appeared to have declined since he surveyed the mounds in 1998 and that most of the gorgonians (*Lophogorgia chilensis*) attached to the shells were small. De Wit concluded that the value of the shell mounds as habitat had declined in 2000 compared to the de Wit (1998) survey. Gorgonians were not observed during this survey.

AMEC (2002) collected sediment from all four shell mounds by vibracore and analyzed the sediment for contaminants and toxicity to determine whether disposal of the shell mounds at the LA-2 Dredged Material Ocean Disposal Site was a viable option. Shell mound sediments were divided into top, middle, and bottom strata, as well as a composite of all three strata and compared to reference sediments collected from the LA-2 site. Sediment contaminant levels also were compared to ERM, ERL, and Apparent Effects Thresholds (AET). Finally, bioassays and bioaccumulation studies were done. Testing of the AMEC (2002) samples yielded the following results.

- Concentrations of metals at the shell mounds, particularly in the top and middle strata, were elevated compared to the LA-2 reference site. Barium, chromium, and zinc exceeded sediment screening levels at all four shell mounds. Selenium exceeded screening thresholds at the Hazel, Hilda, and Hope shell mounds. Lead and nickel exceeded screening levels at the Hilda and Hope mounds.
- The PCB Aroclor 1254 was detected in concentrations above screening levels in the top and middle strata of the Hazel and Hilda shell mounds and the top stratum of the Hope mound. No PCBs were detected at the Heidi mound or the reference site.
- PAHs were detected in the top and middle strata of the Hazel and Hope mounds and the middle stratum of the Heidi and Hilda mounds. PAHs were not detected at the reference site.

- Statistically significant toxicity was observed in all four solid-phase amphipod exposures and in mysid shrimp tests for Hazel, Hilda, and Heidi sediments.
- In the bioaccumulation tests, statistically significant levels of barium and PAHs were detected in clam and worm tissues compared to reference tissue levels.
- Because sediment from the shell mounds did not meet the limiting permissible concentration (as defined by the Marine Protection, Research, and Sanctuaries Act, also known as the Ocean Dumping Law) for benthic toxicity and bioaccumulation, the AMEC study determined that placement of 4H shell mound sediment at LA-2 was not an acceptable disposal alternative.

MEC Analytical Systems (2002) collected resident invertebrates at the 4H shell mounds and two reference sites, and analyzed the tissues for contaminants.

- Metals were elevated in several of the samples collected at the shell mounds compared to the reference site, but most metals were only slightly elevated (less than two fold) compared to the reference samples.
- A statistical comparison of metals levels in rock crabs in all the shell mounds compared to metals levels in both of the reference sites showed that nickel was the only contaminant both statistically different and more than two-fold greater than the reference site.
- Metals in bat stars showed no statistical difference between the pooled shell mound samples and the pooled reference sites.
- Low levels of certain PAH compounds were found in some of the samples.
- PCBs were detected in sea cucumber samples at Hazel and Hilda.

SAIC (2003) used the mussel watch approach to investigate whether there was evidence that contaminants were leaching from the 4H shell mounds into the water column. Mussels, which filter food from the water column, were tethered above the shell mounds and a reference site for several weeks. The mussels were collected and their tissues analyzed for contaminants.

- Contaminant bioaccumulation in the mussels that had been placed at the shell mounds did not show a statistically significant difference compared to bioaccumulation at the reference sites.
- Most compounds were found at lower concentrations in mussel tissues from the shell mounds compared to mussels from the reference locations.
- The report concluded that the study showed no evidence of contaminant leaching or toxicity/stress from the shell mounds.

Finally, Page et al. 2005 compared the marine life of the 4H shell mounds to shell mounds under platforms that had not been removed and concluded that the structure of shell mound communities is strongly influenced by the presence of the platform structure and the subsidies provided by the clumps of mussels and associated organisms that continually slough from the platform to the sea floor. Sea stars, in particular, were much less abundant and of a smaller size at the shell mound-only sites. However, rock crabs and sea cucumber abundance did not differ between the 4H shell mound sites and the mounds under existing platforms.

2 METHODS

2.1 Field Work

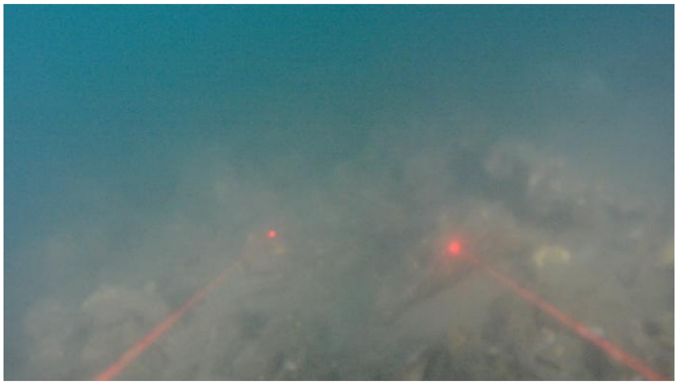
On November 18, 2013, and December 9 and 10, 2013, specialists under contract to AMEC took underwater video and collected organisms at the 4H shell mound sites.[1] The survey vessel was the 46-foot dive boat *Raptor*. The scientific crew consisted of Noel Davis of Chambers Group, Steve Radis, Bonnie Luke and Mike Doyon of Marine Research Specialists and Seth Jones of Marine Taxonomic Services, Ltd. In addition, engineers from Moffatt & Nichol were present on November 18 to make observations on the stability of the mounds. The engineering team consisted of divers Bill Dubbs and Nick Farrante and rescue diver/tender Lu Walcheff.

Two redundant Global Positioning System (GPS) devices and sonar were used to locate the shell mounds. GPS receivers included a Raymarine RS130 GPS Receiver and a Globalsat receiver using a SiRF Star IV GPS chipset using WAAS (Wide Area Augmentation System). Both units are accurate to less than 3 meters (m). A Raymarine DSM300 HD Digital Sonar Module was used to confirm the shell mound depth.

Table 1 shows the coordinates, depths, and substrate for the shell mounds and reference site. The depths represent the bottom of the shell mounds and reference site reef. The reference site was selected because it was a deep reef at a similar depth and in the general area of the 4H shell mounds, but is far enough away to not be influenced by shell mound contaminants.

Most of the diving was done by Steve Radis, Mike Doyon, and Seth Jones using closed circuit rebreathers. Noel Davis made one dive on Hazel and one dive on Hilda using Self Contained Underwater Breathing Apparatus (SCUBA). Video of the shell mounds and reference site was taken by Steve Radis. Video equipment included a Nikon D7100 camera, Ikelite DS161 video lights and two parallel Apinex RLP-LG05-B150 lasers operating at a wavelength of 650 nanometers. The lasers were mounted with a spacing of 10 inches. No video was taken on the Hilda mound because of poor visibility. Organisms were collected by Seth Jones by hand. Mike Doyon operated a guideline so that divers could find their way back to the boat anchor.

[1] Members of the survey team were approved by CSLC staff as part of Contract C2012-055 (May 2013) between the CSLC and Amec Foster Wheeler (formerly AMEC).



Poor visibility on November dives made video, observations, and collection of organisms very difficult.

Improved conditions in December facilitated collection of video and organisms at the shell mounds and the reference site.

On November 18, Noel Davis, Seth Jones, Steve Radis, Mike Doyon, Bill Dobbs, and Nick Farrante dived on the Hazel shell mound, but visibility was too poor to work safely underwater. The swell was 3 to 5 feet. Water temperature was 60 degrees Fahrenheit (°F). Some video was taken at Hazel.

Steve Radis and Mike Doyon then dived on the Hope shell mound where conditions were better and video was taken. Underwater visibility at the Hope mound was about 4 feet. Wind and wave conditions deteriorated in the afternoon of November 10 reaching about 20 nautical miles per hour (knots), and the decision was made to abort the trip.

The survey resumed on December 9 and 10 under better conditions. Swell was 2 to 4 feet and winds were calm. Swell was 2 to 4 feet and winds were calm. The temperature underwater was 55°F. Underwater visibility ranged from about 1 to 10 feet. On December 9, invertebrates were collected on the Hilda and Hazel mounds. On December 10, invertebrates were collected on the Hope and Heidi mounds and the reference site reef, video was taken on the Hope and Heidi mounds and the reference site reef, and long lines to collect fishes were deployed.

Each long line consisted of a lead line with 15 baited hooks attached to a weighted buoy on each end. Hooks were baited with squid (*Loligo opalescens*). Nine fishes were caught by the long lines. The fishes collected included two ocean whitefish (*Caulolatilus princeps*) and two sheephead (*Semicossyphus pulcher*) at the Hope shell mound, three brown rockfish (*Sebastes auriculatus*) at the Hazel mound, and a brown rockfish and a vermillion rockfish (*Sebastes miniatus*) at the reference site. Only rockfishes from the reference site and the Hazel mound were selected for fish tissue analysis.

All organisms except rockfish were collected by hand and placed in net bags prior to transport to the surface.

All organisms collected were catalogued by Bonnie Luke, placed in plastic bags, and put in coolers on ice. Enough organisms were placed in each bag to provide an adequate tissue sample for the analysis. Appendix A contains a list of all organisms collected during the survey.

The survey plan included the collection of bat stars, sea cucumbers, rock crabs, and rockfish. The invertebrate species were selected for collection because they are common at the shell mound depths in the Santa Barbara area and because they were collected by MEC in 2002. Rockfish were selected because they tend to be resident on a reef and because people may fish for them at the shell mounds and consume them. No sea cucumbers were found at the two shallower mounds (Hazel and Hilda); therefore Kellet's whelks were collected instead. However, no Kellet's whelks were observed at the deeper mounds or the reference site. Because there were no reference samples and no prior data on Kellet's whelks at the shell mounds, they were not selected for laboratory analysis. Table 2 shows the sample collection and analysis timeline.

2.2 Laboratory Analysis

Samples were received in the laboratory in good condition and stored frozen at -20 degrees Centigrade (°C). The contaminants selected for analysis included metals, PAHs, PCBs, and organochlorine pesticides. Metals, PCBs and PAHs were selected because they have been found at elevated concentrations in previous studies and may be associated with drilling operations. Organochlorine pesticides are not associated with oil development, but biomagnify throughout the food chain and may represent a risk to consumers of any fish caught near the shell mounds.

Metals (except for mercury) were analyzed by Method 6020A inductively coupled plasma-mass spectrometry. Mercury was analyzed by Method 7470A cold vapor atomic absorption. Organic chemicals were extracted by EPA 3541 automated soxhlet extraction. Pesticides were analyzed by Method 8081B gas chromatography. PCBs were analyzed by Method 8082A gas chromatography. PAHs were analyzed by method 8270D gas chromatography/mass spectrometry. The full laboratory reports including chain of custody forms and information on data quality are contained in Appendix B.

Table 2. Shell Mounds Tissue Analysis Timeline

Sample Collection, Shipping and Receipt	12/9/13	Hazel and Hilda sites collected, stored and transported in cooler on dry ice, stored at MRS office per lab direction in freezer at ≤-4°C
	12/10/13	Heidi, Hope, rockfish lines, Reference sites collected, stored and transported in cooler on dry ice, stored at MRS office per lab direction in freezer at ≤-4°C
	12/18/13	All samples packed in dry ice, shipped overnight in two coolers
	12/19/13	Samples received at lab. Cooler temperatures measured at -26°C, -29.9°C. All custody papers confirmed as correct, sample labels confirmed as complete. Samples stored frozen at -20°C upon receipt at lab.
Sample Extraction and Analysis Sample Group K1212761	12/28/13	Extracted for total lipids, PAH
	12/30/13	Extracted for organochlorine pesticides, PCBs
	12/31/13	Total solids analyzed
	1/03/13	Total lipids analyzed
	1/06/14	Extracted for metals
	1/09/14	Analyzed for metals
	1/09/14, 1/10/14	Analyzed for PAH
	1/10/14, 1/11/14	Analyzed for PCBs
	1/14/14, 1/15/14	Analyzed for organochlorine pesticides
Sample Group K1212762	12/27/13	Extracted for total lipids, PAH
	12/30/13	Total lipids analyzed
	12/31/13	Extracted for organochlorine pesticides and PCBs, analyzed for total solids
	1/06/14	Extracted for metals
	1/08/14, 1/09/14, 1/16/14	Analyzed for organochlorine pesticides
	1/09/14	Analyzed for PCBs, metals
	1/10/14	Analyzed for PAH
Sample Group K1212763	12/28/13	Extracted for total lipids, PAH
	12/30/13	Total lipids analyzed
	1/02/14	Extracted for organochlorine pesticides, PCBs, analyzed for total solids
	1/06/14	Extracted for metals
	1/09/14, 1/13/14	Analyzed for metals
	1/13/14, 1/14/14	Analyzed for PCBs
	1/14/14	Analyzed for organochlorine pesticides, PAH

2.3 Data Analysis

Contaminant concentrations in organisms collected from each shell mound were compared to concentrations from organisms at the reference site, where possible. The difference was tested for significance using a one tailed t-test to maximize sensitivity. Results of the present study also were compared qualitatively with tissue concentrations reported by MEC (2002). A statistical analysis could not be done to determine whether differences in tissue concentrations between the present study and the MEC study were significant because the MEC report only presented tables summarizing the data not the concentrations in the individual samples. Finally, tissue concentrations were compared to levels that may raise human health concerns. Table 3 shows the human health screening levels that were used in this analysis.

Table 3. Human Health Screening Levels

	Screening Level	
Metals mg/Kg wet*	**Shellfish**	**Fish**
Antimony	1.0	1.0
Arsenic	1.4	1.4
Barium	NA	NA
Cadmium	1.0	0.3
Chromium	1.0	1.0
Copper	20.0	20.0
Lead	2.0	2.0
Mercury	0.5	0.5
Nickel	NA	NA
Selenium	0.3	2.0
Zinc	70.0	45.0
PAH mg/Kg wet#		
Naphthalene	123	32.7
Acenaphthene	NA	NA
Fluorene	246	65.3
Phenanthrene and Anthracene	1846	490
Fluoranthene	246	65.3
Pyrene	185	49
Benz(a)anthracene	1.32	0.35
Chrysene	132	35
Benzo(b)fluoranthene	1.32	0.35
Benzo(k)fluoranthene	13.2	3.5
Benzo(a)pyrene	0.132	0.035
Ideno(1,2,3-cd)pyrene	1.32	0.35
Dibenz(a,h)anthracene	0.132	0.035
PCB (µg/Kg wet)+		48
Pesticides (mg/Kg wet)**		
Heptachlor Epoxide	0.3	
All DDTs	5	

* Median International Standards for Trace elements in Freshwater Fish and Marine Shellfish
# Federal Drug Administration (FDA) Level of Concern
+U.S. Environmental Protection Agency (USEPA) Human Health Screening Level based on an assumption of consumption of 1 8 oz meal per month (USEPA 1999)
**FDA Guidelines

3 SHELL MOUND PHYSICAL OBSERVATIONS

3.1 Marine Organisms

Generally, the shell mounds showed minimal diversity and density of sessile and mobile invertebrates, and few fish were present.

The surface of the shell mounds (shell hash) consists of empty shells (primarily mussel shells), silty sediment, and debris. The shell mounds attract hard bottom organisms, but provide far fewer crevices for organisms to hide within when compared to natural reefs. Where there was debris, such as old pipes, there was a greater concentration of organisms than on the shell hash itself. The most conspicuous organism was the bat star (*Asterina miniata*). Other organisms observed included Kellet's whelks (*Kelletia kelletii*), sea cucumbers (*Parastichopus californicus*) and rock crabs (*Cancer productus, Metacarcinus anthonyi,* and *Romaleon antennarium*). A spiny lobster (*Panulirus interruptus)* was observed on the Hope shell mound, and several lobsters were observed in an abandoned pipe on the Hazel mound. In the 1970s before the platforms were removed, diver-biologists observed large numbers of the white sea anemones (*Metridium senile*) on the cuttings piles of Hilda and Hazel (Bascom et al. 1976). Only one white anemone was observed during the present survey. It was attached to a piece of pipe debris on the Hope shell mound. Fishes appeared to be scarce, although the visibility was poor. Burrowing organisms also appeared to be scarce. Only two clam siphons were observed on the Hope shell mound, and disturbance of the shell hash by hand revealed extremely low densities of invertebrates below the mound surface.

The rocky reef reference site had high diversity and abundance of invertebrates and fish species.

In contrast to the shell mounds, the reference site reef supported an abundance of marine life. Fishes were abundant around the rocks. The rocks were covered with attached organisms, including sponges, gorgonians (*Lophogorgia chilensis* and *Eugorgia rubens)*, ostrich plume hydroid (*Aglaophenia struthionides)*, strawberry anemone (*Corynactis californica)*, and cup coral (*Paracyathus stearnsi)*. Mobile invertebrates included bat stars, rock crabs, and sea cucumbers.

3.2 Other Observations

Gas Bubbles

During the present survey, bubbles were observed in the vicinity of the Hazel mound. The bubbles were observed from the surface near the west and northwest side of the Hazel shell mound; however, the precise source could not be identified from this observation. Poulter (2014) of Padre Associates presented video documentation that gas bubbles near the Hazel mound have occurred in the vicinity since before Platform Hazel was removed. The bubbles documented on video emitted from a gas seep in the sea floor adjacent to the Hazel mound rather than the mound itself, but the precise location of the gas source could not be confirmed during the current survey due to poor visibility. While small emissions of bubbles were observed from the shell mound during this survey, their relationship (if any) to the off-mound gas seep formerly documented by Padre Associates (Poulter 2014) could not be confirmed.

Debris

All four shell mounds had significant accumulations of foreign debris, including anchor chains, pipelines, smaller pipes, steel beams, and other assorted metallic objects. There were also several abandoned lobster traps on the shell mounds. It is unknown how deep these objects protrude into the shell mounds, but all were unmovable by divers. Generally, the steeper portions of the shell mounds are characterized by areas with a significant accumulation of foreign objects, many of which protrude from the shell mounds. It would appear that these objects allow the steep slopes to remain undisturbed from external forces, whether it be strong currents or fishermen trawling over the shell mounds. The foreign debris, such as the Hazel caissons, also appears to aid in stabilizing the steeper slopes.

Mound Stability

As noted above, all four shell mounds are characterized by significant shell hash filled with soft sediment. The Hazel and Hilda shell mounds had extremely soft sediments overlying a harder shell hash core that were easily disturbed by the anchor, anchor chain, and divers. The Hope and Heidi shell mounds, which are located farther offshore and in a more dynamic oceanographic environment, had less soft sediment and a generally coarser sediment distribution.

Concurrent with the biological sampling program, engineering divers evaluated the potential for slope instability. SCUBA dives were conducted on each shell mound to look for evidence of prior slope failures and to qualitatively evaluate the cohesion of the sediments along the steeper portions of the shell mounds. In most areas along the shell mound slopes, the slope is relatively gentle and stable, while steeper portions of the slopes appear to be supported by debris anchored in the shell mound. Over all, no indications of slope movement were observed. Although the silty surface sediments are easily disturbed, the underlying slopes appear to be quite firm and stable, even when contacted by divers. The shell hash is well compacted and saturated with sand and mud, and in most cases, covered with a coating of soft sediment. In the absence of significant external forces, such as trawling, the slopes appear to be stable.

4 CONTAMINANT CONCENTRATIONS IN MARINE ORGANISMS AT THE SHELL MOUNDS

Appendix A and B show the results of the analyses of tissue samples from organisms at the shell mounds and the related statistical analysis. The only metals that were significantly elevated at the shell mounds compared to the reference site were barium in the bat stars at the Hope, Heidi and Hazel shell mounds and copper in sea cucumbers at the Hope mound. Several PAHs were significantly elevated in sea cucumbers and bat stars at the shell mounds compared to the reference site. PCBs were significantly elevated in rockfish at the Hazel mound compared to the reference site. Finally, the pesticide heptachlor epoxide was significantly higher in bat stars at the Hope shell mound compared to the reference site. Statistical comparisons could not be made for the Hilda shell mound because only one bat star and no sea cucumbers or rockfish were collected there.

Statistical comparisons to the reference site could not be made for tissue levels in crabs at any of the shell mounds because no crabs were collected at the reference site. Few specimens were observed due to extensive commercial crab harvesting at the reference site and they were located in crevices too deep to allow for capture. The number of burrowing organisms, such as worms and clams, observed on the mounds during the study was too small for a representative sample. Two clam siphons were observed on the Hope shell mound and extremely low densities of invertebrates were detected below the mound's surface when the shell hash was disturbed by hand. Due to the apparent lack of abundance (both observed by the scientific dive crew and documented by MEC [2002]), difficulties in retrieving samples without overly disturbing shell hash, and additional costs associated with retrieving organisms within the substrate of the shell mounds, burrowing organisms were not sampled for this study.

The results are summarized below for each shell mound.

4.1 Hilda Shell Mound

Metals

Invertebrates. The barium level in the one bat star sample collected from Hilda was higher than the highest sample from the reference site, but by less than 10 percent (5.47 micrograms per kilogram [μg/kg] dry weight versus 5.02 μg/kg dry weight). As only one sample was collected, no statistical significance was ascribed to this value. The concentrations of other metals in the bat stars collected from Platform Hilda were similar to or lower than the reference site. The barium concentration in the bat star sample from the Hilda mound was similar to the average of 5.8 milligrams per kilogram (mg/kg) found by MEC (2002) in bat stars at the Hilda mound. Other metal concentrations also were similar to the concentrations found in bat stars at Hilda by MEC. The concentrations of most metals, with the exception of cadmium, were similar in rock crabs to the levels in crabs sampled at Hilda by MEC. The average cadmium in crabs collected at the Hilda mound in this study was 2.72 mg/kg compared to an average of 0.12 mg/kg in crabs at the Hilda mound in the MEC (2002) study. Barium and cadmium were both found to be elevated in Strata 1 and Strata 2 shell mound sediments at the Hilda mound compared to reference sediments in the de Wit (2001) study. In the AMEC (2002) study, barium was elevated at the Hilda mound compared to the reference but cadmium was not detected in the Hilda shell mound sediments.

Rockfish. No rockfish were retrieved from longlines deployed at Hilda.

Polycyclic Aromatic Hydrocarbons

Invertebrates. No PAHs were detected in the bat star collected at Hilda, and no sea cucumbers were collected. Slightly elevated PAH levels were observed in crabs collected at Hilda in the current study, with naphthalene showing the greatest increase as compared to the other shell mounds (average of 7.30 µg/kg dry weight compared to 4.30, 4.14, and 3.34 µg/kg dry weight at the other three mounds). No crabs were collected from the reference site; therefore no statistical comparison was made. These levels are only slightly above analytical limits and several orders of magnitude below any published levels of biological effect for naphthalene. PAH levels in rock crabs at Hilda in this study were higher than PAH levels in crabs sampled by MEC in 2002. MEC found only phenanthrene (mean of 0.93 µg/kg) and benzo (g,h,i) perylene (average of 1.1 µg/kg) in red rock crabs at the Hilda shell mound. PAHs were elevated in Strata 1 and 2 sediments of the Hilda shell mound in 2001 (de Wit 2001) and in sediments in the middle stratum of the Hilda mound relative to the reference in 2002 (SAIC 2002).

Rockfish. No rockfish were retrieved from longlines deployed at Hilda.

Polychlorinated Biphenyls

Invertebrates. No PCBs were observed in the bat star collected from Hilda. One of the four crab samples from Hilda showed detectable levels of Arochlor 1260; however no Arochlor was observed in the other crabs collected from Hilda and no statistical significance was ascribed to this value. PCBs were below detection limits in the crabs sampled by MEC (2002). Arochlor 1260 was not found to be elevated in Hilda shell mound sediments in either the de Wit (2001) or AMEC (2002) study

Rockfish. No rockfish were retrieved from longlines deployed at Hilda.

Organochlorine Pesticides

Invertebrates. No significant differences were observed in levels of organochlorine pesticides observed in tissues from bat stars collected at Hilda compared to the reference site. Similar to the other mounds, crabs collected from Hilda had measurable levels of 4,4’ Dichlorodiphenyldichloroethylene (DDE) in their tissues; however, these levels were well below those reported as having biological effects in the U.S. Army Corps of Engineers (USACE) Environmental Residue Effects Database (see http://el.erdc.usace.army.mil/ered/ - Accessed March 2014).

Rockfish. No rockfish were retrieved from longlines deployed at Hilda.

4.2 Hazel Shell Mound

Metals

Invertebrates. Barium in bat stars was the only metal that was significantly elevated at the Hazel shell mound, compared to the reference site. Barium in bat star tissues was generally higher in the current study, compared to the MEC (2002) study, although the MEC study found barium in bat stars to be significantly higher than at the MEC reference site. No sea cucumbers were present at Hazel, so they were not collected.

The barium levels observed in bat stars from Hazel were the highest of all four mounds, with an average of 26.9 parts per million (ppm), as compared to 1.73 ppm at Hilda, 3.35 ppm at the Heidi shell mound, and 3.52 ppm at the Hope shell mound.

Barium concentrations in crabs could not be compared to the reference site because no crabs were collected at the reference site. The average barium level in crabs at the Hazel mound in this study was 26.9 mg/kg which exceeds the average of 6.9 mg/kg found in rock crabs at the Hazel mound by MEC (2002).

Rockfish. Barium concentrations in rockfish were slightly higher at Hazel than at the reference site, but the results were not statistically significant.

Polycyclic Aromatic Hydrocarbons

Invertebrates. PAH levels in bat stars collected from Hazel were not significantly different from those in tissues from bat stars collected from the reference site. No sea cucumbers were present at Hazel, so they were not collected. Crabs collected at the Hazel mound had detectible levels of several PAH compounds. Crabs collected at the Hazel mound in 2002 did not have any PAHs above detection limits (MEC 2002). Total PAH concentrations were found to be elevated in Strata 1 and 2 of the Hazel mound sediments in 2001 (de Wit 2001) and were higher than the reference site in sediments collected from the Hazel mound middle stratum by AMEC (2002).

Rockfish. PAH levels in rockfish collected at Hazel were not higher than those in rockfish at the reference site. PAHs do not tend to accumulate in fishes because they are able to biomodify and eliminate these compounds.

Polychlorinated Biphenyls

Invertebrates. PCBs were not detected in bat stars at the Hazel shell mound in the current study. Arochlor 1254 was detected in one crab from the Hazel mound. No PCBs were detected in crabs from the Hazel mound in 2002 (MEC 2002). No sea cucumbers were present at Hazel, so they were not collected. De Wit (2001) found elevated levels of PCBs in Stratum 1 of the Hazel mound and AMEC (2002) found Arochlor 1254 at elevated levels in both the top and middle strata at the Hazel mound. PCBs are not known to have been used in drilling muds, but were used prior to 1984 in hydraulic fluids that could have been incorporated into the mounds. PCBs in the Hazel shell mound also could have come from debris that fell from the platform.

Rockfish. In the current study, PCBs (Arochlor 1254 and Arochlor 1260) were significantly elevated in rockfish at Hazel compared to the reference site. PCBs biomagnify through the food chain; therefore, rockfish may be acquiring PCBs by eating invertebrates with low levels of PCBs at the Hazel shell mound or from the nearby sediments. The U.S. Environmental Protection Agency (USEPA) human health screening level for PCBs is 0.048 mg/kg wet weight (USEPA 1999); the levels observed in the rockfish at Hazel average 0.006 mg/kg and do not exceed this level. In Atlantic cod, Arochlor 1254 tissue levels of 60 µg/kg wet weight (approximately 8 times the levels seen in the tissue samples from Hazel) were preliminarily correlated with reproductive abnormalities, and 90 percent mortality was observed at 1,290 µg/kg wet weight (Sangalang et al. 1981).

Organochlorine Pesticides

Invertebrates. No sea cucumbers were present at Hazel, so they were not collected. Levels of 4,4’-DDE in bat stars collected at Hazel were significantly lower than those from bat stars collected at the reference site.

Rockfish. The level of 4,4’ DDE was significantly elevated in rockfish at Hazel compared to the reference site. 4,4’ DDE is the breakdown product of dichlorodiphenyltrichloroethane (DDT), which was widely used as a pesticide until it was banned in 1972. Like PCBs, DDE magnifies at higher trophic levels in the food chain. DDE is still ubiquitous in California coastal waters. Based on studies compiled in the USACE Environmental Residue Effects Database, concentration of 4,4’ DDE of 4,000 µg/kg wet weight in largemouth bass (approximately 160 times greater than the levels observed in rockfish in the current study) resulted in a range of reproductive and physiological abnormalities, while levels as low as 80 µg/kg wet weight (approximately 4 times greater than the levels observed in rockfish in the current study) resulted in changes in organ size in rainbow trout.

4.3 Hope Shell Mound

Metals

Invertebrates. The only metals that were statistically significantly elevated at the Hope mound compared to the reference site were barium in bat stars and copper in both sea cucumbers and bat stars. The barium levels observed in bat star samples from Hope averaged 6.16 mg/kg. Barium in sea cucumbers at Hope was higher than at the reference site, but the difference was not statistically significant. MEC (2002) also found barium in bat stars to be significantly higher than at their reference site, and the average concentration of 6.78 mg/kg found in bat stars collected by MEC at the Hope mound was similar to the present study. MEC did not collect sea cucumbers at the Hope mound. Barium concentrations in crabs could not be compared to the reference site because no crabs were collected at the reference site. Barium levels in crabs (average 3.52 mg/kg) generally were similar to levels found in the MEC study (average of 6.71 mg/kg). Both the de Wit (2001) study and the MEC (2002) study found that barium in sediment in all three strata at the Hope mound exceeded reference values.

Copper levels were significantly higher in bat stars and sea cucumbers at Hope compared to the reference site. The copper levels in bat stars at Hope in the current study were also higher than those found at Hope by MEC (2002) (MEC did not have samples of sea cucumbers from Hope or a reference site). The levels of copper found in sea cucumbers at Hazel, Heidi, and Hilda were lower than those found at Hope in the current study (Hazel was only slightly lower with an average of 15.70 ppm compared to 17.97 ppm at Hope). Concentrations of copper in crabs in the present study (average of 36.7 mg/kg) generally were lower than those found in crabs at the Hope mound in the MEC study (average of 66.6 mg/kg). MEC (2002) did find copper concentrations in crabs at the Hope mound significantly elevated compared to their reference site. Tissue levels in crabs and the other marine invertebrates at the Hope mound are less than the Median International Standard for Trace Elements in Freshwater Fish and Marine Shellfish (100 mg/kg dry weight for copper). Like barium, copper was elevated in all three strata of Hope shell mound sediments compared to the reference sites in the de Wit (2001) and AMEC (2002) studies. Copper is not typically a drilling mud component. The copper in the Hope shell mound may have come from platform debris. Copper is widely used in wires, cables, motors and plumbing.

Rockfish. No rockfish were retrieved from long lines deployed at Hope.

Polycyclic Aromatic Hydrocarbons

Invertebrates. Levels of phenanthrene, pyrene and benzo(b)fluoranthene were significantly greater in sea cucumbers at Hope compared to the reference reef. In bat stars, fluorine, phenanthrene, fluoranthene, pyrene and total PAH were significantly elevated at the Hope shell mound compared to the reference site. Naphthalene and phenanthrene were also found in crabs at all of the shell mounds, including Hope, but no crabs were collected at the reference site and the observed levels in the crabs collected from the mounds were only slightly above the detection limits.

Overall, PAH levels in all of the invertebrates at Hope were higher than those recorded by MEC (2002). Generally, the levels observed in the tissues of animals collected from the shell mounds are an order of magnitude or more below Food and Drug Administration (FDA) levels of concern (Table 3). Tissue-level PAH chronic toxicity values available for echinoderms in the USACE Environmental Residue Effects Database,[2] though lower than the FDA levels of concern, remain 100 or more times greater than the levels observed in the tissues of organisms at the shell mounds. For example, toxic effects to polychaetes were found from phenanthrene levels of 780 µg/kg wet weight, while the highest levels observed in invertebrates at Hope was 2.80 µg/kg wet weight.

Total PAH concentrations in sediments at the Hope shell mound did not exceed the ERL screening level in either the de Wit (2001) or AMEC (2002) study. However, naphthalene, acenaphthene and phenanthrene exceeded their ERL values in the AMEC study.

Rockfish. As stated above, rockfish were not collected from Hope.

Polychlorinated Biphenyls

PCBs were not detected in any samples collected from Hope during the current study.

Organochlorine Pesticides

The pesticide derivative heptachlor epoxide was significantly elevated in bat stars at Hope compared to the reference reef. Heptachlor epoxide is derived from a pesticide that was banned in the U.S. in the 1980s, and is not known to be related to drilling discharges or oil and gas operations. No tissue-specific levels of biological concern are available for organochlorine pesticides in echinoderms; however, the minimum level determined to affect growth rates in eastern oysters was 10 µg/kg wet weight in eastern oysters (more than 30 times the level observed in the bat stars at Hope of approximately 0.3 µg/kg wet weight). Levels of 4,4’-DDE in bat stars collected at Hope were significantly lower than those from bat stars collected at the reference site, as was also the case for bat stars collected at Heidi and Hazel. The FDA Guideline for human health safety for consumption of fish is 300 µg/kg wet weight for heptachlor epoxide or orders of magnitude greater than observed in bat stars in this study.

[2] http://el.erdc.usace.army.mil/ered/

4.4 Heidi Shell Mound

Metals

Invertebrates. Barium levels observed in bat star samples from the Heidi shell mound averaged 5.84 mg/kg. Barium was significantly elevated in bat stars at Heidi compared to the reference site (average of 4.92 mg/kg). Barium in sea cucumbers at Heidi was higher than at the reference site (12.08 mg/kg compared to 7.73 mg/kg), but the difference was not statistically significant. Barium levels in sea cucumbers collected at Heidi in the current study were an order of magnitude lower than the levels collected by MEC (2002) (average of 108.3 mg/kg). Barium concentrations in crabs from Heidi could not be compared to the reference site because no crabs were collected at the reference site; however, the barium levels observed in crabs collected at Heidi in the current study (average of 3.35 mg/kg) were similar to levels found by MEC (2002) (average of 2.56 mg/kg). Barium in sediments sampled from the Heidi shell mound was found to be elevated compared to reference sediment in both the de Wit (2001) and AMEC (2002) study.

Copper levels observed in bat stars at Heidi were similar to, or lower, than those found in bat stars by MEC (2002), and were not elevated compared to the reference site. Copper levels were not elevated in sea cucumbers collected from Heidi.

Rockfish. No rockfish were retrieved from longlines deployed at Heidi.

Polycyclic Aromatic Hydrocarbons

Invertebrates. The average total PAH in sea cucumbers at Heidi was 76.84 µg/kg dry weight, similar to the total PAH levels seen at the reference site and at the other shell mounds. Phenanthrene, fluoranthene and benzo(a)anthracene were significantly elevated in sea cucumbers compared to the reference. In bat stars collected from Heidi, dibenzofuran, phenanthrene, fluoranthene, pyrene and total PAH were significantly greater compared to the reference. Average total PAH in bat stars was 26.38 µg/kg dry weight, significantly greater than at the reference site, Hazel and Hilda, but lower than at Hope. Five types of PAHs were also found in crabs from Heidi, but most of the samples showed PAH levels below analytical detection limits, and even those that were detected were only slightly above the detection limit. No crabs were collected from the reference site, so statistical comparison could not be performed.

PAH levels in all of the invertebrates collected at Heidi were higher than those recorded in the MEC (2002) study. Generally, the levels observed in the tissues of animals collected from Heidi were an order of magnitude or more below FDA levels of concern. Tissue-level PAH chronic toxicity values available for echinoderms in the USACE Environmental Residue Effects Database, though lower than the FDA levels of concern, remain 10 or more times greater than the levels observed in the tissues of organisms at the Heidi mound. For example, toxic effects to polychaetes were found from phenanthrene levels of 780 µg/kg wet weight, while the highest level observed in invertebrates at Heidi was 2.10 µg/kg wet weight in the bat stars.

PAHs in sediments sampled at the Heidi shell mound by de Wit (2001) were below the ERL level. AMEC found naphthalene and phenanthrene above the ERL level in sediments from the middle stratum of the Heidi mound (AMEC 2002).

Rockfish. As stated above, no rockfish were collected at Heidi.

Polychlorinated Biphenyls

No PCBs were detected in the tissues of animals collected at Heidi.

Organochlorine Pesticides

Invertebrates. No significant differences were observed in levels of organochlorine pesticides observed in tissues from the sea cucumbers collected at Heidi compared to the reference site. Levels of 4,4’-DDE in bat stars collected at Heidi were significantly lower than those from bat stars collected at the reference site, as was also the case for bat stars collected at Hope and Hazel. Crabs collected from Heidi had measurable levels of 4,4’-DDE, but the levels were generally consistent with those observed at the other mounds.

Rockfish. As stated above, no rockfish were collected at Heidi.

5 CONCLUSIONS

Barium and copper were the only metals found to be elevated in the tissues of invertebrates collected at the shell mounds during this survey. Barium in bat stars was elevated compared to the reference at all four shell mounds. Barium in sea cucumbers collected at the Hope and Heidi mounds was higher than at the reference site, but the results were not statistically significant. Barium is a major component of drilling muds and was found in previous studies to be elevated in the sediments of the shell mounds (de Wit 2001, AMEC 2002), and barium levels were anticipated to be greater in the tissues of resident invertebrates at the shell mounds when compared to levels found at the reference site. Barium was not significantly elevated in rockfish collected at the Hazel shell mound compared to the reference reef.

Copper was significantly elevated in the tissues of bat stars and sea cucumbers at the Hope shell mound, but not at the three other shell mounds. The levels of copper found in invertebrates living on the Hope mound are below the Median International Standard for copper in marine shellfish which is approximately 100 mg/kg wet weight(based on an assumption of 20 percent solids content). Copper was found to be elevated in all three strata of the Hope mound sediments in the de Wit (2001) and AMEC (2002) studies. Copper is widely used in wires, plumbing, cables and motors and may have come from debris that fell from Platform Hope.

Metal levels in the present study were generally similar to those found in the tissues of organisms collected from the shell mounds by MEC (2002), although some metals in some invertebrates were higher than in the MEC study. There is no pattern that would indicate that organisms are accumulating greater concentrations of metals in 2013 compared to 2002.

The concentrations of several PAHs were significantly elevated in bat stars and sea cucumbers at the Heidi and Hope shell mounds compared to the reference reef. PAH concentrations in this study generally were higher than those found in the tissues of invertebrates collected at the shell mounds by MEC (2002). PAH levels detected in invertebrates and rockfish in this study were orders of magnitude below FDA levels of concern (Table 3).

PCBs were found to be significantly elevated in rockfish collected at the Hazel shell mound compared to the reference site. No rockfish were collected on Hilda, Hope or Heidi, therefore no data are available for those sites. PCBs biomagnify at higher levels in the food chain. Therefore, rockfish could have acquired PCBs by feeding on invertebrates with low levels of PCBs at the Hazel mound. Stratum 1 of the Hazel mound was the only shell mound sediment with detectible levels of PCBs in 2001 (de Wit 2001). The PCB level measured in the Hazel mound stratum 1 sediments exceeded the ERM level for PCBs. Arochlor 1254 was found at elevated levels in both the top and middle strata of the Hazel mound in 2002 (AMEC 2002). Arochlor 1254 at the Hazel mound exceeded the ERM and AET screening levels in 2002. AMEC found PCBs above ERM and AET screening levels in all of the 4H mound sediments except Heidi. PCBs were widely used in electrical equipment, oils, inks, and dyes until they were banned by the USEPA in 1977. Large amounts of PCBs were discharged through sewage outfalls prior to this date and they are ubiquitous in southern California ocean sediments. Therefore, PCBs at the Hazel mound may have come from hydraulic fluids used on the platform, but also could come from historic sewage discharges.

Hetachlor epoxide in bat star tissues collected from the Hope mound was the only pesticide significantly higher than the reference site. Heptachlor epoxide is derived from a pesticide that was banned in the 1980s. This chemical is not associated with oil and gas operations. Organochlorine pesticides may have entered the ocean through past sewage discharges and runoff.

In summary, barium, copper, some PAHs, PCBs and hetachlor epoxide were elevated in the tissues of some invertebrates at some of the shell mounds. PAH concentrations in this study generally were higher than those found in the tissues of invertebrates collected at the shell mounds by MEC (2002). With the exception of PAH compounds, there is no pattern to suggest that contaminants have increased since the MEC (2002) study. Concentrations of contaminants observed in resident marine organism tissue samples were recorded below levels that would represent a human health concern. Therefore, at this point, no further analysis is warranted under the observed conditions of the shell mounds in their stable and contained state. However, the stability of the shell mounds could potentially become compromised following a significant seismic event. Shifting, slumping, or other settling of the shell mounds could create the potential for anomalous contaminant releases, which may necessitate additional physical surveys.

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Appendix A: Data Tables and Statistical Analysis

Tissue Concentrations in Sea Cucumbers

	Site				Range		Mean	Site					Range		Mean	Site					Range		Mean
Analyte	**REF-A1**	**REF-A2**	**REF-A3**	**REF-A4**	**Low**	**High**		**HEI-A1**	**HEI-A2**	**HEI-A3**	**HEI-A4**	**HEI-A5**	**Low**	**High**		**HOP-A1**	**HOP-A2**	**HOP-A3**	**HOP-A4**	**HOP-A5**	**Low**	**High**	
Metals mg/Kg dry																							
Antimony	0.05	0.03	0.03	0.02	0.02	0.05	0.03	0.02	0.02	0.02	0.01	0.02	0.01	0.02	0.02	0.03	0.02	0.00	0.05	0.04	0.00	0.05	0.03
Arsenic	29.40	30.20	14.30	25.00	14.30	30.20	24.73	3.85	5.79	5.05	2.27	6.06	2.27	6.06	4.60	5.04	8.84	7.91	15.80	9.61	5.04	15.80	9.44
Barium	1.20	18.20	9.73	1.78	1.20	18.20	7.73	23.50	13.90	11.10	3.10	8.80	3.10	23.50	12.08	37.90	31.60	1.89	2.42	76.40	1.89	76.40	30.04
Beryllium	0.00	0.80	0.05	0.01	0.00	0.80	0.22	0.02	0.02	0.02	0.00	0.01	0.00	0.02	0.01	0.03	0.04	0.00	0.01	0.08	0.00	0.08	0.03
Cadmium	1.05	0.39	0.39	0.62	0.39	1.05	0.62	0.22	0.27	0.22	0.21	0.53	0.21	0.53	0.29	0.50	0.38	0.23	1.35	0.34	0.23	1.35	0.56
Chromium	1.87	7.58	5.78	1.73	1.73	7.58	4.24	8.48	4.44	4.04	0.67	1.53	0.67	8.48	3.83	8.00	5.70	0.48	0.76	8.61	0.48	8.61	4.71
Cobalt	0.08	0.78	0.50	0.11	0.08	0.78	0.37	0.27	0.22	0.17	0.04	0.14	0.04	0.27	0.17	0.35	0.42	0.03	0.12	0.82	0.03	0.82	0.35
Copper	6.00	4.54	6.59	1.37	1.37	6.59	4.63	2.68	1.64	1.37	0.82	1.64	0.82	2.68	1.63	30.10	24.70	4.27	24.60	6.18	4.27	30.10	17.97
Lead	2.27	1.18	0.96	0.19	0.19	2.27	1.15	0.45	0.34	0.26	0.16	0.25	0.16	0.45	0.29	1.45	2.09	0.26	1.04	1.32	0.26	2.09	1.23
Mercury	0.04	0.03	0.03	0.02	0.02	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.03	0.01	0.01	0.03	0.02
Molybdenum	1.68	1.51	3.09	0.49	0.49	3.09	1.69	1.33	0.80	0.81	0.25	0.57	0.25	1.33	0.75	0.79	0.43	0.60	0.47	0.70	0.43	0.79	0.60
Nickel	0.99	4.01	2.82	1.01	0.99	4.01	2.21	4.58	2.30	2.55	0.33	0.78	0.33	4.58	2.11	4.08	2.72	0.32	1.38	4.33	0.32	4.33	2.57
Selenium	18.60	5.90	9.60	15.10	5.90	18.60	12.30	7.50	7.30	8.40	3.00	9.80	3.00	9.80	7.20	6.60	7.60	8.80	14.60	9.80	6.60	14.60	9.48
Silver	0.02	0.03	0.02	0.02	0.02	0.03	0.02	0.03	0.05	0.02	0.02	0.08	0.02	0.08	0.04	0.01	0.01	0.01	0.03	0.02	0.01	0.03	0.02
Thallium	0.00	0.02	0.01	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.00	0.02	0.01
Vanadium	0.70	10.00	6.16	0.94	0.70	10.00	4.45	2.85	2.72	1.94	0.63	1.75	0.63	2.85	1.98	3.73	4.81	0.61	0.76	9.70	0.61	9.70	3.92
Zinc	50.10	38.10	31.10	42.60	31.10	50.10	40.48	29.00	30.70	35.10	14.70	33.50	14.70	35.10	28.60	41.90	39.10	24.70	50.40	36.40	24.70	50.40	38.50
PAH ug/Kg dry																							
Naphthalene	10.68	8.07	9.40	9.58	8.07	10.68	9.43	8.16	24.43	9.58	6.15	10.75	6.15	24.43	11.81	9.00	9.60	11.81	37.04	8.20	8.20	37.04	15.13
Dibenzofuran	3.13	2.42	2.76	2.75	2.42	3.13	2.76	2.45	3.44	2.74	1.84	3.23	1.84	3.44	2.74	2.70	2.81	3.54	8.25	5.17	2.70	8.25	4.50
Phenanthrene	10.83	3.48	13.78	4.02	3.48	13.78	8.03	16.32	18.32	28.73	10.66	13.36	10.66	28.73	17.48	16.62	11.93	18.90	26.94	35.31	11.93	35.31	21.94
Fluoranthene	3.42	2.61	3.01	3.00	2.61	3.42	3.01	18.50	13.59	17.78	8.20	3.53	3.53	18.50	12.32	2.98	9.88	13.23	4.04	30.26	2.98	30.26	12.08
Pyrene	3.49	2.48	3.07	3.07	2.48	3.49	3.03	47.88	8.40	30.10	5.33	3.76	3.76	47.88	19.09	3.19	17.83	12.60	6.23	27.74	3.19	27.74	13.52
Benz(a)anthracene	2.64	2.67	2.32	2.36	2.32	2.67	2.50	7.18	8.24	7.52	4.59	2.69	2.69	8.24	6.05	2.29	2.40	2.99	3.20	11.22	2.29	11.22	4.42
Chrysene	3.85	2.92	3.38	3.38	2.92	3.85	3.38	2.99	4.20	3.35	2.25	3.92	2.25	4.20	3.34	3.32	3.43	4.33	4.55	7.82	3.32	7.82	4.69
Benzo(b)fluoranthene	4.56	3.48	4.07	3.51	3.48	4.56	3.91	3.59	5.04	4.04	2.70	4.69	2.70	5.04	4.01	4.02	4.12	5.20	5.47	7.19	4.02	7.19	5.20
Total PAHs	74.64	32.98	69.99	79.57	55.98	96.79	71.71	107.07	85.65	103.83	41.72	45.93	41.72	107.07	76.84	44.11	62.00	72.60	95.71	132.91	44.11	132.91	81.47
Pesticides (ug/Kg dry)																							
4,4'-DDE	6.55	7.95	41.35	8.68	6.55	41.35	16.14	17.41	21.37	32.83	5.57	16.90	5.57	32.83	18.82	34.63	15.09	14.80	26.94	10.09	10.09	34.63	20.31
Methoxychlor	3.42	2.98	3.01	3.07	0.00	0.00	0.00	2.61	3.66	3.28	1.97	7.99	1.97	7.99	3.90	3.32	3.29	3.78	5.56	3.03	3.03	5.56	3.80
Solids and Lipids																							
Percent Solids	7.02	8.05	7.98	7.83	7.02	8.05	7.72	9.19	6.55	7.31	12.20	6.51	6.51	12.20	8.35	7.22	7.29	6.35	5.94	7.93	5.94	7.93	6.95
Total Lipids	0.07	0.04	0.17	0.02	0.02	0.17	0.08	0.09	0.08	0.14	0.05	0.08	0.05	0.14	0.09	0.20	0.07	3.80	2.70	0.04	0.04	3.80	1.36

(shaded) Analyte ND, value assumes 0.5 MDL based on Passivirta 1991

Tissue Concentrations in Bat Stars

	Site					Range		Mean	Site			Range		Mean
Analyte	**REF-B1**	**REF-B2**	**REF-B3**	**REF-B4**	**REF-B5**	**Low**	**High**		**HAZ-B1**	**HAZ-B2**	**HAZ-B3**	**Low**	**High**	
Metals mg/Kg dry														
Antimony	0.17	0.03	0.07	0.08	0.03	0.03	0.17	0.07	0.01	0.01	0.02	0.01	0.02	0.01
Arsenic	8.17	6.48	7.20	6.97	6.56	6.48	8.17	7.08	2.76	3.38	2.17	2.17	3.38	2.77
Barium	4.97	4.81	5.02	4.91	4.88	4.81	5.02	4.92	16.90	9.09	10.20	9.09	16.90	12.06
Beryllium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
Cadmium	45.60	42.40	31.90	42.10	34.30	31.90	45.60	39.26	14.70	11.90	15.80	11.90	15.80	14.13
Chromium	2.44	5.56	1.38	1.07	1.37	1.07	5.56	2.36	1.88	9.91	1.87	1.87	9.91	4.55
Cobalt	0.32	0.50	0.34	0.32	0.35	0.32	0.50	0.37	0.09	0.15	0.10	0.09	0.15	0.11
Copper	18.00	16.80	14.40	13.10	12.60	12.60	18.00	14.98	14.70	10.20	12.90	10.20	14.70	12.60
Lead	6.91	1.48	5.99	3.27	1.17	1.17	6.91	3.76	0.62	0.45	0.48	0.45	0.62	0.52
Mercury	0.14	0.10	0.13	0.12	0.14	0.10	0.14	0.12	0.02	0.02	0.02	0.02	0.02	0.02
Molybdenum	1.08	1.03	1.56	0.89	0.68	0.68	1.56	1.05	0.31	0.31	0.26	0.26	0.31	0.29
Nickel	2.91	7.02	3.45	2.66	2.72	2.66	7.02	3.75	1.10	4.38	1.04	1.04	4.38	2.17
Selenium	2.30	2.20	2.10	2.50	1.90	1.90	2.50	2.20	1.00	1.10	1.20	1.00	1.20	1.10
Silver	0.58	0.57	0.45	0.52	0.48	0.45	0.58	0.52	0.30	0.23	0.31	0.23	0.31	0.28
Thallium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vanadium	0.71	0.56	0.56	0.63	0.61	0.56	0.71	0.61	0.57	0.37	0.39	0.37	0.57	0.44
Zinc	22.10	19.30	18.90	18.00	18.90	18.00	22.10	19.44	16.80	14.10	14.90	14.10	16.80	15.27
PAH ug/Kg dry														
Naphthalene	1.69	1.56	1.68	1.59	1.69	1.56	1.69	1.64	1.71	3.58	1.66	1.66	3.58	2.31
Acenaphthene	1.66	0.49	0.50	0.50	1.53	0.49	1.66	0.94	0.54	0.51	0.49	0.49	0.54	0.51
Fluorene	1.17	0.53	0.56	0.56	0.56	0.53	1.17	0.68	0.59	0.57	0.54	0.54	0.59	0.57
Phenanthrene	0.71	0.68	1.77	0.70	0.71	0.68	1.77	0.91	1.61	1.66	0.68	0.68	1.66	1.32
Pyrene	0.54	0.51	1.25	0.53	0.54	0.51	1.25	0.68	0.57	0.55	0.52	0.52	0.57	0.55
Benz(a)anthracene	0.42	0.39	0.41	0.41	1.35	0.39	1.35	0.60	0.43	0.41	0.40	0.40	0.43	0.41
Indeno(1,2,3-cd)pyrene	1.03	0.98	1.03	1.02	3.16	0.98	3.16	1.44	1.09	1.05	0.99	0.99	1.09	1.04
Dibenz(a,h)anthracene	0.92	0.88	0.92	0.91	2.71	0.88	2.71	1.27	0.98	0.94	0.89	0.89	0.98	0.94
Benzo(g,h,i)pyrylene	1.02	0.98	1.02	1.01	4.74	0.98	4.74	1.75	1.07	1.04	0.98	0.98	1.07	1.03
Total PAHs	9.16	8.66	10.70	8.92	18.70	6.99	21.21	11.23	10.40	10.31	8.81	7.15	12.32	9.84
Pesticides (ug/Kg dry)														
4,4'-DDE	17.30	5.33	10.07	5.90	9.93	5.33	17.30	9.71	1.76	1.50	1.83	1.50	1.83	1.70
Total Pesticides	17.30	5.33	10.07	5.90	9.93	5.33	17.30	9.71	1.76	1.50	1.83	1.50	1.83	1.70
Solids and Lipids														
Percent Solids	44.50	45.00	44.70	44.10	44.30	44.10	45.00	44.52	41.00	44.70	45.30	41.00	45.30	43.67
Total Lipids	0.63	0.05	0.56	0.51	0.59	0.05	0.63	0.47	0.34	0.29	0.28	0.28	0.34	0.30

Analyte ND, value assumes 0.5 MDL based on Passivirta 1991

Tissue Concentrations in Bat Stars

	Site	Site					Range		Mean	Site					Range		Mean
Analyte	HIL-B1	HEI-B1	HEI-B2	HEI-B3	HEI-B4	HEI-B5	Low	High		HOP-B1	HOP-B2	HOP-B3	HOP-B4	HOP-B5	Low	High	
Metals mg/Kg dry																	
Antimony	0.01	0.01	0.04	0.01	0.01	0.01	0.01	0.04	0.02	0.03	0.03	0.03	0.02	0.03	0.02	0.03	0.03
Arsenic	2.30	2.85	2.95	2.93	3.81	2.68	2.68	3.81	3.04	4.54	4.81	4.55	5.59	4.35	4.35	5.59	4.77
Barium	5.47	6.13	5.48	6.03	5.77	5.78	5.48	6.13	5.84	6.80	6.07	6.47	5.74	5.74	5.74	6.80	6.16
Beryllium	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.01
Cadmium	20.50	17.70	15.40	13.70	21.00	16.60	13.70	21.00	16.88	25.40	20.50	19.90	28.10	21.90	19.90	28.10	23.16
Chromium	2.16	2.63	1.79	3.33	3.60	2.95	1.79	3.60	2.86	2.18	3.34	2.58	3.39	2.70	2.18	3.39	2.84
Cobalt	0.08	0.08	0.09	0.09	0.98	0.08	0.08	0.98	0.26	0.11	0.10	0.09	0.10	0.08	0.08	0.11	0.09
Copper	12.20	11.80	10.80	9.57	10.70	10.90	9.57	11.80	10.75	26.70	24.20	19.80	18.50	19.40	18.50	26.70	21.72
Lead	0.41	0.23	0.24	0.21	0.28	0.26	0.21	0.28	0.24	0.53	0.86	0.89	0.40	1.26	0.40	1.26	0.79
Mercury	0.03	0.02	0.02	0.01	0.04	0.02	0.01	0.04	0.02	0.04	0.03	0.02	0.04	0.03	0.02	0.04	0.03
Molybdenum	0.28	0.19	0.21	0.20	0.20	0.17	0.17	0.21	0.19	0.26	0.40	0.31	0.27	0.25	0.25	0.40	0.30
Nickel	1.25	1.22	0.88	1.55	1.65	1.37	0.88	1.65	1.33	1.10	1.76	1.34	1.65	1.33	1.10	1.76	1.44
Selenium	0.90	1.50	1.90	1.40	1.40	1.50	1.40	1.90	1.54	1.90	1.60	1.90	2.20	1.90	1.60	2.20	1.90
Silver	0.38	0.32	0.31	0.27	0.32	0.28	0.27	0.32	0.30	0.32	0.29	0.30	0.36	0.31	0.29	0.36	0.32
Thallium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.01
Vanadium	0.30	0.41	0.44	0.43	0.66	0.38	0.38	0.66	0.46	0.73	0.60	0.47	0.51	0.43	0.43	0.73	0.55
Zinc	12.90	13.70	11.40	12.30	13.70	13.00	11.40	13.70	12.82	22.10	20.10	20.00	18.60	19.70	18.60	22.10	20.10
PAH ug/Kg dry																	
Acenaphthene	0.52	0.56	0.56	1.19	0.54	0.56	0.54	1.19	0.68	4.44	1.27	2.41	0.53	3.15	0.53	4.44	2.36
Dibenzofuran	0.50	0.54	1.38	0.49	1.12	1.10	0.49	1.38	0.93	1.28	0.46	0.53	1.26	3.39	0.46	3.39	1.39
Fluorene	0.58	0.62	1.38	1.16	0.59	0.62	0.59	1.38	0.88	1.60	1.09	0.98	1.24	4.84	0.98	4.84	1.95
Phenanthrene	0.73	4.52	9.23	0.71	5.49	6.94	0.71	9.23	5.38	9.14	3.29	4.34	8.74	67.80	3.29	67.80	18.66
Anthracene	0.41	0.45	0.45	0.42	0.43	0.45	0.42	0.45	0.44	0.86	0.39	0.45	0.43	9.44	0.39	9.44	2.31
Fluoranthene	0.54	3.57	5.64	0.54	3.66	3.83	0.54	5.64	3.45	4.44	2.82	2.89	5.29	87.17	2.82	87.17	20.52
Pyrene	0.55	2.14	10.77	0.55	6.86	2.99	0.55	10.77	4.66	4.44	1.95	3.01	8.05	225.18	1.95	225.18	48.53
Benz(a)anthracene	0.41	1.86	1.62	0.42	0.43	1.53	0.42	1.86	1.17	0.41	0.39	0.45	1.72	1.82	0.39	1.82	0.96
Indeno(1,2,3-cd)pyrene	1.05	1.13	1.14	1.04	1.10	1.15	1.04	1.15	1.11	1.02	0.97	1.13	2.18	2.91	0.97	2.91	1.64
Dibenz(a,h)anthracene	0.94	1.02	1.01	0.93	0.98	1.03	0.93	1.03	1.00	0.91	0.87	1.01	2.11	0.92	0.87	2.11	1.17
Benzo(g,h,i)pyrylene	1.04	1.12	1.13	1.03	1.09	1.14	1.03	1.14	1.10	0.91	0.96	1.12	3.68	11.38	0.91	11.38	3.61
Pesticides (ug/Kg dry)																	
Heptachlor Epoxide	0.21	0.21	0.23	0.20	0.21	0.22	0.20	0.23	0.21	0.47	0.59	0.96	0.62	0.56	0.47	0.96	0.64
4,4'-DDE	2.53	3.10	3.08	1.71	2.75	2.13	1.71	3.10	2.55	3.21	2.58	4.10	3.45	2.32	2.32	4.10	3.13
Total Pesticides	2.74	3.31	3.31	1.91	2.95	2.34	1.91	3.33	2.77	3.68	3.17	5.06	4.07	2.88	2.88	5.06	3.77
Solids and Lipids																	
Percent Solids	43.40	42.00	39.00	45.50	43.70	41.80	39.00	45.50	42.40	40.50	42.60	41.50	43.50	41.30	40.50	43.50	41.88
Total Lipids	0.29	0.31	0.26	0.31	0.31	0.31	0.26	0.31	0.30	0.36	0.38	0.35	0.32	0.39	0.32	0.39	0.36

Tissue Concentrations in Crabs

	Site					Range		Mean	Site				Range		Mean
Analyte	**HEI-C1**	**HEI-C2**	**HEI-C3**	**HEI-C4**	**HEI-C5**	**Low**	**High**		**HOP-C1**	**HOP-C2**	**HOP-C3**	**HOP-C4**	**Low**	**High**	
Metals mg/Kg dry															
Antimony	0.04	0.02	0.02	0.02	0.02	0.02	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Arsenic	49.40	41.90	42.00	44.40	52.10	41.90	52.10	45.96	33.80	45.80	22.50	33.50	22.50	45.80	33.90
Barium	4.01	5.09	1.57	1.89	4.18	1.57	5.09	3.35	5.15	3.01	4.41	1.50	1.50	5.15	3.52
Beryllium	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium	47.60	5.90	2.21	2.36	8.61	2.21	47.60	13.34	2.42	0.66	6.92	4.90	0.66	6.92	3.73
Chromium	0.38	0.31	0.42	0.26	0.22	0.22	0.42	0.32	0.64	0.10	0.30	0.45	0.10	0.64	0.37
Cobalt	1.54	0.23	0.14	0.16	0.39	0.14	1.54	0.49	0.06	0.05	0.16	0.10	0.05	0.16	0.09
Copper	128.00	65.40	51.40	32.10	36.50	32.10	128.00	62.68	48.30	35.50	40.80	22.20	22.20	48.30	36.70
Lead	0.99	0.13	0.04	0.03	0.05	0.03	0.99	0.25	0.03	0.33	0.03	0.04	0.03	0.33	0.11
Mercury	0.37	0.34	0.64	0.43	0.83	0.34	0.83	0.52	0.23	0.17	0.23	0.30	0.17	0.30	0.23
Molybdenum	0.40	0.09	0.08	0.06	0.10	0.06	0.40	0.15	0.09	0.05	0.07	0.08	0.05	0.09	0.07
Nickel	2.76	1.15	1.04	0.78	1.19	0.78	2.76	1.38	0.51	0.12	0.29	0.38	0.12	0.51	0.33
Selenium	10.30	18.70	13.30	15.60	19.50	10.30	19.50	15.48	5.40	3.90	3.70	3.70	3.70	5.40	4.18
Silver	3.86	2.55	2.12	0.94	2.15	0.94	3.86	2.32	2.08	0.84	0.69	0.47	0.47	2.08	1.02
Thallium	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vanadium	1.37	0.37	0.19	0.16	0.37	0.16	1.37	0.49	0.27	0.12	0.20	0.09	0.09	0.27	0.17
Zinc	306.00	364.00	340.00	296.00	316.00	296.00	364.00	324.40	280.00	270.00	279.00	352.00	270.00	352.00	295.25
PAH ug/Kg dry															
Naphthalene	3.76	3.07	3.30	3.16	3.39	3.07	3.76	3.34	3.64	6.05	3.47	3.41	3.41	6.05	4.14
Acenaphthylene	2.42	0.94	0.97	0.97	1.00	0.94	2.42	1.26	1.13	0.93	1.06	1.05	0.93	1.13	1.04
Dibenzofuran	2.74	0.92	0.95	0.95	0.97	0.92	2.74	1.31	1.09	0.91	1.04	1.02	0.91	1.09	1.02
Fluorene	2.90	1.07	2.20	1.10	1.13	1.07	2.90	1.68	1.26	1.05	1.20	1.18	1.05	1.26	1.17
Phenanthrene	5.91	1.33	1.39	3.25	1.43	1.33	5.91	2.66	3.35	3.10	1.53	1.50	1.50	3.35	2.37
Fluoranthene	1.24	1.00	1.04	1.03	1.06	1.00	1.24	1.07	1.19	0.99	1.13	1.11	0.99	1.19	1.11
Pyrene	1.26	1.02	1.06	1.05	1.09	1.02	1.26	1.10	1.21	1.01	1.16	1.14	1.01	1.21	1.13
Benz(a)anthracene	2.96	0.78	0.81	0.80	0.81	0.78	2.96	1.23	0.92	0.77	0.88	0.86	0.77	0.92	0.86
PCB (ug/Kg dry															
Arochlor 1254	4.03	3.07	3.30	3.16	3.39	3.07	4.03	3.39	6.80	9.88	12.50	6.36	6.36	12.50	8.88
Arochlor 1260	4.03	3.07	3.30	3.16	3.39	3.07	4.03	3.39	6.80	9.88	12.50	6.36	6.36	12.50	8.88
Pesticides (ug/Kg dry)															
gamma-Chlordane	0.70	0.53	0.57	0.55	0.59	0.53	0.70	0.59	0.63	0.91	1.16	0.59	0.59	1.16	0.82
4,4'-DDE	19.35	7.38	9.69	2.95	4.98	2.95	19.35	8.87	4.22	6.45	2.01	1.02	1.02	6.45	3.43
Solids and Lipids															
Percent Solids	18.60	24.40	22.70	23.70	22.10	18.60	24.40	22.30	20.60	24.80	21.60	22.00	20.60	24.80	22.25
Total Lipids	0.77	0.30	0.30	0.21	0.10	0.10	0.77	0.34	0.08	0.23	0.09	0.05	0.05	0.23	0.11

(shaded) Analyte ND, value assumes 0.5 MDL based on Passivirta 1991

Tissue Concentrations in Crabs

	Site				Range		Mean	Site				Range		Mean
Analyte	**HAZ-C1**	**HAZ-C2**	**HAZ-C3**	**HAZ-C4**	**Low**	**High**		**HIL-C1**	**HIL-C2**	**HIL-C3**	**HIL-C4**	**Low**	**High**	
Metals mg/Kg dry														
Antimony	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01
Arsenic	112.00	36.20	34.90	27.30	27.30	112.00	52.60	39.30	32.40	45.90	101.00	32.40	101.00	54.65
Barium	4.62	0.89	14.60	87.50	0.89	87.50	26.90	0.93	1.09	3.99	0.91	0.91	3.99	1.73
Beryllium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium	0.30	0.75	1.15	3.92	0.30	3.92	1.53	0.41	0.23	8.36	1.90	0.23	8.36	2.72
Chromium	0.24	0.07	0.20	1.21	0.07	1.21	0.43	0.18	0.26	0.28	0.11	0.11	0.28	0.21
Cobalt	0.56	0.35	0.08	0.11	0.08	0.56	0.28	0.05	0.05	0.37	0.09	0.05	0.37	0.14
Copper	42.00	28.60	22.70	48.30	22.70	48.30	35.40	23.20	40.20	88.70	32.50	23.20	88.70	46.15
Lead	0.08	0.50	0.15	0.23	0.08	0.50	0.24	0.20	0.27	0.31	0.07	0.07	0.31	0.21
Mercury	0.67	0.36	0.34	0.79	0.34	0.79	0.54	0.29	0.52	2.38	1.47	0.29	2.38	1.17
Molybdenum	0.03	0.03	0.06	0.10	0.03	0.10	0.06	0.06	0.05	0.11	0.08	0.05	0.11	0.08
Nickel	0.16	0.22	0.20	0.74	0.16	0.74	0.33	0.25	0.19	0.43	0.21	0.19	0.43	0.27
Selenium	3.00	6.70	2.90	7.10	2.90	7.10	4.93	3.60	3.80	4.80	4.00	3.60	4.80	4.05
Silver	0.32	0.64	0.60	1.25	0.32	1.25	0.70	0.42	0.53	1.34	0.25	0.25	1.34	0.63
Thallium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vanadium	0.15	0.05	0.40	0.49	0.05	0.49	0.27	0.22	0.21	0.39	0.19	0.19	0.39	0.25
Zinc	329.00	373.00	201.00	265.00	201.00	373.00	292.00	302.00	314.00	353.00	373.00	302.00	373.00	335.50
PAH ug/Kg dry														
Naphthalene	3.26	2.86	7.96	3.10	2.86	7.96	4.30	3.71	6.39	8.65	10.43	3.71	10.43	7.30
Acenaphthylene	2.26	0.88	1.14	2.02	0.88	2.26	1.58	1.14	0.91	3.51	1.32	0.91	3.51	1.72
Dibenzofuran	0.98	0.86	1.12	0.91	0.86	1.12	0.97	1.11	1.87	1.22	1.29	1.11	1.87	1.37
Fluorene	6.09	3.79	4.03	5.37	3.79	6.09	4.82	4.26	2.65	9.73	1.50	1.50	9.73	4.53
Phenanthrene	4.78	3.52	3.78	4.96	3.52	4.96	4.26	3.56	5.02	7.57	4.85	3.56	7.57	5.25
Fluoranthene	2.13	0.93	1.22	0.97	0.93	2.13	1.31	1.21	2.33	3.30	1.41	1.21	3.30	2.06
Pyrene	1.09	0.95	1.24	0.99	0.95	1.24	1.07	1.21	4.20	1.35	1.44	1.21	4.20	2.05
Benz(a)anthracene	2.96	2.56	0.95	2.23	0.95	2.96	2.17	0.94	0.75	1.03	1.10	0.75	1.10	0.96
PCB (ug/Kg dry														
Arochlor 1254	6.09	22.03	6.97	5.79	5.79	22.03	10.22	7.18	7.99	7.57	8.59	7.18	8.59	7.83
Arochlor 1260	6.09	6.17	6.97	5.79	5.79	6.97	6.25	7.18	7.99	20.00	8.59	7.18	20.00	10.94
Pesticides (ug/Kg dry)														
gamma-Chlordane	0.57	1.28	0.65	0.54	0.54	1.28	0.76	0.67	0.75	0.70	0.80	0.67	0.80	0.73
4,4'-DDE	39.13	6.61	10.45	18.18	6.61	39.13	18.59	7.92	8.22	38.38	3.25	3.25	38.38	14.44
Solids and Lipids														
Percent Solids	23.00	22.70	20.10	24.20	20.10	24.20	22.50	20.20	21.90	18.50	16.30	16.30	21.90	19.23
Total Lipids	0.29	0.24	0.22	0.65	0.22	0.65	0.35	0.41	0.36	0.41	0.06	0.06	0.41	0.31

Tissue Concentrations in Fish

	Site			Range		Average	Site		Range		Average
Analyte	**HAZ-L1**	**HAZ-L2**	**HAZ-L3**	**Low**	**High**		**REF-L1**	**REF-L2**	**Low**	**High**	
Metals mg/Kg dry											
Antimony	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arsenic	1.52	2.09	3.98	1.52	3.98	2.53	10.10	8.78	8.78	10.10	9.44
Barium	0.84	0.26	0.15	0.15	0.84	0.42	0.38	0.26	0.26	0.38	0.32
Beryllium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium	0.56	0.49	0.25	0.25	0.56	0.44	0.05	0.34	0.05	0.34	0.19
Chromium	0.23	0.15	0.10	0.10	0.23	0.16	0.09	0.12	0.09	0.12	0.11
Cobalt	0.02	0.02	0.04	0.02	0.04	0.03	0.00	0.01	0.00	0.01	0.01
Copper	1.43	1.03	1.21	1.03	1.43	1.22	0.81	1.13	0.81	1.13	0.97
Lead	0.02	0.02	0.05	0.02	0.05	0.03	0.05	0.06	0.05	0.06	0.05
Mercury	1.56	0.58	1.12	0.58	1.56	1.09	0.34	0.92	0.34	0.92	0.63
Molybdenum	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01
Nickel	0.07	0.08	0.05	0.05	0.08	0.07	0.05	0.07	0.05	0.07	0.06
Selenium	1.40	1.40	1.70	1.40	1.70	1.50	1.60	1.60	1.60	1.60	1.60
Silver	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Thallium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vanadium	0.04	0.06	0.04	0.04	0.06	0.05	0.04	0.03	0.03	0.04	0.04
Zinc	29.30	31.00	25.20	25.20	31.00	28.50	20.80	28.60	20.80	28.60	24.70
PAH ug/Kg dry											
Naphthalene	3.39	3.49	6.52	3.39	6.52	4.47	7.49	3.44	3.44	7.49	5.46
Fluorene	1.13	4.65	3.91	1.13	4.65	3.23	4.41	2.94	2.94	4.41	3.67
Phenanthrene	2.99	4.42	3.30	2.99	4.42	3.57	5.29	6.42	5.29	6.42	5.85
Fluoranthene	1.06	1.14	1.00	1.00	1.14	1.07	2.11	2.94	2.11	2.94	2.53
Pyrene	1.09	1.16	1.00	1.00	1.16	1.08	1.06	4.04	1.06	4.04	2.55
Benz(a)anthracene	0.81	0.88	0.76	0.76	0.88	0.82	3.44	0.85	0.85	3.44	2.14
Chrysene	1.20	1.28	1.11	1.11	1.28	1.20	2.69	1.24	1.24	2.69	1.96
Benzo(b)fluoranthene	1.43	1.53	1.33	1.33	1.53	1.43	5.29	1.49	1.49	5.29	3.39
Benzo(k)fluoranthene	1.22	1.33	1.15	1.15	1.33	1.23	2.95	1.28	1.28	2.95	2.12
Ideno(1,2,3-cd)pyrene	2.06	2.21	1.93	1.93	2.21	2.07	5.73	2.16	2.16	5.73	3.94
Dibenz(a,h)anthracene	1.86	1.98	1.74	1.74	1.98	1.86	4.85	1.93	1.93	4.85	3.39
Benzo(g,h,i)pyrylene	2.04	2.19	1.91	1.91	2.19	2.05	9.69	2.13	2.13	9.69	5.91
Total PAHs	21.15	27.16	26.52	20.29	30.20	24.95	54.98	31.95	25.91	59.91	42.91
PCB (ug/Kg dry											
Arochlor 1254	35.29	35.35	38.70	35.29	38.70	36.45	6.17	6.42	6.17	6.42	6.29
Arochlor 1260	28.96	19.53	24.78	19.53	28.96	24.43	6.17	6.42	6.17	6.42	6.29
Pesticides (ug/Kg dry)											
gamma-Chlordane	0.84	1.77	1.02	0.84	1.77	1.21	0.57	0.60	0.57	0.60	0.58
4,4'-DDE	81.45	65.12	104.35	65.12	104.35	83.64	37.44	43.58	37.44	43.58	40.51
4,4'-DDD	1.24	1.28	2.48	1.24	2.48	1.67	1.21	1.26	1.21	1.26	1.24
Solids and Lipids											
Percent Solids	22.10	21.50	23.00	21.50	23.00	22.20	22.70	21.80	21.80	22.70	22.25
Total Lipids	0.28	0.56	0.64	0.28	0.64	0.49	0.83	0.39	0.39	0.83	0.61

(Shaded) Analyte ND, value assumes 0.5 MDL based on Passivirta 1991

One Tailed T-Test

Sea Cucumbers

PAHs	Compared to Reference *Heidi*	Compared to Reference *Hope*	
Naphthalene	0.254777141	0.180809998	
Dibenzofuran	N/A	0.086890376	
Phenanthrene	**0.025293298**	**0.014268285**	Heidi and Hope significantly higher than reference
Fluoranthene	**0.015723293**	0.069658529	Heidi significantly higher than reference
Pyrene	0.068071886	**0.037234842**	Hope significant higher than reference
Benz(a)anthracene	**0.013714013**	0.162066097	Heidi significantly higher than reference
Chrysene	N/A	0.09742236	
Benzo(b)fluoranthene	N/A	**0.047623013**	
Total PAHs	0.248987838	0.193920666	

Metals	Compared to Reference *Heidi*	Compared to Reference *Hope*	
Antimony	0.186955645	0.408717545	
Arsenic	**0.00621514**	**0.009871602**	Heidi and Hope significantly lower than in reference
Barium	0.218270197	0.089665589	
Beryllium	0.188161028	0.207891497	
Cadmium	0.061002016	0.417839305	
Chromium	0.421944848	0.420879658	
Cobalt	0.165476089	0.464811269	
Copper	**0.044491043**	**0.018564409**	Heidi significantly lower than reference, Hope significantly higher
Lead	0.070180154	0.441086192	
Mercury	**0.000946788**	**0.028460668**	Heidi and Hope significantly lower than in reference
Molybdenum	0.085650113	0.067604995	
Nickel	0.463677038	0.373388773	
Selenium	0.084694295	0.210519558	
Silver	0.092007155	0.095137014	
Thallium	0.159793056	0.457806868	
Vanadium	0.178137711	0.427672343	
Zinc	**0.031789447**	0.371121822	Heidi significantly lower than reference.

Pesticides (ug/Kg dry)	Compared to Reference *Heidi*	Compared to Reference *Hope*
4,4'-DDE	0.293666526	0.240131639
Methoxychlor	0.25138074	N/A

One Tailed T-Test

Bat Stars

	Compared to Reference	Compared to Reference	Compared to Reference	Compared to Reference		
Metals mg/Kg dry	*Hazel*	*Hilda*	*Heidi*	*Hope*		
Antimony	**0.035760794**	N/A	**0.044209551**	0.067586035	Significantly lower for Hazel, Heidi	
Arsenic	**0.000120789**	N/A	**5.25265E-06**	**0.000228761**	Significantly lower for Hazel, Heidi, Hope	
Barium	**0.049744916**	N/A	**0.00029241**	**0.002067844**	Significantly higher for Hazel, Heidi, Hope	
Beryllium	0.465567174	N/A	0.231302715	0.215131242		
Cadmium	**0.000159061**	N/A	**0.000121558**	**0.000570896**	Significantly lower for Hazel, Heidi, Hope	
Chromium	0.258377208	N/A	0.300580183	0.303412845		
Cobalt	**0.000285592**	N/A	0.302947948	**0.000673304**	Significantly lower for Hazel, Hope	
Copper	0.114288936	N/A	**0.006193013**	**0.004712489**	Significantly lower for Heidi, Significantly higher for Hope	
Lead	**0.024665804**	N/A	**0.019453605**	**0.031992161**	Significantly lower for Hazel, Heidi, Hope	
Mercury	**5.7557E-05**	N/A	**2.8552E-06**	**2.32301E-05**	Significantly lower for Hazel, Heidi, Hope	
Molybdenum	**0.003304802**	N/A	**0.002111509**	**0.003567157**	Significantly lower for Hazel, Heidi, Hope	
Nickel	0.158229809	N/A	**0.022521348**	**0.025268429**	Significantly lower for Heidi and Hope	
Selenium	**3.81671E-05**	N/A	**0.000644594**	**0.030601103**	Significantly lower for Hazel, Heidi, Hope	
Silver	**0.000524739**	N/A	**8.76845E-05**	**0.000153937**	Significantly lower for Hazel, Heidi, Hope	
Thallium	0.146446609	N/A	0.186950483	0.186950483		
Vanadium	**0.047975787**	N/A	**0.020415201**	0.169974675	Significantly lower for Hazel, Heidi	
Zinc	**0.005545253**	N/A	**4.47811E-05**	0.241960703	Significantly lower for Hazel, Heidi	
PAH ug/Kg dry	*Hazel*	*Hilda*	*Heidi*	*Hope*		*Hope w/ removal of outlier*
Naphthalene	0.199312639	N/A	N/A	0.159983394		0.174097232
Acenaphthylene	N/A	N/A	N/A	0.168203491		0.132701579
Acenaphthene	N/A	N/A	0.212385804	0.072811954		0.121545544
Dibenzofuran	N/A	N/A	**0.031511289**	0.080653658	Significantly higher for Heidi	0.082810341
Fluorene	N/A	N/A	0.18183521	0.079292374		**0.009229502**
Phenanthrene	0.175242878	N/A	**0.017565569**	0.111923025	Significantly higher for Heidi	**0.018233977**
Anthracene	N/A	N/A	N/A	0.17269301		0.170999152
Fluoranthene	N/A	N/A	**0.011740047**	0.148189365	Significantly higher for Heidi	**0.005882727**
Pyrene	N/A	N/A	**0.048832942**	0.16977327		**0.034510481**
Benz(a)anthracene	N/A	N/A	0.078308893	0.189846921		0.355818195
Chrysene	N/A	N/A	N/A	0.183002818		0.14600022
Benzo(b)fluoranthene	N/A	N/A	N/A	0.169556527		0.129045061
Benzo(a)pyrene	N/A	N/A	N/A	0.114930111		0.166703178
Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	0.365729698		0.418785811
Dibenz(a,h)anthracene	N/A	N/A	N/A	0.415246452		0.472524528
Benzo(g,h,i)pyrylene	N/A	N/A	N/A	0.209447068		0.479040429
Total PAH	0.312154713	N/A	**0.040858061**	0.155763829	Significantly higher for Heidi	**0.032926613**
Pesticides (ug/Kg dry)	*Hazel*	*Hilda*	*Heidi*	*Hope*		
Heptachlor Epoxide	N/A	N/A	N/A	**0.003371045**	Significantly higher for Hope	
4,4'-DDE	**0.010058921**	N/A	**0.014729344**	**0.019200856**	Significantly lower for Hazel, Heidi, Hope	

One Tailed T-Test

Fish

	Compared to Reference	
Metals mg/Kg dry	*Hazel*	
Antimony	0.403774955	
Arsenic	**0.022224434**	Significantly lower for Hazel
Barium	0.349670868	
Beryllium	0.146446609	
Cadmium	0.147498274	
Chromium	0.134834291	
Cobalt	0.054684408	
Copper	0.164019268	
Lead	0.112943218	
Mercury	0.168995938	
Molybdenum	0.304416675	
Nickel	0.333333333	
Selenium	0.211324865	
Silver	0.211324865	
Thallium	0.146446609	
Vanadium	0.089848444	
Zinc	0.268258908	
PAH ug/Kg dry	*Hazel*	
Naphthalene	0.351740494	
Fluorene	0.378939138	
Phenanthrene	**0.042770874**	Significantly lower for Hazel
PCB (ug/Kg dry	*Hazel*	
Arochlor 1254	**0.000703301**	Significantly higher for Hazel
Arochlor 1260	**0.010959845**	Significantly higher for Hazel
Pesticides (ug/Kg dry)	*Hazel*	
gamma-Chlordane	0.079783279	
4,4'-DDE	**0.0336109**	Significantly higher for Hazel
4,4'-DDD	0.200134111	

Appendix B: Laboratory Results

January 27, 2014 Analytical Report for Service Request No: K1313761

Michael Henry
AMEC Environment & Infrastructure, Inc.
10670 White Rock Road, Suite 100
Rancho Cordova, CA 95670-6032

RE: 4H Shell Mound Survey

Dear Michael:

Enclosed are the results of the samples submitted to our laboratory on December 19, 2013. For your reference, these analyses have been assigned our service request number K1313761.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3293. You may also contact me via Email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA Corp. dba ALS Environmental

Shar Samy, Ph.D.
Project Manager

SS/kd

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ALS Group USA, Corp. Part of the ALS Group An ALS Limited Company

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2286
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L12-28
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Georgia DNR	http://www.gaepd.org/Documents/techguide_pcb.html#cel	881
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
Indiana DOH	http://www.in.gov/isdh/24859.htm	C-WA-01
ISO 17025	http://www.pjlabs.com/	L12-27
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	3016
Maine DHS	Not available	WA0035
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-368
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA35
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA200001
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427-08-TX
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C1203
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.caslab.com or at the accreditation bodies web site

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

ALS ENVIRONMENTAL

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request No.:**	K1313761
Project:	4H Shell Mound Survey	**Date Received:**	K1313761
Sample Matrix:	Animal Tissue		

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), Matrix/Duplicate Matrix Spike (MS/DMS), Laboratory Control Sample (LCS), and Laboratory/Duplicate Laboratory Control Sample (LCS/DLCS).

Sample Receipt

Eighteen animal tissue samples were received for analysis at ALS Environmental on K1313761. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at –20ºC upon receipt at the laboratory.

Total Metals

Matrix Spike Recovery Exceptions:
The control criteria for matrix spike recovery of Cadmium for sample REF-B5 were not applicable. The analyzed concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

The matrix spike recovery of Silver for sample REF-B5 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. The matrix spike outlier suggested a potential low bias in this matrix. No further corrective action was appropriate.

Relative Percent Difference Exceptions:
The Relative Percent Difference (RPD) for the replicate analysis of Cobalt and Lead in sample REF-B5 was outside the Method control limits. The variability in the results was attributed to the heterogeneous distribution of Cobalt and Lead m in the sample. Freeze drying, grinding in combination with standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

No other anomalies associated with the analysis of these samples were observed.

Organochlorine Pesticides by EPA Method 8081

Matrix Spike Recovery Exceptions:
The control criteria for the matrix spike/duplicate matrix spike recoveries of Endosulfan II for sample REF-B2 were not applicable. The chromatogram indicated non-target matrix background components contributed to the reported matrix spike concentrations. Thus, the reported recoveries contained a high bias.

Sample Confirmation Notes:
The confirmation comparison criterion of 40% difference was exceeded for 4,4'-DDE in sample REF-B2. The lower of the two values was reported when there was an apparent interference on the alternate column that produced the higher value.

Approved by____

Elevated Detection Limits:
The detection limit was elevated for one or more target analytes in several field samples. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compounds at the normal limit. The results were flagged to indicate the matrix interference.

Sample Notes and Discussion:
Insufficient sample mass was available to perform a Matrix Spike/Matrix Spike Duplicate (MS/MSD) for Toxaphene. A Laboratory Control Sample/Duplicate Laboratory Control Sample (LCS/DLCS) was analyzed and reported in lieu of the MS/MSD for this analyte.

No other anomalies associated with the analysis of these samples were observed.

PCB Aroclors by EPA Method 8082

Second Source Exceptions:
The analysis of PCB Aroclors by EPA 8082 requires the use of dual column confirmation. When the Initial Calibration Verification (ICV) criteria are met for both columns, the lower of the two sample results is generally reported. The criteria were not met for Aroclor 1268 in CAL 12999. The data quality was not affected. No further corrective action was necessary.

Calibration Verification Exceptions:
The analysis of PCB Aroclors by EPA 8082 requires the use of dual column confirmation. When the Continuing Calibration Verification (CCV) criterion is met for both columns, the lower of the two sample results is generally reported. The primary evaluation criteria were not met on the confirmation column for Aroclor 1016 in 0110F030. The results from associated QC samples were reported from the column with an acceptable CCV. The data quality was not affected. No further corrective action was necessary.

The upper control criterion was exceeded for Aroclor 1016 in Continuing Calibration Verification (CCV) 0110F030. The field samples analyzed in this sequence did not contain any target Aroclors. Since the apparent problem indicated a potential high bias, the data quality was not affected. No further corrective action was required.

No other anomalies associated with the analysis of these samples were observed.

Polynuclear Aromatic Hydrocarbons by EPA Method 8270

Matrix Spike Recovery Exceptions:
The upper control criterion was exceeded for various analytes in the Matrix Spike (MS) of sample REF-B5. The analytes in question were not detected at levels greater than the MRL in the associated field samples. The error associated with elevated recovery indicated a high bias. The sample data was not significantly affected. No further corrective action was appropriate.

The upper control criterion was exceeded for Dibenz(a,h)anthracene in the Matrix Spike Duplicate (MSD) of sample REF-B5. The analyte in question was not detected at levels greater than the MRL in the associated field samples. The error associated with elevated recovery indicated a high bias. The sample data was not significantly affected. No further corrective action was appropriate.

Lab Control Sample Exceptions:
The upper control criterion was exceeded for several analytes in the replicate Laboratory Control Samples (LCS/DLCS) KWG1314064-3 and KWG1314064-4. The analytes in question were not detected at levels greater than the MRL in the associated field samples. The error associated with elevated recovery indicated a high bias. The sample data was not significantly affected. No further corrective action was appropriate.

No other anomalies associated with the analysis of these samples were observed.

Approved by______________________________

ALS

☐ ALS Environmental
1317 South 13th Ave
Kelso, WA 98626
(Tel) 360.577.7222
(Fax) 360.636.1068

Chain of Custody Form

☐

Page 1 of 2

K1313761

ALS Project Manager:		ALS Work Order #:	

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	4H Shell Mound Survey	A	CAM-17 Metals - 6010C, 6020A, 7471B
Work Order		Project Number		B	PAHs by CC/MS SIM - 8270D
Company Name	AMEC	Bill To Company		C	PCBs by GC - 8082A
Send Report To	Michael Henry	Invoice Attn.		D	Organochlorine Pesticides- 8081B
Address	10670 White Rock Rd. Suite 100	Address		E	lipids
				F	freeze dry
City/State/Zip	Rancho Cordova/CA/95670-6032	City/State/Zip		G	de-shell (back and claw) and homogenize composited tissue (crabs)
Phone	916-853-8947	Phone		H	whole body homogenization (sea cucumbers and bat stars)
Fax	916-636-3208	Fax		I	fillet (skin on) and homogenize tissue (fish)
e-Mail Address	michael.henry@amec.com			J	

No.	Sample Description	Date	Time	Matrix	Pres. Key Numbers	# Bags	A	B	C	D	E	F	G	H	I	J	Hold
1	HEI-C1 (2 crabs)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
2	HEI-C2 (2 crabs)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
3	HEI-C3 (2 crabs)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
4	HEI-C4 (2 crabs)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
5	HEI-C5 (2 crabs)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
6	HOP-C1 (1 crab)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
7	HOP-C2 (1 crab)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
8	HOP-C3 (1 crab)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
9	HOP-C4 (1 crab)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
10	REF- A1 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			

Sampler(s): Please Print & Sign	Shipment Method:	Required Turnaround Time: (Check Box)	Results Due Date:
Bonnie Luke (Marine Research Specialists) [signature]	Fed Ex overnight	☐ 10 Wk Days ☐ 5 Wk Days ☐ 3 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☑ Other Standard	

Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Notes:
Bonnie Luke (Marine Research Specialists) [signature]	[illegible]	[illegible]	[signature]	12/19/13	1200	
Relinquished by:	Date:	Time:	Received by (Laboratory):	Date:	Time:	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):			

ALS Cooler ID	Cooler Temp	QC Package: (Check Box Below)	
		☑ Level II: Standard QC	☐ Level III: Raw Data
		☐ TRRP LRC	☐ TRRP Level IV
		☐ Level IV: SW846 Methods/CLP like	
		☐ Other:	

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C

Note: Any changes must be made in writing once samples and COC Form have been submitted to ALS.

ALS Environmental
1317 South 13th Ave
Kelso, WA 98626
(Tel) 360.577.7222
(Fax) 360.636.1068

Chain of Custody Form

ALS Project Manager:		ALS Work Order #:	

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	4H Shell Mound Survey	A	CAM-17 Metals - 6010C, 6020A, 7471B
Work Order		Project Number		B	PAHs by CC/MS SIM - 8270D
Company Name	AMEC	Bill To Company		C	PCBs by GC - 8082A
Send Report To	Michael Henry	Invoice Attn.		D	Organochlorine Pesticides- 8081B
Address	10670 White Rock Rd. Suite 100	Address		E	lipids
				F	freeze dry
City/State/Zip	Rancho Cordova/CA/95670-6032	City/State/Zip		G	de-shell (back and claw) and homogenize composited tissue (crabs)
Phone	916-853-8947	Phone		H	whole body homogenization (sea cucumbers and bat stars)
Fax	916-636-3208	Fax		I	fillet (skin on) and homogenize tissue (fish)
e-Mail Address	michael.henry@amec.com			J	

No.	Sample Description	Date	Time	Matrix	Pres. Key Numbers	# Bags	A	B	C	D	E	F	G	H	I	J	Hold
1	REF- A2 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
2	REF- A3 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
3	REF- A4 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
4	REF- B1 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
5	REF- B2 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
6	REF- B3 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
7	REF- B4 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
8	REF- B5 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
9																	
10																	

Sampler(s): Please Print & Sign
Bonnie Luke (Marine Research Specialists)

Shipment Method: Fed Ex overnight

Required Turnaround Time: (Check Box) ☐ 10 Wk Days ☐ 5 Wk Days ☐ 3 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☑ Other Std TAT

Results Due Date:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Notes:
Bonnie Luke (Marine Research Specialists)	12/13/13	12:05				
Relinquished by:	Date:	Time:	Received by (Laboratory):	Date:	Time:	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):			

ALS Cooler ID	Cooler Temp	QC Package: (Check Box Below)	
		☑ Level II: Standard QC	☐ Level III: Raw Data
		☐ TRRP LRC	☐ TRRP Level IV
		☐ Level IV: SW846 Methods/CLP like	
		☐ Other:	

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C

Note: Any changes must be made in writing once samples and COC Form have been submitted to ALS.

ALS

PC Shaw

Cooler Receipt and Preservation Form

Client / Project: ALS Service Request K13 13761

Received: 12/19/13 Opened: 12/19/13 By: AC Unloaded: 12/19/13 By: [illegible]

1. Samples were received via? Mail (Fed Ex) UPS DHL PDX Courier Hand Delivered
2. Samples were received in: (circle) Cooler (Box) Envelope Other ______ NA
3. Were custody seals on coolers? NA Y (N) If yes, how many and where? ______
   If present, were custody seals intact? Y N If present, were they signed and dated? Y (N)

Raw Cooler Temp	Corrected. Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID (NA)	Tracking Number	NA	Filed
-26	-26	—	—	0.0	316		7974 5715 8826		
-30	-29.9	—	—	-0.1	345		" 5120 8258		

4. Packing material: Inserts Baggies Bubble Wrap Gel Packs Wet Ice Dry Ice Sleeves DRY ICE
5. Were custody papers properly filled out (ink, signed, etc.)? NA (Y) N
6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA (Y) N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA (Y) N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* (NA) Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* (NA) Y N
12. Was C12/Res negative? (NA) Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: ______

Page ____ *of* ____

COLUMBIA ANALYTICAL SERVICES, INC.
Now part of the ALS Group
Analytical Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/13
Sample Matrix:	Tissue	**Date Received:**	12/19/13

Solids, Total

Prep Method:	NONE	Units:	PERCENT
Analysis Method:	Freeze Dry	Basis:	Wet
Test Notes:			

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
HEI-C1	K1313761-001	12/31/13	18.6	
HEI-C2	K1313761-002	12/31/13	24.4	
HEI-C3	K1313761-003	12/31/13	22.7	
HEI-C4	K1313761-004	12/31/13	23.7	
HEI-C5	K1313761-005	12/31/13	22.1	
HOP-C1	K1313761-006	12/31/13	20.6	
HOP-C2	K1313761-007	12/31/13	24.8	
HOP-C3	K1313761-008	12/31/13	21.6	
HOP-C4	K1313761-009	12/31/13	22.0	
REF-A1	K1313761-010	12/31/13	7.02	
REF-A2	K1313761-011	12/31/13	8.05	
REF-A3	K1313761-012	12/31/13	7.98	
REF-A4	K1313761-013	12/31/13	7.83	
REF-B1	K1313761-014	12/31/13	44.5	
REF-B2	K1313761-015	12/31/13	45.0	
REF-B3	K1313761-016	12/31/13	44.7	
REF-B4	K1313761-017	12/31/13	44.1	
REF-B5	K1313761-018	12/31/13	44.3	

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/13
Sample Matrix:	Tissue	**Date Received:**	12/19/13
		Date Extracted:	NA
		Date Analyzed:	12/31/13

Duplicate Summary

Sample Name:	REF-B5	Units:	PERCENT
Lab Code:	K1313761-018D	Basis:	Wet
Test Notes:			

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Moisture	NA	Freeze Dry	44.3	44.7	44.5	<1	

ALS Group USA, Corp.
dba ALS Environmental

- Cover Page -
INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructure, Inc.
Service Request: K1313761
Project Name: 4H Shell Mound Survey
Project No.:

Sample Name:	Lab Code:
HEI-C1	K1313761-001
HEI-C2	K1313761-002
HEI-C3	K1313761-003
HEI-C4	K1313761-004
HEI-C5	K1313761-005
HOP-C1	K1313761-006
HOP-C2	K1313761-007
HOP-C3	K1313761-008
HOP-C4	K1313761-009
REF-A1	K1313761-010
REF-A2	K1313761-011
REF-A3	K1313761-012
REF-A4	K1313761-013
REF-B1	K1313761-014
REF-B2	K1313761-015
REF-B3	K1313761-016
REF-B4	K1313761-017
REF-B5	K1313761-018
REF-B5D	K1313761-018D
REF-B5S	K1313761-018S
Method Blank	K1313761-MB

Comments:

ALS Group USA, Corp.
dba ALS Environmental

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur **Service Request:** K1313761

Project No.: NA **Date Collected:** 12/10/13

Project Name: 4H Shell Mound Survey **Date Received:** 12/19/13

Matrix: TISSUE **Units:** mg/Kg

Basis: DRY

Sample Name: HEI-C1 **Lab Code:** K1313761-001

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.039	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	49.4		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	4.010		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.005	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	47.6		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.38		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	1.540		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	128		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.994		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.374		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.403		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.76		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	10.3		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	3.860		N
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	1.370		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	306		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HEI-C2** **Lab Code:** **K1313761-002**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.024	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	41.9		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	5.090		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	5.900		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.31		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.226		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	65.4		
Lead	6020A	0.0198	0.0005	5.0	01/06/14	01/09/14	0.126		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.341		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.091		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.15		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	18.7		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	2.550		N
Thallium	6020A	0.0198	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.198	0.007	5.0	01/06/14	01/09/14	0.368		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	364		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HEI-C3** **Lab Code:** **K1313761-003**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.017	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	42.0		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	1.570		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	2.210		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.42		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.139		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	51.4		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.0350		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.640		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.084		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.04		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	13.3		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	2.120		N
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.186	J	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	340		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313761
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HEI-C4** **Lab Code:** **K1313761-004**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.048	0.002	5.0	01/06/14	01/09/14	0.018	J	
Arsenic	6020A	0.48	0.02	5.0	01/06/14	01/09/14	44.4		
Barium	6020A	0.048	0.005	5.0	01/06/14	01/09/14	1.890		
Beryllium	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.019	0.002	5.0	01/06/14	01/09/14	2.360		
Chromium	6020A	0.19	0.02	5.0	01/06/14	01/09/14	0.26		
Cobalt	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.159		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	32.1		
Lead	6020A	0.0194	0.0005	5.0	01/06/14	01/09/14	0.0291		*
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.426		
Molybdenum	6020A	0.048	0.008	5.0	01/06/14	01/09/14	0.056		
Nickel	6020A	0.19	0.02	5.0	01/06/14	01/09/14	0.78		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	15.6		
Silver	6020A	0.019	0.006	5.0	01/06/14	01/09/14	0.942		N
Thallium	6020A	0.0194	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.194	0.007	5.0	01/06/14	01/09/14	0.158	J	
Zinc	6020A	0.48	0.06	5.0	01/06/14	01/09/14	296		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HEI-C5
Lab Code: K1313761-005

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.019	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	52.1		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	4.180		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	8.610		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.22		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.389		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	36.5		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.0455		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.834		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.100		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.19		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	19.5		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	2.150		N
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.371		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	316		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313761
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HOP-C1** **Lab Code:** **K1313761-006**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.008	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	33.8		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	5.150		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	2.420		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.64		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.061		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	48.3		
Lead	6020A	0.0198	0.0005	5.0	01/06/14	01/09/14	0.0349		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.230		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.088		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.51		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	5.4		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	2.080		N
Thallium	6020A	0.0198	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.198	0.007	5.0	01/06/14	01/09/14	0.268		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	280		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HOP-C2 **Lab Code:** K1313761-007

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.009	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	45.8		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	3.010		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.660		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.10	J	
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.046		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	35.5		
Lead	6020A	0.0198	0.0005	5.0	01/06/14	01/09/14	0.0330		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.166		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.053		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.12	J	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	3.9		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.844		N
Thallium	6020A	0.0198	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.198	0.007	5.0	01/06/14	01/09/14	0.115	J	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	270		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HOP-C3 **Lab Code:** K1313761-008

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.011	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	22.5		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	4.410		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	6.920		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.30		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.157		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	40.8		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.0346		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.232		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.070		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.29		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	3.7		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.692		N
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.196	J	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	279		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HOP-C4 **Lab Code:** K1313761-009

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.008	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	33.5		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	1.500		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	4.900		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.45		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.100		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	22.2		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.0421		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.296		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.081		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.38		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	3.7		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.472		N
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.090	J	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	352		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313761
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **REF-A1** **Lab Code:** **K1313761-010**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.048	0.002	5.0	01/06/14	01/09/14	0.054		
Arsenic	6020A	0.48	0.02	5.0	01/06/14	01/09/14	29.4		
Barium	6020A	0.048	0.005	5.0	01/06/14	01/09/14	1.200		
Beryllium	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.004	J	
Cadmium	6020A	0.019	0.002	5.0	01/06/14	01/09/14	1.050		
Chromium	6020A	0.19	0.02	5.0	01/06/14	01/09/14	1.87		
Cobalt	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.076		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	6.00		
Lead	6020A	0.0192	0.0005	5.0	01/06/14	01/09/14	2.27		*
Mercury	7470A	0.038	0.008	4.0	01/06/14	01/13/14	0.035	J	
Molybdenum	6020A	0.048	0.008	5.0	01/06/14	01/09/14	1.680		
Nickel	6020A	0.19	0.02	5.0	01/06/14	01/09/14	0.99		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	18.6		
Silver	6020A	0.019	0.006	5.0	01/06/14	01/09/14	0.022		N
Thallium	6020A	0.0192	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.192	0.007	5.0	01/06/14	01/09/14	0.702		
Zinc	6020A	0.48	0.06	5.0	01/06/14	01/09/14	50.1		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **REF-A2** **Lab Code:** **K1313761-011**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.048	0.002	5.0	01/06/14	01/09/14	0.025	J	
Arsenic	6020A	0.48	0.02	5.0	01/06/14	01/09/14	30.2		
Barium	6020A	0.048	0.005	5.0	01/06/14	01/09/14	18.2		
Beryllium	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.080		
Cadmium	6020A	0.019	0.002	5.0	01/06/14	01/09/14	0.394		
Chromium	6020A	0.19	0.02	5.0	01/06/14	01/09/14	7.58		
Cobalt	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.781		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	4.54		
Lead	6020A	0.0194	0.0005	5.0	01/06/14	01/09/14	1.18		*
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.027	J	
Molybdenum	6020A	0.048	0.008	5.0	01/06/14	01/09/14	1.510		
Nickel	6020A	0.19	0.02	5.0	01/06/14	01/09/14	4.01		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	5.9		
Silver	6020A	0.019	0.006	5.0	01/06/14	01/09/14	0.031		N
Thallium	6020A	0.0194	0.0009	5.0	01/06/14	01/09/14	0.0239		
Vanadium	6020A	0.194	0.007	5.0	01/06/14	01/09/14	10.0		
Zinc	6020A	0.48	0.06	5.0	01/06/14	01/09/14	38.1		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: REF-A3
Lab Code: K1313761-012

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.025	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	14.3		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	9.730		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.053		
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.392		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	5.78		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.504		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	6.59		
Lead	6020A	0.0196	0.0005	5.0	01/06/14	01/09/14	0.963		*
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.027	J	
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	3.090		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.82		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	9.6		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.016	J	N
Thallium	6020A	0.0196	0.0009	5.0	01/06/14	01/09/14	0.0121	J	
Vanadium	6020A	0.196	0.007	5.0	01/06/14	01/09/14	6.160		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	31.1		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313761
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **REF-A4** **Lab Code:** **K1313761-013**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.017	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	25.0		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	1.780		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.006	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.624		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.73		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.112		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	1.37		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.192		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.024	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.487		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.01		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	15.1		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.022		N
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.942		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	42.6		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313761
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **REF-B1** **Lab Code:** **K1313761-014**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.048	0.002	5.0	01/06/14	01/09/14	0.166		
Arsenic	6020A	0.48	0.02	5.0	01/06/14	01/09/14	8.17		
Barium	6020A	0.048	0.005	5.0	01/06/14	01/09/14	4.970		
Beryllium	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.004	J	
Cadmium	6020A	0.019	0.002	5.0	01/06/14	01/09/14	45.6		
Chromium	6020A	0.19	0.02	5.0	01/06/14	01/09/14	2.44		
Cobalt	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.315		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	18.0		
Lead	6020A	0.0192	0.0005	5.0	01/06/14	01/09/14	6.91		*
Mercury	7470A	0.038	0.008	4.0	01/06/14	01/13/14	0.142		
Molybdenum	6020A	0.048	0.008	5.0	01/06/14	01/09/14	1.080		
Nickel	6020A	0.19	0.02	5.0	01/06/14	01/09/14	2.91		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	2.3		
Silver	6020A	0.019	0.006	5.0	01/06/14	01/09/14	0.584		N
Thallium	6020A	0.0192	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.192	0.007	5.0	01/06/14	01/09/14	0.706		
Zinc	6020A	0.48	0.06	5.0	01/06/14	01/09/14	22.1		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **REF-B2** **Lab Code:** **K1313761-015**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.029	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	6.48		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	4.810		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.004	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	42.4		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	5.56		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.497		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	16.8		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	1.48		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.104		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	1.030		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	7.02		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	2.2		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.568		N
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.555		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	19.3		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313761
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **REF-B3** **Lab Code:** **K1313761-016**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.047	0.002	5.0	01/06/14	01/09/14	0.070		
Arsenic	6020A	0.48	0.02	5.0	01/06/14	01/09/14	7.20		
Barium	6020A	0.047	0.005	5.0	01/06/14	01/09/14	5.020		
Beryllium	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.019	0.002	5.0	01/06/14	01/09/14	31.9		
Chromium	6020A	0.19	0.02	5.0	01/06/14	01/09/14	1.38		
Cobalt	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.343		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	14.4		
Lead	6020A	0.0190	0.0005	5.0	01/06/14	01/09/14	5.99		*
Mercury	7470A	0.038	0.008	4.0	01/06/14	01/13/14	0.125		
Molybdenum	6020A	0.047	0.008	5.0	01/06/14	01/09/14	1.560		
Nickel	6020A	0.19	0.02	5.0	01/06/14	01/09/14	3.45		
Selenium	6020A	0.9	0.2	5.0	01/06/14	01/09/14	2.1		
Silver	6020A	0.019	0.006	5.0	01/06/14	01/09/14	0.454		N
Thallium	6020A	0.0190	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.190	0.007	5.0	01/06/14	01/09/14	0.560		
Zinc	6020A	0.48	0.06	5.0	01/06/14	01/09/14	18.9		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313761
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **REF-B4** **Lab Code:** **K1313761-017**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.076		
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	6.87		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	4.910		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	42.1		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.07		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.316		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	13.1		
Lead	6020A	0.0198	0.0005	5.0	01/06/14	01/09/14	3.27		*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.115		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.893		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.66		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	2.5		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.523		N
Thallium	6020A	0.0198	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.198	0.007	5.0	01/06/14	01/09/14	0.625		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	18.0		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313761
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **REF-B5** **Lab Code:** **K1313761-018**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.048	0.002	5.0	01/06/14	01/09/14	0.030	J	
Arsenic	6020A	0.48	0.02	5.0	01/06/14	01/09/14	6.56		
Barium	6020A	0.048	0.005	5.0	01/06/14	01/09/14	4.880		
Beryllium	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.004	J	
Cadmium	6020A	0.019	0.002	5.0	01/06/14	01/09/14	34.3		
Chromium	6020A	0.19	0.02	5.0	01/06/14	01/09/14	1.37		
Cobalt	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.354		*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	12.6		
Lead	6020A	0.0194	0.0005	5.0	01/06/14	01/09/14	1.17		*
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.135		
Molybdenum	6020A	0.048	0.008	5.0	01/06/14	01/09/14	0.679		
Nickel	6020A	0.19	0.02	5.0	01/06/14	01/09/14	2.72		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.9		
Silver	6020A	0.019	0.006	5.0	01/06/14	01/09/14	0.479		N
Thallium	6020A	0.0194	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.194	0.007	5.0	01/06/14	01/09/14	0.614		
Zinc	6020A	0.48	0.06	5.0	01/06/14	01/09/14	18.9		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur **Service Request:** K1313761

Project No.: NA **Date Collected:**

Project Name: 4H Shell Mound Survey **Date Received:**

Matrix: TISSUE **Units:** mg/Kg

Basis: DRY

Sample Name: **Method Blank** **Lab Code:** **K1313761-MB**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.002	U	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	0.02	U	
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	0.005	U	
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.002	U	
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.02	U	
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.006	J	*
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	0.03	J	
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.0005	U	*
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.008	U	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.008	U	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.02	U	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	0.2	U	
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.006	J	N
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.007	U	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	0.06	U	

Comments:

ALS Group USA, Corp.
dba ALS Environmental

Metals
- 5A -
SPIKE SAMPLE RECOVERY

Client: AMEC Environment & Infrastructur **Service Request:** K1313761

Project No.: NA **Units:** MG/KG

Project Name: 4H Shell Mound Survey **Basis:** DRY

Matrix: TISSUE

Sample Name: REF-B5S **Lab Code:** K1313761-018S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Antimony	75 - 125	46.812		0.030	J	49.342	94.8		6020A
Arsenic	75 - 125	27.04		6.56		16.48	124.3		6020A
Barium	75 - 125	215.185		4.881		197.368	106.6		6020A
Beryllium	75 - 125	4.484		0.004	J	4.934	90.8		6020A
Cadmium		45.770		34.263		4.934	233.2		6020A
Chromium	75 - 125	24.45		1.37		19.74	116.9		6020A
Cobalt	75 - 125	54.399		0.354		49.342	109.5		6020A
Copper	75 - 125	39.54		12.62		24.67	109.1		6020A
Lead	75 - 125	45.0887		1.1716		49.3421	89.0		6020A
Mercury	80 - 120	2.17		0.135		1.97	103.3		7470A
Molybdenum	75 - 125	19.445		0.679		16.480	113.9		6020A
Nickel	75 - 125	53.23		2.72		49.34	102.4		6020A
Selenium	75 - 125	21.3		1.9		16.5	117.6		6020A
Silver	75 - 125	3.866		0.479		4.934	68.6	N	6020A
Thallium	75 - 125	15.0787		0.0009	U	16.4803	91.5		6020A
Vanadium	75 - 125	61.035		0.614		49.342	122.5		6020A
Zinc	75 - 125	68.64		18.88		49.34	100.9		6020A

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

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DUPLICATES

Client: AMEC Environment & Infrastructur **Service Request:** K1313761

Project No.: NA **Units:** MG/KG

Project Name: 4H Shell Mound Survey **Basis:** DRY

Matrix: TISSUE

Sample Name: REF-B5D **Lab Code:** K1313761-018D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Antimony		0.030	J	0.035	J	15.4		6020A
Arsenic	20	6.56		6.60		0.6		6020A
Barium	20	4.881		5.252		7.3		6020A
Beryllium		0.004	J	0.003	U	200.0		6020A
Cadmium	20	34.263		35.544		3.7		6020A
Chromium	20	1.37		1.58		14.2		6020A
Cobalt	20	0.354		0.278		24.1	*	6020A
Copper	20	12.62		12.93		2.4		6020A
Lead	20	1.1716		1.5460		27.6	*	6020A
Mercury		0.135		0.147		8.5		7470A
Molybdenum	20	0.679		0.743		9.0		6020A
Nickel	20	2.72		2.31		16.3		6020A
Selenium		1.9		1.7		11.1		6020A
Silver	20	0.479		0.494		3.1		6020A
Thallium		0.0009	U	0.0009	U			6020A
Vanadium		0.614		0.634		3.2		6020A
Zinc	20	18.88		20.63		8.9		6020A

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals
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LABORATORY CONTROL SAMPLE

Client: AMEC Environment & Infrastructur **Service Request:** K1313761

Project No.: NA

Project Name: 4H Shell Mound Survey

Aqueous LCS Source: CAS MIXED **Solid LCS Source:**

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Antimony	500.0	505.8	101.2						
Arsenic	167.0	183.7	110.0						
Barium	2000.0	2032.1	101.6						
Beryllium	50.0	52.0	104.0						
Cadmium	50.0	53.2	106.4						
Chromium	200.0	200.6	100.3						
Cobalt	500.0	501.6	100.3						
Copper	250.0	253.9	101.6						
Lead	500.0	519.6	103.9						
Mercury	20	20.4	102.0						
Molybdenum	167.0	172.4	103.2						
Nickel	500.0	507.4	101.5						
Selenium	167.0	180.4	108.0						
Silver	50.0	47.5	95.0						
Thallium	167.0	163.5	97.9						
Vanadium	500.0	505.8	101.2						
Zinc	500.0	514.7	102.9						

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	01/06/14
		Date Analyzed:	01/09/14

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1313761-SRM1	Basis:	Dry
Test Notes:			

Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	6020A	6.80	8.04	118	4.93 - 8.93	
Cadmium	PSEP Tissue	6020A	0.306	0.337	110	0.233 - 0.385	
Chromium	PSEP Tissue	6020A	1.87	1.90	102	1.37 - 2.44	
Copper	PSEP Tissue	6020A	15.9	15.9	100	12.0 - 20.2	
Lead	PSEP Tissue	6020A	0.416	0.346	83	0.290 - 0.563	
Nickel	PSEP Tissue	6020A	1.36	1.50	110	0.912 - 1.90	
Selenium	PSEP Tissue	6020A	3.56	4.43	124	2.58-4.68	
Zinc	PSEP Tissue	6020A	52.20	55.3	106	39.2 - 66.5	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	01/06/14
		Date Analyzed:	01/09,13/14

Standard Reference Material Summary
Total Metals

Sample Name: Standard Reference Material
Lab Code: K1313761-SRM2
Test Notes:

Units: mg/Kg (ppm)
Basis: Dry

Source: N.R.C.C. Tort-2

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	6020A	21.6	25.2	117	15.8-28.1	
Cadmium	PSEP Tissue	6020A	26.7	30.1	113	20.9-32.8	
Chromium	PSEP Tissue	6020A	0.77	0.64	83	0.5-1.1	
Cobalt	PSEP Tissue	6020A	0.51	0.53	104	0.34-0.72	
Copper	PSEP Tissue	6020A	106	105	99	77-139	
Lead	PSEP Tissue	6020A	0.35	0.37	106	0.18-0.58	
Mercury	PSEP Tissue	7470A	0.27	0.28	104	0.17-0.40	
Molybdenum	PSEP Tissue	6020A	0.95	1.09	115	0.68-1.26	
Nickel	PSEP Tissue	6020A	2.5	2.34	94	1.85-3.23	
Selenium	PSEP Tissue	6020A	5.63	7.26	129	3.97-7.56	
Vanadium	PSEP Tissue	6020A	1.64	1.86	113	1.46-2.2	
Zinc	PSEP Tissue	6020A	180	203	113	139-223	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Lipids, Total

Prep Method:	EPA 3541	Units:	PERCENT
Analysis Method:	NOAA	Basis:	Wet Weight
Test Notes:			

Sample Name	Lab Code	MRL	Date Extracted	Date Analyzed	Result	Result Notes
HEI-C1	K1313761-001	0.05	12/28/2014	1/3/2014	0.77	
HEI-C2	K1313761-002	0.05	12/28/2014	1/3/2014	0.30	
HEI-C3	K1313761-003	0.05	12/28/2014	1/3/2014	0.30	
HEI-C4	K1313761-004	0.05	12/28/2014	1/3/2014	0.21	
HEI-C5	K1313761-005	0.05	12/28/2014	1/3/2014	0.10	
HOP-C1	K1313761-006	0.05	12/28/2014	1/3/2014	0.08	
HOP-C2	K1313761-007	0.05	12/28/2014	1/3/2014	0.23	
HOP-C3	K1313761-008	0.05	12/28/2014	1/3/2014	0.09	
HOP-C4	K1313761-009	0.05	12/28/2014	1/3/2014	0.05	U
REF-A1	K1313761-010	0.05	12/28/2014	1/3/2014	0.07	
REF-A2	K1313761-011	0.04	12/28/2014	1/3/2014	0.04	
REF-A3	K1313761-012	0.05	12/28/2014	1/3/2014	0.17	
REF-A4	K1313761-013	0.05	12/28/2014	1/3/2014	0.02	
REF-B1	K1313761-014	0.05	12/28/2014	1/3/2014	0.63	
REF-B2	K1313761-015	0.05	12/28/2014	1/3/2014	0.52	
REF-B3	K1313761-016	0.05	12/28/2014	1/3/2014	0.56	
REF-B4	K1313761-017	0.05	12/28/2014	1/3/2014	0.51	
REF-B5	K1313761-018	0.05	12/28/2014	1/3/2014	0.59	
Method Blank	K1313761-MB	0.04	12/28/2014	1/3/2014	0.04	U

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013
		Date Extracted:	12/28/2014
		Date Analyzed:	1/3/2014

Triplicate Summary
Lipids, Total

Sample Name:	REF-B5	Units:	PERCENT
Lab Code:	K1313761-018 TRP	Basis:	Wet Weight
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Triplicate Sample Result	Average	Percent Relative Standard Deviation	Result Notes
Lipids, Total	EPA 3541	NOAA	0.05	0.59	0.60	0.57	0.59	3	

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	NA
Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	12/28/2014
		Date Analyzed:	1/3/2014

Laboratory Control Sample
Lipids, Total

Sample Name: K1313761-LCS

Units: % (percent)
Basis: Wet Weight

Test Notes:

Analyte	**Prep Method**	**Analysis Method**	**Spike Level Percent**	**Result**	**CAS Advisory Limits**	**Result Notes**
Lipids, Total	EPA 3541	NOAA	100	91	70-130	

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Organochlorine Pesticides

Sample Name:	HEI-C1	**Units:**	ug/Kg
Lab Code:	K1313761-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.99	0.16	1	12/30/13	01/15/14	KWG1400287	
beta-BHC	ND	U	0.99	0.41	1	12/30/13	01/15/14	KWG1400287	
gamma-BHC (Lindane)	ND	U	0.99	0.21	1	12/30/13	01/15/14	KWG1400287	
delta-BHC	ND	U	0.99	0.20	1	12/30/13	01/15/14	KWG1400287	
Heptachlor	ND	U	0.99	0.27	1	12/30/13	01/15/14	KWG1400287	
Aldrin	ND	U	0.99	0.74	1	12/30/13	01/15/14	KWG1400287	
Heptachlor Epoxide	ND	U	0.99	0.18	1	12/30/13	01/15/14	KWG1400287	
gamma-Chlordane†	ND	U	0.99	0.26	1	12/30/13	01/15/14	KWG1400287	
Endosulfan I	ND	U	0.99	0.22	1	12/30/13	01/15/14	KWG1400287	
alpha-Chlordane	ND	U	0.99	0.25	1	12/30/13	01/15/14	KWG1400287	
Dieldrin	ND	U	0.99	0.20	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDE	**3.6**		0.99	0.45	1	12/30/13	01/15/14	KWG1400287	
Endrin	ND	U	0.99	0.28	1	12/30/13	01/15/14	KWG1400287	
Endosulfan II	ND	U	0.99	0.24	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDD	ND	U	0.99	0.55	1	12/30/13	01/15/14	KWG1400287	
Endrin Aldehyde	ND	U	0.99	0.62	1	12/30/13	01/15/14	KWG1400287	
Endosulfan Sulfate	ND	U	0.99	0.53	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDT	ND	U	0.99	0.49	1	12/30/13	01/15/14	KWG1400287	
Endrin Ketone	ND	U	0.99	0.39	1	12/30/13	01/15/14	KWG1400287	
Methoxychlor	ND	U	0.99	0.48	1	12/30/13	01/15/14	KWG1400287	
Toxaphene	ND	U	50	13	1	12/30/13	01/15/14	KWG1400287	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	69	29-117	01/15/14	Acceptable
Decachlorobiphenyl	74	22-121	01/15/14	Acceptable

† Analyte Comments

gamma-Chlordane	For this analyte (CAS Registry No. 5103-74-2), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	42 Shell Mound Survey	**Date Collected:**	1gW0Wg013
Sample Matrix:	Animal tissue	**Date Received:**	1gW9Wg013

Organochlorine Pesticides

Sample Name:	2 EI-Cg	**Units:**	u/ Wk/
Lab Code:	K1313761-00g	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-B2 C	ND	U	1.0	0.16	1	1gW30W3	01W5W4	KH G1400g87	
beta-B2 C	ND	U	1.0	0.41	1	1gW30W3	01W5W4	KH G1400g87	
/ amma-B2 C (Lindane)	ND	U	1.0	0.g1	1	1gW30W3	01W5W4	KH G1400g87	
delta-B2 C	ND	U	1.0	0.g0	1	1gW30W3	01W5W4	KH G1400g87	
2 eptachlor	ND	U	1.0	0.g7	1	1gW30W3	01W5W4	KH G1400g87	
Aldrin	ND	U	1.0	0.74	1	1gW30W3	01W5W4	KH G1400g87	
2 eptachlor Epoxide	ND	U	1.0	0.18	1	1gW30W3	01W5W4	KH G1400g87	
/ amma-Chlordane†	ND	U	1.0	0.g6	1	1gW30W3	01W5W4	KH G1400g87	
Endosulfan I	ND	U	1.0	0.gg	1	1gW30W3	01W5W4	KH G1400g87	
alpha-Chlordane	ND	U	1.0	0.g5	1	1gW30W3	01W5W4	KH G1400g87	
Dieldrin	ND	U	1.0	0.g0	1	1gW30W3	01W5W4	KH G1400g87	
4,4'-DDE	**1.8**		1.0	0.45	1	1gW30W3	01W5W4	KH G1400g87	
Endrin	ND	U	1.0	0.g8	1	1gW30W3	01W5W4	KH G1400g87	
Endosulfan II	ND	U	1.0	0.g4	1	1gW30W3	01W5W4	KH G1400g87	
4,4'-DDD	ND	U	1.0	0.55	1	1gW30W3	01W5W4	KH G1400g87	
Endrin Aldehyde	ND	U	1.0	0.6g	1	1gW30W3	01W5W4	KH G1400g87	
Endosulfan Sulfate	ND	U	1.0	0.53	1	1gW30W3	01W5W4	KH G1400g87	
4,4'-DDT	ND	U	1.0	0.49	1	1gW30W3	01W5W4	KH G1400g87	
Endrin Ketone	ND	U	1.0	0.39	1	1gW30W3	01W5W4	KH G1400g87	
Methoxychlor	ND	U	1.0	0.48	1	1gW30W3	01W5W4	KH G1400g87	
Toxaphene	ND	U	50	13	1	1gW30W3	01W5W4	KH G1400g87	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	60	g9-117	01W5W4	Acceptable
Decachlorobiphenyl	74	gg-1g1	01W5W4	Acceptable

† Analyte Comments

/ amma-Chlordane	For this analyte (CAS Re/ istry No. 5103-74-g), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Organochlorine Pesticides

Sample Name:	HEI-C3	**Units:**	ug/Kg
Lab Code:	K1313761-003	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.97	0.16	1	12/30/13	01/15/14	KWG1400287	
beta-BHC	ND	U	0.97	0.41	1	12/30/13	01/15/14	KWG1400287	
gamma-BHC (Lindane)	ND	U	0.97	0.21	1	12/30/13	01/15/14	KWG1400287	
delta-BHC	ND	U	0.97	0.20	1	12/30/13	01/15/14	KWG1400287	
Heptachlor	ND	U	0.97	0.27	1	12/30/13	01/15/14	KWG1400287	
Aldrin	ND	U	0.97	0.74	1	12/30/13	01/15/14	KWG1400287	
Heptachlor Epoxide	ND	U	0.97	0.18	1	12/30/13	01/15/14	KWG1400287	
gamma-Chlordane†	ND	U	0.97	0.26	1	12/30/13	01/15/14	KWG1400287	
Endosulfan I	ND	U	0.97	0.22	1	12/30/13	01/15/14	KWG1400287	
alpha-Chlordane	ND	U	0.97	0.25	1	12/30/13	01/15/14	KWG1400287	
Dieldrin	ND	U	0.97	0.20	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDE	**2.2**		0.97	0.45	1	12/30/13	01/15/14	KWG1400287	
Endrin	ND	U	0.97	0.28	1	12/30/13	01/15/14	KWG1400287	
Endosulfan II	ND	U	0.97	0.24	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDD	ND	U	0.97	0.55	1	12/30/13	01/15/14	KWG1400287	
Endrin Aldehyde	ND	U	0.97	0.62	1	12/30/13	01/15/14	KWG1400287	
Endosulfan Sulfate	ND	U	0.97	0.53	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDT	ND	U	0.97	0.49	1	12/30/13	01/15/14	KWG1400287	
Endrin Ketone	ND	U	0.97	0.39	1	12/30/13	01/15/14	KWG1400287	
Methoxychlor	ND	U	0.97	0.48	1	12/30/13	01/15/14	KWG1400287	
Toxaphene	ND	U	49	13	1	12/30/13	01/15/14	KWG1400287	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	76	29-117	01/15/14	Acceptable
Decachlorobiphenyl	83	22-121	01/15/14	Acceptable

† Analyte Comments

gamma-Chlordane	For this analyte (CAS Registry No. 5103-74-2), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Organochlorine Pesticides

Sample Name:	HEI-C4	**Units:**	ug/Kg
Lab Code:	K1313761-004	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.99	0.16	1	12/30/13	01/15/14	KWG1400287	
beta-BHC	ND	U	0.99	0.41	1	12/30/13	01/15/14	KWG1400287	
gamma-BHC (Lindane)	ND	U	0.99	0.21	1	12/30/13	01/15/14	KWG1400287	
delta-BHC	ND	U	0.99	0.20	1	12/30/13	01/15/14	KWG1400287	
Heptachlor	ND	U	0.99	0.27	1	12/30/13	01/15/14	KWG1400287	
Aldrin	ND	U	0.99	0.74	1	12/30/13	01/15/14	KWG1400287	
Heptachlor Epoxide	ND	U	0.99	0.18	1	12/30/13	01/15/14	KWG1400287	
gamma-Chlordane†	ND	U	0.99	0.26	1	12/30/13	01/15/14	KWG1400287	
Endosulfan I	ND	U	0.99	0.22	1	12/30/13	01/15/14	KWG1400287	
alpha-Chlordane	ND	U	0.99	0.25	1	12/30/13	01/15/14	KWG1400287	
Dieldrin	ND	U	0.99	0.20	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDE	**0.70**	J	0.99	0.45	1	12/30/13	01/15/14	KWG1400287	
Endrin	ND	U	0.99	0.28	1	12/30/13	01/15/14	KWG1400287	
Endosulfan II	ND	U	0.99	0.24	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDD	ND	U	0.99	0.55	1	12/30/13	01/15/14	KWG1400287	
Endrin Aldehyde	ND	U	0.99	0.62	1	12/30/13	01/15/14	KWG1400287	
Endosulfan Sulfate	ND	U	0.99	0.53	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDT	ND	U	0.99	0.49	1	12/30/13	01/15/14	KWG1400287	
Endrin Ketone	ND	U	0.99	0.39	1	12/30/13	01/15/14	KWG1400287	
Methoxychlor	ND	U	0.99	0.48	1	12/30/13	01/15/14	KWG1400287	
Toxaphene	ND	U	50	13	1	12/30/13	01/15/14	KWG1400287	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	75	29-117	01/15/14	Acceptable
Decachlorobiphenyl	84	22-121	01/15/14	Acceptable

† Analyte Comments

gamma-Chlordane	For this analyte (CAS Registry No. 5103-74-2), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	S2 hdell MounL hurvey	**Date Collected:**	19W0W013
Sample Matrix:	Animal tissue	**Date Received:**	19W4W013

Organochlorine Pesticides

Sample Name:	2 EI-Cg	**Units:**	u/ WK/
Lab Code:	K1313761-00g	**Basis:**	H et
Extraction Method:	E5A 3gS1	**Level:**	woP
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda-B2 C	ND	U	0.47	0.16	1	19W30W3	01WgWS	KH G1S00987	
beta-B2 C	ND	U	0.47	0.S1	1	19W30W3	01WgWS	KH G1S00987	
/ amma-B2 C (winLane)	ND	U	0.47	0.91	1	19W30W3	01WgWS	KH G1S00987	
Lelta-B2 C	ND	U	0.47	0.90	1	19W30W3	01WgWS	KH G1S00987	
2 eptacdlor	ND	U	0.47	0.97	1	19W30W3	01WgWS	KH G1S00987	
AlLrin	ND	U	0.47	0.7S	1	19W30W3	01WgWS	KH G1S00987	
2 eptacdlor EpoxiLe	ND	U	0.47	0.18	1	19W30W3	01WgWS	KH G1S00987	
/ amma-CdlorLane†	ND	U	0.47	0.96	1	19W30W3	01WgWS	KH G1S00987	
EnLosulfan I	ND	U	0.47	0.99	1	19W30W3	01WgWS	KH G1S00987	
alpda-CdlorLane	ND	U	0.47	0.9g	1	19W30W3	01WgWS	KH G1S00987	
DielLrin	ND	U	0.47	0.90	1	19W30W3	01WgWS	KH G1S00987	
S,S'-DDE	**1.1**		0.47	0.Sg	1	19W30W3	01WgWS	KH G1S00987	
EnLrin	ND	U	0.47	0.98	1	19W30W3	01WgWS	KH G1S00987	
EnLosulfan II	ND	U	0.47	0.9S	1	19W30W3	01WgWS	KH G1S00987	
S,S'-DDD	ND	U	0.47	0.gg	1	19W30W3	01WgWS	KH G1S00987	
EnLrin AlLedyLe	ND	U	0.47	0.69	1	19W30W3	01WgWS	KH G1S00987	
EnLosulfan hulfate	ND	U	0.47	0.g3	1	19W30W3	01WgWS	KH G1S00987	
S,S'-DDT	ND	U	0.47	0.S4	1	19W30W3	01WgWS	KH G1S00987	
EnLrin Ketone	ND	U	0.47	0.34	1	19W30W3	01WgWS	KH G1S00987	
Metdoxycdlor	ND	U	0.47	0.S8	1	19W30W3	01WgWS	KH G1S00987	
Toxapdene	ND	U	S4	13	1	19W30W3	01WgWS	KH G1S00987	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro-m-xylene	61	94-117	01WgWS	Acceptable
Decacdlorobipdenyl	68	99-191	01WgWS	Acceptable

† **Analyte Comments**

/ amma-CdlorLane	For tdis analyte (CAh Re/ istry No. g103-7S-9), UhE5A das correcteL tde name to be beta-CdlorLane, also knoP n as trans-CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Organochlorine Pesticides

Sample Name:	HOP-C1	**Units:**	ug/Kg
Lab Code:	K1313761-006	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.99	0.16	1	12/30/13	01/15/14	KWG1400287	
beta-BHC	ND	U	0.99	0.41	1	12/30/13	01/15/14	KWG1400287	
gamma-BHC (Lindane)	ND	U	0.99	0.21	1	12/30/13	01/15/14	KWG1400287	
delta-BHC	ND	U	0.99	0.20	1	12/30/13	01/15/14	KWG1400287	
Heptachlor	ND	U	0.99	0.27	1	12/30/13	01/15/14	KWG1400287	
Aldrin	ND	U	0.99	0.74	1	12/30/13	01/15/14	KWG1400287	
Heptachlor Epoxide	ND	U	0.99	0.18	1	12/30/13	01/15/14	KWG1400287	
gamma-Chlordane†	ND	U	0.99	0.26	1	12/30/13	01/15/14	KWG1400287	
Endosulfan I	ND	U	0.99	0.22	1	12/30/13	01/15/14	KWG1400287	
alpha-Chlordane	ND	U	0.99	0.25	1	12/30/13	01/15/14	KWG1400287	
Dieldrin	ND	U	0.99	0.20	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDE	**0.87**	J	0.99	0.45	1	12/30/13	01/15/14	KWG1400287	
Endrin	ND	U	0.99	0.28	1	12/30/13	01/15/14	KWG1400287	
Endosulfan II	ND	U	0.99	0.24	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDD	ND	U	0.99	0.55	1	12/30/13	01/15/14	KWG1400287	
Endrin Aldehyde	ND	U	0.99	0.62	1	12/30/13	01/15/14	KWG1400287	
Endosulfan Sulfate	ND	U	0.99	0.53	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDT	ND	U	0.99	0.49	1	12/30/13	01/15/14	KWG1400287	
Endrin Ketone	ND	U	0.99	0.39	1	12/30/13	01/15/14	KWG1400287	
Methoxychlor	ND	U	0.99	0.48	1	12/30/13	01/15/14	KWG1400287	
Toxaphene	ND	U	50	13	1	12/30/13	01/15/14	KWG1400287	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	72	29-117	01/15/14	Acceptable
Decachlorobiphenyl	80	22-121	01/15/14	Acceptable

† **Analyte Comments**

gamma-Chlordane	For this analyte (CAS Registry No. 5103-74-2), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Organochlorine Pesticides

Sample Name:	HOP-C2	**Units:**	ug/Kg
Lab Code:	K1313761-007	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	1.8	0.28	1	12/30/13	01/15/14	KWG1400287	
beta-BHC	ND	U	1.8	0.71	1	12/30/13	01/15/14	KWG1400287	
gamma-BHC (Lindane)	ND	U	1.8	0.37	1	12/30/13	01/15/14	KWG1400287	
delta-BHC	ND	U	1.8	0.35	1	12/30/13	01/15/14	KWG1400287	
Heptachlor	ND	U	1.8	0.47	1	12/30/13	01/15/14	KWG1400287	
Aldrin	ND	U	1.8	1.3	1	12/30/13	01/15/14	KWG1400287	
Heptachlor Epoxide	ND	U	1.8	0.32	1	12/30/13	01/15/14	KWG1400287	
gamma-Chlordane†	ND	U	1.8	0.45	1	12/30/13	01/15/14	KWG1400287	
Endosulfan I	ND	U	1.8	0.38	1	12/30/13	01/15/14	KWG1400287	
alpha-Chlordane	ND	U	1.8	0.44	1	12/30/13	01/15/14	KWG1400287	
Dieldrin	ND	U	1.8	0.35	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDE	**1.6**	J	1.8	0.78	1	12/30/13	01/15/14	KWG1400287	
Endrin	ND	U	1.8	0.49	1	12/30/13	01/15/14	KWG1400287	
Endosulfan II	ND	U	1.8	0.42	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDD	ND	U	1.8	0.95	1	12/30/13	01/15/14	KWG1400287	
Endrin Aldehyde	ND	U	1.8	1.1	1	12/30/13	01/15/14	KWG1400287	
Endosulfan Sulfate	ND	U	1.8	0.92	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDT	ND	U	1.8	0.85	1	12/30/13	01/15/14	KWG1400287	
Endrin Ketone	ND	U	1.8	0.68	1	12/30/13	01/15/14	KWG1400287	
Methoxychlor	ND	U	1.8	0.83	1	12/30/13	01/15/14	KWG1400287	
Toxaphene	ND	U	87	23	1	12/30/13	01/15/14	KWG1400287	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	69	29-117	01/15/14	Acceptable
Decachlorobiphenyl	82	22-121	01/15/14	Acceptable

† Analyte Comments

gamma-Chlordane	For this analyte (CAS Registry No. 5103-74-2), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Organochlorine Pesticides

Sample Name:	HOP-C3	**Units:**	ug/Kg
Lab Code:	K1313761-008	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	2.0	0.31	1	12/30/13	01/15/14	KWG1400287	
beta-BHC	ND	U	2.0	0.79	1	12/30/13	01/15/14	KWG1400287	
gamma-BHC (Lindane)	ND	U	2.0	0.41	1	12/30/13	01/15/14	KWG1400287	
delta-BHC	ND	U	2.0	0.39	1	12/30/13	01/15/14	KWG1400287	
Heptachlor	ND	U	2.0	0.52	1	12/30/13	01/15/14	KWG1400287	
Aldrin	ND	U	2.0	1.5	1	12/30/13	01/15/14	KWG1400287	
Heptachlor Epoxide	ND	U	2.0	0.35	1	12/30/13	01/15/14	KWG1400287	
gamma-Chlordane†	ND	U	2.0	0.50	1	12/30/13	01/15/14	KWG1400287	
Endosulfan I	ND	U	2.0	0.43	1	12/30/13	01/15/14	KWG1400287	
alpha-Chlordane	ND	U	2.0	0.48	1	12/30/13	01/15/14	KWG1400287	
Dieldrin	ND	U	2.0	0.39	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDE	ND	U	2.0	0.87	1	12/30/13	01/15/14	KWG1400287	
Endrin	ND	U	2.0	0.54	1	12/30/13	01/15/14	KWG1400287	
Endosulfan II	ND	U	2.0	0.46	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDD	ND	U	2.0	1.1	1	12/30/13	01/15/14	KWG1400287	
Endrin Aldehyde	ND	U	2.0	1.2	1	12/30/13	01/15/14	KWG1400287	
Endosulfan Sulfate	ND	U	2.0	1.1	1	12/30/13	01/15/14	KWG1400287	
4,4'-DDT	ND	U	2.0	0.94	1	12/30/13	01/15/14	KWG1400287	
Endrin Ketone	ND	U	2.0	0.75	1	12/30/13	01/15/14	KWG1400287	
Methoxychlor	ND	U	2.0	0.92	1	12/30/13	01/15/14	KWG1400287	
Toxaphene	ND	U	96	25	1	12/30/13	01/15/14	KWG1400287	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	71	29-117	01/15/14	Acceptable
Decachlorobiphenyl	82	22-121	01/15/14	Acceptable

† Analyte Comments	
gamma-Chlordane	For this analyte (CAS Registry No. 5103-74-2), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	2H 4Sell Mounh 4urvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/18/9013

Organochlorine Pesticides

Sample Name:	HOP-C2	**Units:**	ug/Kg
Lab Code:	K1313761-008	**Basis:**	Wet
Extraction Method:	EPA 3w21	**Level:**	doL
Analysis Method:	5051B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpSa-BHC	ND	U	0.88	0.16	1	19/30/13	01/1w12	KWG1200957	
beta-BHC	ND	U	0.88	0.21	1	19/30/13	01/1w12	KWG1200957	
gamma-BHC (dinhane)	ND	U	0.88	0.91	1	19/30/13	01/1w12	KWG1200957	
helta-BHC	ND	U	0.88	0.90	1	19/30/13	01/1w12	KWG1200957	
HeptacSlor	ND	U	0.88	0.97	1	19/30/13	01/1w12	KWG1200957	
Alhrin	ND	U	0.88	0.72	1	19/30/13	01/1w12	KWG1200957	
HeptacSlor Epoxihe	ND	U	0.88	0.15	1	19/30/13	01/1w12	KWG1200957	
gamma-CSlorhane†	ND	U	0.88	0.96	1	19/30/13	01/1w12	KWG1200957	
Enhosulfan I	ND	U	0.88	0.99	1	19/30/13	01/1w12	KWG1200957	
alpSa-CSlorhane	ND	U	0.88	0.9w	1	19/30/13	01/1w12	KWG1200957	
Dielhrin	ND	U	0.88	0.90	1	19/30/13	01/1w12	KWG1200957	
2,2'-DDE	ND	U	0.88	0.2w	1	19/30/13	01/1w12	KWG1200957	
Enhrin	ND	U	0.88	0.95	1	19/30/13	01/1w12	KWG1200957	
Enhosulfan II	ND	U	0.88	0.92	1	19/30/13	01/1w12	KWG1200957	
2,2'-DDD	ND	U	0.88	0.ww	1	19/30/13	01/1w12	KWG1200957	
Enhrin AlheSyhe	ND	U	0.88	0.69	1	19/30/13	01/1w12	KWG1200957	
Enhosulfan 4ulfate	ND	U	0.88	0.w3	1	19/30/13	01/1w12	KWG1200957	
2,2'-DDT	ND	U	0.88	0.28	1	19/30/13	01/1w12	KWG1200957	
Enhrin Ketone	ND	U	0.88	0.38	1	19/30/13	01/1w12	KWG1200957	
MetSoxycSlor	ND	U	0.88	0.25	1	19/30/13	01/1w12	KWG1200957	
ToxapSene	ND	U	w0	13	1	19/30/13	01/1w12	KWG1200957	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracSloro-m-xylene	w7	98-117	01/1w12	Acceptable
DecacSlorobipSenyl	73	99-191	01/1w12	Acceptable

† Analyte Comments

gamma-CSlorhane	For tSis analyte (CA4 Registry No. wl03-72-9), U4EPA Sas correcteh tSe name to be beta-CSlorhane, also knoLn as trans-CSlorhane.

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	9S hdell MounL hurvey	**Date Collected:**	1Hg10gH013
Sample Matrix:	Animal tissue	**Date Received:**	1Hg12gH013

Organochlorine Pesticides

Sample Name:	REW-A1	**Units:**	u4gK4
Lab Code:	K1313761-010	**Basis:**	/ et
Extraction Method:	E5A 3891	**Level:**	woP
Analysis Method:	B0B1G		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albda-GS C	Dp	N	0.BB	0.16	1	1Hg30g13	01g18g19	K/ U1900HB7	
(eta-GS C	Dp	N	0.BB	0.91	1	1Hg30g13	01g18g19	K/ U1900HB7	
4amma-GS C)winLanex	Dp	N	0.BB	0.H1	1	1Hg30g13	01g18g19	K/ U1900HB7	
Lelta-GS C	Dp	N	0.BB	0.H0	1	1Hg30g13	01g18g19	K/ U1900HB7	
S ebtacdlor	Dp	N	0.BB	0.H7	1	1Hg30g13	01g18g19	K/ U1900HB7	
AlLrin	Dp	N	0.BB	0.79	1	1Hg30g13	01g18g19	K/ U1900HB7	
S ebtacdlor Ebo†iLe	Dp	N	0.BB	0.1B	1	1Hg30g13	01g18g19	K/ U1900HB7	
4amma-CdlorLaneJ	Dp	N	0.BB	0.H6	1	1Hg30g13	01g18g19	K/ U1900HB7	
EnLosulfan I	Dp	N	0.BB	0.HH	1	1Hg30g13	01g18g19	K/ U1900HB7	
albda-CdlorLane	Dp	N	0.BB	0.H8	1	1Hg30g13	01g18g19	K/ U1900HB7	
p ielLrin	Dp	N	0.BB	0.H0	1	1Hg30g13	01g18g19	K/ U1900HB7	
9,9T-p p E	**0.46**	'	0.BB	0.98	1	1Hg30g13	01g18g19	K/ U1900HB7	
EnLrin	Dp	N	0.BB	0.HB	1	1Hg30g13	01g18g19	K/ U1900HB7	
EnLosulfan II	Dp	N	0.BB	0.H9	1	1Hg30g13	01g18g19	K/ U1900HB7	
9,9T-p p p	Dp	N	0.BB	0.88	1	1Hg30g13	01g18g19	K/ U1900HB7	
EnLrin AlLedyLe	Dp	N	0.BB	0.6H	1	1Hg30g13	01g18g19	K/ U1900HB7	
EnLosulfan hulfate	Dp	N	0.BB	0.83	1	1Hg30g13	01g18g19	K/ U1900HB7	
9,9T-p p F	Dp	N	0.BB	0.92	1	1Hg30g13	01g18g19	K/ U1900HB7	
EnLrin Ketone	Dp	N	0.BB	0.32	1	1Hg30g13	01g18g19	K/ U1900HB7	
Metdo†ycdlor	Dp	N	0.BB	0.9B	1	1Hg30g13	01g18g19	K/ U1900HB7	
Fo†abdene	Dp	N	99	13	1	1Hg30g13	01g18g19	K/ U1900HB7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fetracdloro-m-†ylene	60	H2-117	01g18g19	Accebta(le
p ecacdloro(ibdenyl	6B	HH-1H1	01g18g19	Accebta(le

† Analyte Comments

4amma-CdlorLane	Wor tdis analyte)CAh Re4istry Do. 8103-79-Hx, NhE5A das correcteL tde name to (e (eta-CdlorLane, also knoP n as trans-CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	9S hdell MounL hurvey	**Date Collected:**	1Hg10gH013
Sample Matrix:	Animal tissue	**Date Received:**	1Hg12gH013

Organochlorine Pesticides

Sample Name:	REW-AH	**Units:**	u4gK4
Lab Code:	K1313761-011	**Basis:**	/ et
Extraction Method:	E5A 3891	**Level:**	woP
Analysis Method:	B0B1G		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albda-GS C	Dp	N	0.28	0.16	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
(eta-GS C	Dp	N	0.28	0.91	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
4amma-GS C)winLanex	Dp	N	0.28	0.H1	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
Lelta-GS C	Dp	N	0.28	0.H0	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
S ebtacdlor	Dp	N	0.28	0.H7	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
AlLrin	Dp	N	0.28	0.79	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
S ebtacdlor Ebo†iLe	Dp	N	0.28	0.1B	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
4amma-CdlorLaneJ	Dp	N	0.28	0.H6	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
EnLosulfan I	Dp	N	0.28	0.HH	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
albda-CdlorLane	Dp	N	0.28	0.H8	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
p ielLrin	Dp	N	0.28	0.H0	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
9,9T-p p E	**0.46**	'	0.28	0.98	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
EnLrin	Dp	N	0.28	0.HB	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
EnLosulfan II	Dp	N	0.28	0.H9	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
9,9T-p p p	Dp	N	0.28	0.88	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
EnLrin AlLedyLe	Dp	N	0.28	0.6H	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
EnLosulfan hulfate	Dp	N	0.28	0.83	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
9,9T-p p F	Dp	N	0.28	0.92	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
EnLrin Ketone	Dp	N	0.28	0.32	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
Metdo†ycdlor	Dp	N	0.28	0.9B	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	
Fo†abdene	Dp	N	9B	13	1	1Hg30gl3	01gl8gl9	K/ U1900HB7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fetracdloro-m-†ylene	61	H2-117	01gl8gl9	Accebta(le
p ecacdloro(ibdenyl	62	HH-1H1	01gl8gl9	Accebta(le

† **Analyte Comments**

4amma-CdlorLane	Wor tdis analyte)CAh Re4istry Do. 8103-79-Hx, NhE5A das correcteL tde name to (e (eta-CdlorLane, also knoP n as trans-CdlorLane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4S hdell MounL hurvey	**Date Collected:**	1gW0Wg013
Sample Matrix:	Animal tissue	**Date Received:**	1gW9Wg013

Organochlorine Pesticides

Sample Name:	RE2-A3	**Units:**	u/ WK/
Lab Code:	K1313761-01g	**Basis:**	H et
Extraction Method:	E5A 3841	**Level:**	woP
Analysis Method:	B0B1G		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albda-GS C	Dp	N	0.9B	0.16	1	1gW0W3	01W8W4	KH U1400gB7	
(eta-GS C	Dp	N	0.9B	0.41	1	1gW0W3	01W8W4	KH U1400gB7	
/ amma-GS C)winLanex	Dp	N	0.9B	0.g1	1	1gW0W3	01W8W4	KH U1400gB7	
Lelta-GS C	Dp	N	0.9B	0.g0	1	1gW0W3	01W8W4	KH U1400gB7	
S ebtacdlor	Dp	N	0.9B	0.g7	1	1gW0W3	01W8W4	KH U1400gB7	
AlLrin	Dp	N	0.9B	0.74	1	1gW0W3	01W8W4	KH U1400gB7	
S ebtacdlor Ebo†iLe	Dp	N	0.9B	0.1B	1	1gW0W3	01W8W4	KH U1400gB7	
/ amma-CdlorLane'	Dp	N	0.9B	0.g6	1	1gW0W3	01W8W4	KH U1400gB7	
EnLosulfan I	Dp	N	0.9B	0.gg	1	1gW0W3	01W8W4	KH U1400gB7	
albda-CdlorLane	Dp	N	0.9B	0.g8	1	1gW0W3	01W8W4	KH U1400gB7	
p ielLrin	Dp	N	0.9B	0.g0	1	1gW0W3	01W8W4	KH U1400gB7	
4,4Tp p E	**3.3**		0.9B	0.48	1	1gW0W3	01W8W4	KH U1400gB7	
EnLrin	Dp	N	0.9B	0.gB	1	1gW0W3	01W8W4	KH U1400gB7	
EnLosulfan II	Dp	Ni	0.9B	0.g6	1	1gW0W3	01W8W4	KH U1400gB7	
4,4Tp p p	Dp	N	0.9B	0.88	1	1gW0W3	01W8W4	KH U1400gB7	
EnLrin AlLedyLe	Dp	N	0.9B	0.6g	1	1gW0W3	01W8W4	KH U1400gB7	
EnLosulfan hulfate	Dp	N	0.9B	0.83	1	1gW0W3	01W8W4	KH U1400gB7	
4,4Tp p F	Dp	N	0.9B	0.49	1	1gW0W3	01W8W4	KH U1400gB7	
EnLrin Ketone	Dp	N	0.9B	0.39	1	1gW0W3	01W8W4	KH U1400gB7	
Metdo†ycdlor	Dp	N	0.9B	0.4B	1	1gW0W3	01W8W4	KH U1400gB7	
Fo†abdene	Dp	N	49	13	1	1gW0W3	01W8W4	KH U1400gB7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fetracdloro-m-†ylene	63	g9-117	01W8W4	Accebta(le
p ecacdloro(ibdenyl	69	gg-1g1	01W8W4	Accebta(le

† **Analyte Comments**

/ amma-CdlorLane	2or tdis analyte)CAh Re/ istry Do. 8103-74-gx, NhE5A das correcteL tde name to (e (eta-CdlorLane, also knoP n as trans-CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	2S hdell MounL hurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Organochlorine Pesticides

Sample Name:	REH-A2	**Units:**	ug/Kg
Lab Code:	K1313761-013	**Basis:**	Wet
Extraction Method:	E5A 3821	**Level:**	woP
Analysis Method:	B0B1G		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albda-GS C	Dp	N	0.69	0.16	1	19/30/13	01/18/12	KWU12009B7	
(eta-GS C	Dp	N	0.69	0.21	1	19/30/13	01/18/12	KWU12009B7	
gamma-GS C)winLanex	Dp	N	0.69	0.91	1	19/30/13	01/18/12	KWU12009B7	
Lelta-GS C	Dp	N	0.69	0.90	1	19/30/13	01/18/12	KWU12009B7	
S ebtacdlor	Dp	N	0.69	0.97	1	19/30/13	01/18/12	KWU12009B7	
AlLrin	Dp	N	0.72	0.72	1	19/30/13	01/18/12	KWU12009B7	
S ebtacdlor Ebo†iLe	Dp	N	0.69	0.1B	1	19/30/13	01/18/12	KWU12009B7	
gamma-CdlorLane'	Dp	N	0.69	0.96	1	19/30/13	01/18/12	KWU12009B7	
EnLosulfan I	Dp	N	0.69	0.99	1	19/30/13	01/18/12	KWU12009B7	
albda-CdlorLane	Dp	N	0.69	0.98	1	19/30/13	01/18/12	KWU12009B7	
p ielLrin	Dp	N	0.69	0.90	1	19/30/13	01/18/12	KWU12009B7	
2,2T-p p E	**0.68**		0.69	0.28	1	19/30/13	01/18/12	KWU12009B7	
EnLrin	Dp	N	0.69	0.9B	1	19/30/13	01/18/12	KWU12009B7	
EnLosulfan II	Dp	N	0.69	0.92	1	19/30/13	01/18/12	KWU12009B7	
2,2T-p p p	Dp	N	0.69	0.88	1	19/30/13	01/18/12	KWU12009B7	
EnLrin AlLedyLe	Dp	N	0.69	0.69	1	19/30/13	01/18/12	KWU12009B7	
EnLosulfan hulfate	Dp	N	0.69	0.83	1	19/30/13	01/18/12	KWU12009B7	
2,2T-p p F	Dp	N	0.69	0.24	1	19/30/13	01/18/12	KWU12009B7	
EnLrin Ketone	Dp	N	0.69	0.34	1	19/30/13	01/18/12	KWU12009B7	
Metdo†ycdlor	Dp	N	0.69	0.2B	1	19/30/13	01/18/12	KWU12009B7	
Fo†abdene	Dp	N	31	13	1	19/30/13	01/18/12	KWU12009B7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fetracdloro-m-†ylene	61	94-117	01/18/12	Accebta(le
p ecacdloro(ibdenyl	6B	99-191	01/18/12	Accebta(le

† **Analyte Comments**

gamma-CdlorLane	Hor tdis analyte)CAh Registry Do. 8103-72-9x, NhE5A das correcteL tde name to (e (eta-CdlorLane, also knoP n as trans-CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	gh dLell Mounwdurvey	**Date Collected:**	14W0W013
Sample Matrix:	Animal tissue	**Date Received:**	14WSW013

Organochlorine Pesticides

Sample Name:	RE2-9 1	**Units:**	u/ WK/
Lab Code:	K1313761-01g	**Basis:**	H et
Extraction Method:	E8A 3Bg1	**Level:**	Po5
Analysis Method:	G0G19		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albLa-9 h C	Dp	N	0.S7	0.16	1	14W30W13	01WBWg	KH U1g004G7	
(eta-9 h C	Dp	Ni	0.S7	0.63	1	14W30W13	01WBWg	KH U1g004G7	
/ amma-9 h C)Pinwanex	Dp	N	0.S7	0.41	1	14W30W13	01WBWg	KH U1g004G7	
welta-9 h C	Dp	Ni	0.S7	0.71	1	14W30W13	01WBWg	KH U1g004G7	
h ebtacLlor	Dp	N	0.S7	0.47	1	14W30W13	01WBWg	KH U1g004G7	
Alwrin	Dp	N	0.S7	0.7g	1	14W30W13	01WBWg	KH U1g004G7	
h ebtacLlor Ebo†iwe	Dp	N	0.S7	0.1G	1	14W30W13	01WBWg	KH U1g004G7	
/ amma-CLlorwane'	Dp	N	0.S7	0.46	1	14W30W13	01WBWg	KH U1g004G7	
Enwosulfan I	Dp	N	0.S7	0.44	1	14W30W13	01WBWg	KH U1g004G7	
albLa-CLlorwane	Dp	N	0.S7	0.4B	1	14W30W13	01WBWg	KH U1g004G7	
p ielwrin	Dp	Ni	0.S7	0.47	1	14W30W13	01WBWg	KH U1g004G7	
g,gT-p p E	**7.7**		0.S7	0.gB	1	14W30W13	01WBWg	KH U1g004G7	
Enwrin	Dp	N	0.S7	0.4G	1	14W30W13	01WBWg	KH U1g004G7	
Enwosulfan II	Dp	Ni	0.S7	0.31	1	14W30W13	01WBWg	KH U1g004G7	
g,gT-p p p	Dp	N	0.S7	0.BB	1	14W30W13	01WBWg	KH U1g004G7	
Enwrin AlweLywe	Dp	N	0.S7	0.64	1	14W30W13	01WBWg	KH U1g004G7	
Enwosulfan dulfate	Dp	N	0.S7	0.B3	1	14W30W13	01WBWg	KH U1g004G7	
g,gT-p p F	Dp	N	0.S7	0.gS	1	14W30W13	01WBWg	KH U1g004G7	
Enwrin Ketone	Dp	N	0.S7	0.3S	1	14W30W13	01WBWg	KH U1g004G7	
MetLo†ycLlor	Dp	N	0.S7	0.gG	1	14W30W13	01WBWg	KH U1g004G7	
Fo†abLene	Dp	N	gS	13	1	14W30W13	01WBWg	KH U1g004G7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
FetracLloro-m-†ylene	70	4S-117	01WBWg	Accebta(le
p ecacLloro(ibLenyl	6S	44-141	01WBWg	Accebta(le

† Analyte Comments

/ amma-CLlorwane	2or tLis analyte)CAd Re/ istry Do. B103-7g-4x, NdE8A Las correctewtLe name to (e (eta-CLlorwane, also kno5 n as trans-CLlorwane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	hd Lwell MounP Lurvey	**Date Collected:**	14W0W013
Sample Matrix:	Animal tissue	**Date Received:**	14WSW013

Organochlorine Pesticides

Sample Name:	RE2-9 4	**Units:**	u/ Wk/
Lab Code:	K1313761-01g	**Basis:**	H et
Extraction Method:	EBA 3gh1	**Level:**	5 o8
Analysis Method:	C0G19		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albwa-9 d C	Dp	N	0.S4	0.16	1	14W30W13	01WgWh	KH U1h004G7	
(eta-9 d C	Dp	N	0.S4	0.h1	1	14W30W13	01WgWh	KH U1h004G7	
/ amma-9 d C)5 inPanex	Dp	N	0.S4	0.41	1	14W30W13	01WgWh	KH U1h004G7	
Pelta-9 d C	Dp	Ni	0.S4	0.71	1	14W30W13	01WgWh	KH U1h004G7	
d ebtacwlor	Dp	N	0.S4	0.47	1	14W30W13	01WgWh	KH U1h004G7	
AlPrin	Dp	N	0.S4	0.7h	1	14W30W13	01WgWh	KH U1h004G7	
d ebtacwlor Ebo†iPe	Dp	N	0.S4	0.1G	1	14W30W13	01WgWh	KH U1h004G7	
/ amma-CwlorPane'	Dp	N	0.S4	0.46	1	14W30W13	01WgWh	KH U1h004G7	
EnPosulfan I	Dp	N	0.S4	0.44	1	14W30W13	01WgWh	KH U1h004G7	
albwa-CwlorPane	Dp	N	0.S4	0.4g	1	14W30W13	01WgWh	KH U1h004G7	
p ielPrin	Dp	Ni	0.S4	0.g7	1	14W30W13	01WgWh	KH U1h004G7	
h,hT-p p E	**2.4**	B	0.S4	0.hg	1	14W30W13	01WgWh	KH U1h004G7	
EnPrin	Dp	N	0.S4	0.4G	1	14W30W13	01WgWh	KH U1h004G7	
EnPosulfan II	Dp	Ni	1.h	1.h	1	14W30W13	01WgWh	KH U1h004G7	
h,hT-p p p	Dp	N	0.S4	0.gg	1	14W30W13	01WgWh	KH U1h004G7	
EnPrin AlPewyPe	Dp	N	0.S4	0.64	1	14W30W13	01WgWh	KH U1h004G7	
EnPosulfan Lulfate	Dp	N	0.S4	0.g3	1	14W30W13	01WgWh	KH U1h004G7	
h,hT-p p F	Dp	N	0.S4	0.hS	1	14W30W13	01WgWh	KH U1h004G7	
EnPrin Ketone	Dp	N	0.S4	0.3S	1	14W30W13	01WgWh	KH U1h004G7	
Metwo†ycwlor	Dp	N	0.S4	0.hG	1	14W30W13	01WgWh	KH U1h004G7	
Fo†abwene	Dp	N	h6	13	1	14W30W13	01WgWh	KH U1h004G7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fetracwloro-m-†ylene	7h	4S-117	01WgWh	Accebta(le
p ecacwloro(ibwenyl	71	44-141	01WgWh	Accebta(le

† **Analyte Comments**

/ amma-CwlorPane	2or twis analyte)CAL Re/ istry Do. g103-7h-4x, NLEBA was correcteP twe name to (e (eta-CwlorPane, also kno8 n as trans-CwlorPane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	Sh dLell Mounwdurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Organochlorine Pesticides

Sample Name:	REH-2 3	**Units:**	ug/Kg
Lab Code:	K1313761-016	**Basis:**	Wet
Extraction Method:	E8A 3BS1	**Level:**	Po5
Analysis Method:	G0G12		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albLa-2 h C	Dp	N	1.0	0.16	1	19/30/13	01/1S/1S	KWU1S009G7	
(eta-2 h C	Dp	Ni	1.0	0.BG	1	19/30/13	01/1S/1S	KWU1S009G7	
gamma-2 h C)Pinwanex	Dp	Ni	1.0	0.9S	1	19/30/13	01/1S/1S	KWU1S009G7	
welta-2 h C	Dp	Ni	1.0	0.66	1	19/30/13	01/1S/1S	KWU1S009G7	
h ebtacLlor	Dp	N	1.0	0.97	1	19/30/13	01/1S/1S	KWU1S009G7	
Alwrin	Dp	N	1.0	0.7S	1	19/30/13	01/1S/1S	KWU1S009G7	
h ebtacLlor Ebo†iwe	Dp	N	1.0	0.1G	1	19/30/13	01/1S/1S	KWU1S009G7	
gamma-CLlorwane'	Dp	N	1.0	0.96	1	19/30/13	01/1S/1S	KWU1S009G7	
Enwosulfan I	Dp	N	1.0	0.99	1	19/30/13	01/1S/1S	KWU1S009G7	
albLa-CLlorwane	Dp	N	1.0	0.9B	1	19/30/13	01/1S/1S	KWU1S009G7	
p ielwrin	Dp	N	1.0	0.90	1	19/30/13	01/1S/1S	KWU1S009G7	
S,ST-p p E	**4.5**		1.0	0.SB	1	19/30/13	01/1S/1S	KWU1S009G7	
Enwrin	Dp	N	1.0	0.9G	1	19/30/13	01/1S/1S	KWU1S009G7	
Enwosulfan II	Dp	Ni	1.9	1.9	1	19/30/13	01/1S/1S	KWU1S009G7	
S,ST-p p p	Dp	N	1.0	0.BB	1	19/30/13	01/1S/1S	KWU1S009G7	
Enwrin AlweLywe	Dp	N	1.0	0.69	1	19/30/13	01/1S/1S	KWU1S009G7	
Enwosulfan dulfate	Dp	N	1.0	0.B3	1	19/30/13	01/1S/1S	KWU1S009G7	
S,ST-p p F	Dp	N	1.0	0.S4	1	19/30/13	01/1S/1S	KWU1S009G7	
Enwrin Ketone	Dp	N	1.0	0.34	1	19/30/13	01/1S/1S	KWU1S009G7	
MetLo†ycLlor	Dp	N	1.0	0.SG	1	19/30/13	01/1S/1S	KWU1S009G7	
Fo†abLene	Dp	N	B0	13	1	19/30/13	01/1S/1S	KWU1S009G7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
FetracLloro-m-†ylene	76	94-117	01/1S/1S	Accebta(le
p ecacLloro(ibLenyl	77	99-191	01/1S/1S	Accebta(le

† **Analyte Comments**

gamma-CLlorwane	Hor tLis analyte)CAd Registry Do. B103-7S-9x, NdE8A Las correctewtLe name to (e (eta-CLlorwane, also kno5 n as trans-CLlorwane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	9h dLell Mounwdurvey	**Date Collected:**	14/10/4013
Sample Matrix:	Animal tissue	**Date Received:**	14/1S/4013

Organochlorine Pesticides

Sample Name:	REH-2 9	**Units:**	ug/Kg
Lab Code:	K1313761-017	**Basis:**	Wet
Extraction Method:	E8A 3B91	**Level:**	Po5
Analysis Method:	G0G12		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albLa-2 h C	Dp	Ni	0.SS	0.47	1	14/30/13	01/19/19	KWU19004G7	
(eta-2 h C	Dp	Ni	0.SS	0.66	1	14/30/13	01/19/19	KWU19004G7	
gamma-2 h C)Pinwanex	Dp	Ni	0.SS	0.70	1	14/30/13	01/19/19	KWU19004G7	
welta-2 h C	Dp	Ni	0.SS	0.6S	1	14/30/13	01/19/19	KWU19004G7	
h ebtacLlor	Dp	N	0.SS	0.47	1	14/30/13	01/19/19	KWU19004G7	
Alwrin	Dp	N	0.SS	0.79	1	14/30/13	01/19/19	KWU19004G7	
h ebtacLlor Ebo†iwe	Dp	N	0.SS	0.1G	1	14/30/13	01/19/19	KWU19004G7	
gamma-CLlorwane'	Dp	N	0.SS	0.46	1	14/30/13	01/19/19	KWU19004G7	
Enwosulfan I	Dp	N	0.SS	0.44	1	14/30/13	01/19/19	KWU19004G7	
albLa-CLlorwane	Dp	N	0.SS	0.4B	1	14/30/13	01/19/19	KWU19004G7	
p ielwrin	Dp	N	0.SS	0.40	1	14/30/13	01/19/19	KWU19004G7	
9,9'-p p E	**2.6**		0.SS	0.9B	1	14/30/13	01/19/19	KWU19004G7	
Enwrin	Dp	N	0.SS	0.4G	1	14/30/13	01/19/19	KWU19004G7	
Enwosulfan II	Dp	N	0.SS	0.49	1	14/30/13	01/19/19	KWU19004G7	
9,9'-p p p	Dp	N	0.SS	0.BB	1	14/30/13	01/19/19	KWU19004G7	
Enwrin AlweLywe	Dp	N	0.SS	0.64	1	14/30/13	01/19/19	KWU19004G7	
Enwosulfan dulfate	Dp	N	0.SS	0.B3	1	14/30/13	01/19/19	KWU19004G7	
9,9'-p p F	Dp	N	0.SS	0.9S	1	14/30/13	01/19/19	KWU19004G7	
Enwrin Ketone	Dp	N	0.SS	0.3S	1	14/30/13	01/19/19	KWU19004G7	
MetLo†ycLlor	Dp	N	0.SS	0.9G	1	14/30/13	01/19/19	KWU19004G7	
Fo†abLene	Dp	N	B0	13	1	14/30/13	01/19/19	KWU19004G7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
FetracLloro-m-†ylene	G7	4S-117	01/19/19	Accebta(le
p ecacLloro(ibLenyl	Gl	44-141	01/19/19	Accebta(le

† **Analyte Comments**

gamma-CLlorwane	Hor tLis analyte)CAd Registry Do. Bl03-79-4x, NdE8A Las correctewtLe name to (e (eta-CLlorwane, also kno5 n as trans-CLlorwane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	dL wPell Moun5 wurvey	**Date Collected:**	1SW0WS013
Sample Matrix:	Animal tissue	**Date Received:**	1SWhWS013

Organochlorine Pesticides

Sample Name:	RE2-9 4	**Units:**	u/ WK/
Lab Code:	K1313761-01g	**Basis:**	H et
Extraction Method:	EGA 34d1	**Level:**	8 oB
Analysis Method:	g0g19		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albPa-9 L C	Dp	N	0.h7	0.16	1	1SW30W3	01WdWd	KH U1d00Sg7	
(eta-9 L C	Dp	Ni	0.h7	0.6h	1	1SW30W3	01WdWd	KH U1d00Sg7	
/ amma-9 L C)8 in5anex	Dp	N	0.h7	0.S1	1	1SW30W3	01WdWd	KH U1d00Sg7	
5elta-9 L C	Dp	Ni	0.h7	0.71	1	1SW30W3	01WdWd	KH U1d00Sg7	
L ebtacPlor	Dp	N	0.h7	0.S7	1	1SW30W3	01WdWd	KH U1d00Sg7	
Al5rin	Dp	N	0.h7	0.7d	1	1SW30W3	01WdWd	KH U1d00Sg7	
L ebtacPlor Ebo†i5e	Dp	N	0.h7	0.1g	1	1SW30W3	01WdWd	KH U1d00Sg7	
/ amma-CPlor5ane'	Dp	N	0.h7	0.S6	1	1SW30W3	01WdWd	KH U1d00Sg7	
En5osulfan I	Dp	N	0.h7	0.SS	1	1SW30W3	01WdWd	KH U1d00Sg7	
albPa-CPlor5ane	Dp	N	0.h7	0.S4	1	1SW30W3	01WdWd	KH U1d00Sg7	
p iel5rin	Dp	N	0.h7	0.S0	1	1SW30W3	01WdWd	KH U1d00Sg7	
d,dTp p E	**4.4**		0.h7	0.d4	1	1SW30W3	01WdWd	KH U1d00Sg7	
En5rin	Dp	N	0.h7	0.Sg	1	1SW30W3	01WdWd	KH U1d00Sg7	
En5osulfan II	Dp	N	0.h7	0.Sd	1	1SW30W3	01WdWd	KH U1d00Sg7	
d,dTp p p	Dp	N	0.h7	0.44	1	1SW30W3	01WdWd	KH U1d00Sg7	
En5rin Al5ePy5e	Dp	N	0.h7	0.6S	1	1SW30W3	01WdWd	KH U1d00Sg7	
En5osulfan wulfate	Dp	N	0.h7	0.43	1	1SW30W3	01WdWd	KH U1d00Sg7	
d,dTp p F	Dp	N	0.h7	0.dh	1	1SW30W3	01WdWd	KH U1d00Sg7	
En5rin Ketone	Dp	N	0.h7	0.3h	1	1SW30W3	01WdWd	KH U1d00Sg7	
MetPo†ycPlor	Dp	N	0.h7	0.dg	1	1SW30W3	01WdWd	KH U1d00Sg7	
Fo†abPene	Dp	N	dh	13	1	1SW30W3	01WdWd	KH U1d00Sg7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
FetracPloro-m-†ylene	g3	Sh-117	01WdWd	Accebta(le
p ecacPloro(ibPenyl	7h	SS-1S1	01WdWd	Accebta(le

† Analyte Comments

/ amma-CPlor5ane	2or tPis analyte)CAw Re/ istry Do. 4103-7d-Sx, NwEGA Pas correcte5 tPe name to (e (eta-CPlor5ane, also knoBn as trans-CPlor5ane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	gP 5Sell Mounh 5urvey	**Date Collected:**	wA
Sample Matrix:	Animal tissue	**Date Received:**	wA

Organochlorine Pesticides

Sample Name:	MetSoh d lanL	**Units:**	u94K9
Lab Code:	K- 0 1g/ / WH726	**Basis:**	- et
Extraction Method:	EGA 3Ug1	**Level:**	8oB
Analysis Method:	H/ H1d		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpSa2d P C	wD	N	/ .6W	/ .16	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
beta2d P C	wD	N	/ .6W	/ .g1	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
9amma2d P C (8inhane)	wD	N	/ .6W	/ .W1	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
helta2d P C	wD	N	/ .6W	/ .W	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
P eptacSlor	wD	N	/ .6W	/ .W7	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
Alhrin	wD	N	/ .7g	/ .7g	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
P eptacSlor Epoxihe	wD	N	/ .6W	/ .1H	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
9amma2CSlorhane†	wD	N	/ .6W	/ .W6	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
Enhosulfan I	wD	N	/ .6W	/ .WW	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
alpSa2CSlorhane	wD	N	/ .6W	/ .WU	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
Dielhrin	wD	N	/ .6W	/ .W	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
g,g'2DDE	wD	N	/ .6W	/ .gU	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
Enhrin	wD	N	/ .6W	/ .WH	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
Enhosulfan II	wD	N	/ .6W	/ .Wg	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
g,g'2DDD	wD	N	/ .6W	/ .UU	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
Enhrin AlheSyhe	wD	N	/ .6W	/ .6W	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
Enhosulfan 5ulfate	wD	N	/ .6W	/ .U3	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
g,g'2DDF	wD	N	/ .6W	/ .gT	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
Enhrin Ketone	wD	N	/ .6W	/ .3T	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
MetSoxycSlor	wD	N	/ .6W	/ .gH	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	
FoxapSene	wD	N	31	13	1	1W3/ 413	/ 141g41g	K- 0 1g/ / WH7	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
FetracSloro2m2xylene	6g	W12117	/ 141g41g	Acceptable
DecacSlorobipSenyl	73	WW21W1	/ 141g41g	Acceptable

† **Analyte Comments**

9amma2CSlorhane	kor tSis analyte (CA5 Re9istry wo. U1/ 327g2W), N5EGA Sas correcteh tSe name to be beta2CSlorhane, also LnoBn as trans2CSlorhane.

Comments:

QA/QC Report

Client: AMEC Environment & Infrastructure, Inc.
Service Request: K1313761
Project: 4H Shell Mound Survey
Sample Matrix: Animal tissue

Surrogate Recovery Summary
Organochlorine Pesticides

Extraction Method: EPA 3541
Units: Percent
Analysis Method: 8081B
Level: Low

Sample Name	Lab Code	Sur1	Sur2
HEI-C1	K1313761-001	69	74
HEI-C2	K1313761-002	60	74
HEI-C3	K1313761-003	76	83
HEI-C4	K1313761-004	75	84
HEI-C5	K1313761-005	61	68
HOP-C1	K1313761-006	72	80
HOP-C2	K1313761-007	69	82
HOP-C3	K1313761-008	71	82
HOP-C4	K1313761-009	57	73
REF-A1	K1313761-010	60	68
REF-A2	K1313761-011	61	69
REF-A3	K1313761-012	63	69
REF-A4	K1313761-013	61	68
REF-B1	K1313761-014	70	69
REF-B2	K1313761-015	74	71
REF-B3	K1313761-016	76	77
REF-B4	K1313761-017	87	81
REF-B5	K1313761-018	83	79
Method Blank	KWG1400287-6	64	73
REF-B2MS	KWG1400287-1	65	68
REF-B2DMS	KWG1400287-2	70	72
Lab Control Sample	KWG1400287-3	71	74
Lab Control Sample	KWG1400287-4	68	72
Duplicate Lab Control Sample	KWG1400287-5	68	69

Surrogate Recovery Control Limits (%)

Sur1	=	Tetrachloro-m-xylene	29-117
Sur2	=	Decachlorobiphenyl	22-121

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Extracted:**	12/30/2013
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/14/2014

Matrix Spike/Duplicate Matrix Spike Summary
Organochlorine Pesticides

Sample Name:	REF-B2	**Units:**	ug/Kg
Lab Code:	K1313761-015	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B	**Extraction Lot:**	KWG1400287

		REF-B2MS KWG1400287-1 **Matrix Spike**			REF-B2DMS KWG1400287-2 **Duplicate Matrix Spike**					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
alpha-BHC	ND	11.4	19.7	58	12.6	19.8	64	31-118	10	40
beta-BHC	ND	12.3	19.7	62	13.5	19.8	68	22-123	10	40
gamma-BHC (Lindane)	ND	11.8	19.7	60	12.7	19.8	64	34-123	7	40
delta-BHC	ND	13.5	19.7	69	15.3	19.8	77	38-133	12	40
Heptachlor	ND	11.8	19.7	60	11.8	19.8	60	37-122	0	40
Aldrin	ND	11.1	19.7	56	9.38	19.8	47	38-116	17	40
Heptachlor Epoxide	ND	11.9	19.7	60	13.2	19.8	67	39-113	10	40
gamma-Chlordane	ND	12.1	19.7	61	12.9	19.8	65	34-123	6	40
Endosulfan I	ND	11.3	19.7	57	11.5	19.8	58	22-113	1	40
alpha-Chlordane	ND	11.5	19.7	58	13.0	19.8	65	39-113	12	40
Dieldrin	ND	12.4	19.7	63	13.6	19.8	69	33-120	10	40
4,4'-DDE	2.4	14.9	19.7	64	14.9	19.8	63	33-134	0	40
Endrin	ND	14.0	19.7	71	15.7	19.8	79	43-124	11	40
Endosulfan II	ND	11.5	19.7	58 #	13.2	19.8	67 #	28-120	13	40
4,4'-DDD	ND	13.0	19.7	66	14.6	19.8	74	35-126	12	40
Endrin Aldehyde	ND	7.88	19.7	40	8.23	19.8	42	10-118	4	40
Endosulfan Sulfate	ND	12.9	19.7	65	14.5	19.8	73	23-128	12	40
4,4'-DDT	ND	12.2	19.7	62	13.9	19.8	70	26-133	13	40
Endrin Ketone	ND	12.0	19.7	61	13.5	19.8	68	27-128	12	40
Methoxychlor	ND	13.2	19.7	67	14.6	19.8	74	27-148	10	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Extracted:**	12/30/2013
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/14/2014

Lab Control Spike Summary
Organochlorine Pesticides

Extraction Method:	EPA 3541	**Units:**	ug/Kg
Analysis Method:	8081B	**Basis:**	Wet
		Level:	Low
		Extraction Lot:	KWG1400287

	Lab Control Sample KWG1400287-3 **Lab Control Spike**			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
alpha-BHC	12.8	19.8	65	42-124
beta-BHC	12.5	19.8	63	39-122
gamma-BHC (Lindane)	12.6	19.8	63	44-123
delta-BHC	12.3	19.8	62	44-141
Heptachlor	11.3	19.8	57	39-126
Aldrin	9.57	19.8	48	46-116
Heptachlor Epoxide	14.0	19.8	70	43-119
gamma-Chlordane	12.5	19.8	63	38-121
Endosulfan I	11.6	19.8	59	23-116
alpha-Chlordane	12.1	19.8	61	40-121
Dieldrin	13.7	19.8	69	40-120
4,4'-DDE	12.4	19.8	63	36-139
Endrin	15.9	19.8	80	44-130
Endosulfan II	13.1	19.8	66	35-111
4,4'-DDD	14.9	19.8	75	33-138
Endrin Aldehyde	14.1	19.8	71	11-110
Endosulfan Sulfate	17.9	19.8	90	36-127
4,4'-DDT	14.4	19.8	73	49-136
Endrin Ketone	13.0	19.8	66	29-133
Methoxychlor	15.0	19.8	75	37-144

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Extracted:**	12/30/2013
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/14/2014

Lab Control Spike/Duplicate Lab Control Spike Summary
Organochlorine Pesticides

Extraction Method:	EPA 3541	**Units:**	ug/Kg
Analysis Method:	8081B	**Basis:**	Wet
		Level:	Low
		Extraction Lot:	KWG1400287

	Lab Control Sample KWG1400287-4 **Lab Control Spike**			Duplicate Lab Control Sample KWG1400287-5 **Duplicate Lab Control Spike**					
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Toxaphene	81.4	98.7	82	75.1	98.6	76	21-152	8	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	HEI-C1	**Units:**	ug/Kg
Lab Code:	K1313761-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.9	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1221	ND	U	20	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1232	ND	U	9.9	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1242	ND	U	9.9	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1248	ND	U	9.9	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1254	ND	U	9.9	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1260	ND	U	9.9	2.8	1	12/30/13	01/10/14	KWG1400286	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	77	37-139	01/10/14	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	42 Shell Mound Survey	**Date Collected:**	1gW0Wg013
Sample Matrix:	Animal tissue	**Date Received:**	1gW9Wg013

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 EI-Cg	**Units:**	u/ Wk/
Lab Code:	K1313761-00g	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	808gA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	g.8	1	1gW30W3	01W0W4	KH G1400g86	
Aroclor 1gg1	ND	U	g0	g.8	1	1gW30W3	01W0W4	KH G1400g86	
Aroclor 1g3g	ND	U	10	g.8	1	1gW30W3	01W0W4	KH G1400g86	
Aroclor 1g4g	ND	U	10	g.8	1	1gW30W3	01W0W4	KH G1400g86	
Aroclor 1g48	ND	U	10	g.8	1	1gW30W3	01W0W4	KH G1400g86	
Aroclor 1g54	ND	U	10	g.8	1	1gW30W3	01W0W4	KH G1400g86	
Aroclor 1g60	ND	U	10	g.8	1	1gW30W3	01W0W4	KH G1400g86	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	87	37-139	01W0W4	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	HEI-C3	**Units:**	ug/Kg
Lab Code:	K1313761-003	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.7	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1221	ND	U	20	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1232	ND	U	9.7	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1242	ND	U	9.7	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1248	ND	U	9.7	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1254	ND	U	9.7	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1260	ND	U	9.7	2.8	1	12/30/13	01/10/14	KWG1400286	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	92	37-139	01/10/14	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	g2 Shell Mound Survey	**Date Collected:**	19W0W9013
Sample Matrix:	Animal tissue	**Date Received:**	19W4W9013

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 EI-Cg	**Units:**	u/ WK/
Lab Code:	K1313761-00g	**Basis:**	H et
Extraction Method:	EPA 35g1	**Level:**	Low
Analysis Method:	8089A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	4.4	9.8	1	19W30W3	01W0Wg	KH G1g00986	
Aroclor 1991	ND	U	90	9.8	1	19W30W3	01W0Wg	KH G1g00986	
Aroclor 1939	ND	U	4.4	9.8	1	19W30W3	01W0Wg	KH G1g00986	
Aroclor 19g9	ND	U	4.4	9.8	1	19W30W3	01W0Wg	KH G1g00986	
Aroclor 19g8	ND	U	4.4	9.8	1	19W30W3	01W0Wg	KH G1g00986	
Aroclor 195g	ND	U	4.4	9.8	1	19W30W3	01W0Wg	KH G1g00986	
Aroclor 1960	ND	U	4.4	9.8	1	19W30W3	01W0Wg	KH G1g00986	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	87	37-134	01W0Wg	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	S2 hdell MounL hurvey	**Date Collected:**	19W0W013
Sample Matrix:	Animal tissue	**Date Received:**	19W4W013

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 EI-Cg	**Units:**	u/ WK/
Lab Code:	K1313761-00g	**Basis:**	H et
Extraction Method:	E5A 3gS1	**Level:**	woP
Analysis Method:	8089A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	4.7	9.8	1	19W0W3	01W0WS	KH G1S00986	
Aroclor 1991	ND	U	90	9.8	1	19W0W3	01W0WS	KH G1S00986	
Aroclor 1939	ND	U	4.7	9.8	1	19W0W3	01W0WS	KH G1S00986	
Aroclor 19S9	ND	U	4.7	9.8	1	19W0W3	01W0WS	KH G1S00986	
Aroclor 19S8	ND	U	4.7	9.8	1	19W0W3	01W0WS	KH G1S00986	
Aroclor 19gS	ND	U	4.7	9.8	1	19W0W3	01W0WS	KH G1S00986	
Aroclor 1960	ND	U	4.7	9.8	1	19W0W3	01W0WS	KH G1S00986	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	81	37-134	01W0WS	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	hH dLell Mounwdurvey	**Date Collected:**	14/10/4013
Sample Matrix:	Animal tissue	**Date Received:**	14/1S/4013

Polychlorinated Biphenyls (PCBs)

Sample Name:	H2 9-C1	**Units:**	ug/Kg
Lab Code:	K1313761-006	**Basis:**	Wet
Extraction Method:	E9A 38h1	**Level:**	Po5
Analysis Method:	G0G4A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	S.S	4.G	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 1441	Dp	N	40	4.G	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 1434	Dp	N	S.S	4.G	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 14h4	Dp	N	S.S	4.G	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 14hG	Dp	N	S.S	4.G	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 148h	Dp	N	S.S	4.G	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 1460	Dp	N	S.S	4.G	1	14/30/13	01/10/1h	KWU1h004G6	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacLloro: ibLenyl	GG	37-13S	01/10/1h	Accebta: le

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	hH dLell Mounwdurvey	**Date Collected:**	14/10/4013
Sample Matrix:	Animal tissue	**Date Received:**	14/1S/4013

Polychlorinated Biphenyls (PCBs)

Sample Name:	H2 9-C4	**Units:**	ug/Kg
Lab Code:	K1313761-007	**Basis:**	Wet
Extraction Method:	E9A 38h1	**Level:**	Po5
Analysis Method:	C0G4A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	1G	h.S	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 1441	Dp	N	38	h.S	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 1434	Dp	N	1G	h.S	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 14h4	Dp	N	1G	h.S	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 14hG	Dp	N	1G	h.S	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 148h	Dp	N	1G	h.S	1	14/30/13	01/10/1h	KWU1h004G6	
Aroclor 1460	Dp	N	1G	h.S	1	14/30/13	01/10/1h	KWU1h004G6	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacLloro: ibLenyl	G7	37-13S	01/10/1h	Accebta: le

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	d2 Lwell MounP Lurvey	**Date Collected:**	1SW0WS013
Sample Matrix:	Animal tissue	**Date Received:**	1SWhWS013

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 9 4-C3	**Units:**	u/ WK/
Lab Code:	K1313761-00g	**Basis:**	H et
Extraction Method:	E4A 3Gd1	**Level:**	5 o8
Analysis Method:	g0gSA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	S0	Gd	1	1SW30W13	01W0Wd	KH U1d00Sg6	
Aroclor 1SS1	Dp	N	3h	Gd	1	1SW30W13	01W0Wd	KH U1d00Sg6	
Aroclor 1S3S	Dp	N	S0	Gd	1	1SW30W13	01W0Wd	KH U1d00Sg6	
Aroclor 1SdS	Dp	N	S0	Gd	1	1SW30W13	01W0Wd	KH U1d00Sg6	
Aroclor 1Sdg	Dp	N	S0	Gd	1	1SW30W13	01W0Wd	KH U1d00Sg6	
Aroclor 1SGd	Dp	N	S0	Gd	1	1SW30W13	01W0Wd	KH U1d00Sg6	
Aroclor 1S60	Dp	N	S0	Gd	1	1SW30W13	01W0Wd	KH U1d00Sg6	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacwloro: ibwenyl	h0	37-13h	01W0Wd	Accebta: le

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	S2 dLell Mounwdurvey	**Date Collected:**	1hW0W013
Sample Matrix:	Animal tissue	**Date Received:**	1hWgW013

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 9 4-CS	**Units:**	u/ WK/
Lab Code:	K1313761-00g	**Basis:**	H et
Extraction Method:	E4A 38S1	**Level:**	Po5
Analysis Method:	G0GhA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	g.g	h.G	1	1hW30W13	01W0WS	KH U1S00hG6	
Aroclor 1hh1	Dp	N	h0	h.G	1	1hW30W13	01W0WS	KH U1S00hG6	
Aroclor 1h3h	Dp	N	g.g	h.G	1	1hW30W13	01W0WS	KH U1S00hG6	
Aroclor 1hSh	Dp	N	g.g	h.G	1	1hW30W13	01W0WS	KH U1S00hG6	
Aroclor 1hSG	Dp	N	g.g	h.G	1	1hW30W13	01W0WS	KH U1S00hG6	
Aroclor 1h8S	Dp	N	g.g	h.G	1	1hW30W13	01W0WS	KH U1S00hG6	
Aroclor 1h60	Dp	N	g.g	h.G	1	1hW30W13	01W0WS	KH U1S00hG6	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacLloro: ibLenyl	G7	37-13g	01W0WS	Accebta: le

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4S hdell MounL hurvey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	REH-A1	**Units:**	ug/Kg
Lab Code:	K1313761-010	**Basis:**	Wet
Extraction Method:	E5A 3841	**Level:**	woP
Analysis Method:	G0G2A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	GG	2.G	1	12/30/13	01/10/14	KWU14002G6	
Aroclor 1221	Dp	N	1G	2.G	1	12/30/13	01/10/14	KWU14002G6	
Aroclor 1232	Dp	N	GG	2.G	1	12/30/13	01/10/14	KWU14002G6	
Aroclor 1242	Dp	N	GG	2.G	1	12/30/13	01/10/14	KWU14002G6	
Aroclor 124G	Dp	N	GG	2.G	1	12/30/13	01/10/14	KWU14002G6	
Aroclor 1284	Dp	N	GG	2.G	1	12/30/13	01/10/14	KWU14002G6	
Aroclor 1260	Dp	N	GG	2.G	1	12/30/13	01/10/14	KWU14002G6	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacdloro: ibdenyl	77	37-139	01/10/14	Accebta: le

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4S hdell MounL hurvey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	REH-A2	**Units:**	ug/Kg
Lab Code:	K1313761-011	**Basis:**	Wet
Extraction Method:	E5A 3841	**Level:**	woP
Analysis Method:	G0G2A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	9.8	2.G	1	12/30/13	01/11/14	KWU14002G6	
Aroclor 1221	Dp	N	19	2.G	1	12/30/13	01/11/14	KWU14002G6	
Aroclor 1232	Dp	N	9.8	2.G	1	12/30/13	01/11/14	KWU14002G6	
Aroclor 1242	Dp	N	9.8	2.G	1	12/30/13	01/11/14	KWU14002G6	
Aroclor 124G	Dp	N	9.8	2.G	1	12/30/13	01/11/14	KWU14002G6	
Aroclor 1284	Dp	N	9.8	2.G	1	12/30/13	01/11/14	KWU14002G6	
Aroclor 1260	Dp	N	9.8	2.G	1	12/30/13	01/11/14	KWU14002G6	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacdloro: ibdenyl	Gl	37-139	01/11/14	Accebta: le

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4S hdell MounL hurvey	**Date Collected:**	1gW0Wg013
Sample Matrix:	Animal tissue	**Date Received:**	1gW9Wg013

Polychlorinated Biphenyls (PCBs)

Sample Name:	RE2-A3	**Units:**	u/ WK/
Lab Code:	K1313761-01g	**Basis:**	H et
Extraction Method:	E5A 3841	**Level:**	woP
Analysis Method:	G0GgA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	9.G	g.G	1	1gW30W13	01W1W14	KH U1400gG6	
Aroclor 1gg1	Dp	N	g0	g.G	1	1gW30W13	01W1W14	KH U1400gG6	
Aroclor 1g3g	Dp	N	9.G	g.G	1	1gW30W13	01W1W14	KH U1400gG6	
Aroclor 1g4g	Dp	N	9.G	g.G	1	1gW30W13	01W1W14	KH U1400gG6	
Aroclor 1g4G	Dp	N	9.G	g.G	1	1gW30W13	01W1W14	KH U1400gG6	
Aroclor 1g84	Dp	N	9.G	g.G	1	1gW30W13	01W1W14	KH U1400gG6	
Aroclor 1g60	Dp	N	9.G	g.G	1	1gW30W13	01W1W14	KH U1400gG6	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacdloro: ibdenyl	G0	37-139	01W1W14	Accebta: le

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	2S hdell MounL hurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Polychlorinated Biphenyls (PCBs)

Sample Name:	REH-A2	**Units:**	ug/Kg
Lab Code:	K1313761-013	**Basis:**	Wet
Extraction Method:	E5A 3821	**Level:**	woP
Analysis Method:	ODGDA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	6.9	9.G	1	19/30/13	01/11/12	KWU12009G6	
Aroclor 1991	Dp	N	13	9.G	1	19/30/13	01/11/12	KWU12009G6	
Aroclor 1939	Dp	N	6.9	9.G	1	19/30/13	01/11/12	KWU12009G6	
Aroclor 1929	Dp	N	6.9	9.G	1	19/30/13	01/11/12	KWU12009G6	
Aroclor 192G	Dp	N	6.9	9.G	1	19/30/13	01/11/12	KWU12009G6	
Aroclor 1982	Dp	N	6.9	9.G	1	19/30/13	01/11/12	KWU12009G6	
Aroclor 1960	Dp	N	6.9	9.G	1	19/30/13	01/11/12	KWU12009G6	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacdloro: ibdenyl	66	37-134	01/11/12	Accebta: le

Comments:

Analytical Results

Client: AMEC Environment & Infrastructure, Inc.
Project: 4H Shell Mound Survey
Sample Matrix: Animal tissue

Service Request: K1313761
Date Collected: 12/10/2013
Date Received: 12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name: REF-B1
Lab Code: K1313761-014

Units: ug/Kg
Basis: Wet

Extraction Method: EPA 3541
Analysis Method: 8082A

Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.7	2.8	1	12/30/13	01/11/14	KWG1400286	
Aroclor 1221	ND	U	20	2.8	1	12/30/13	01/11/14	KWG1400286	
Aroclor 1232	ND	U	9.7	2.8	1	12/30/13	01/11/14	KWG1400286	
Aroclor 1242	ND	U	9.7	2.8	1	12/30/13	01/11/14	KWG1400286	
Aroclor 1248	ND	U	9.7	2.8	1	12/30/13	01/11/14	KWG1400286	
Aroclor 1254	ND	U	9.7	2.8	1	12/30/13	01/11/14	KWG1400286	
Aroclor 1260	ND	U	9.7	2.8	1	12/30/13	01/11/14	KWG1400286	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	72	37-139	01/11/14	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: AMEC Environment & Infrastructure, Inc.
Project: HS hdell MounL hurvey
Sample Matrix: Animal tissue

Service Request: K1313761
Date Collected: 12/10/2013
Date Received: 12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name: REF-B2
Lab Code: K1313761-014

Units: ug/Kg
Basis: Wet

Extraction Method: E5A 34H1
Analysis Method: 8082A

Level: woP

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.2	2.8	1	12/30/13	01/11/1H	KWG1H00286	
Aroclor 1221	ND	U	19	2.8	1	12/30/13	01/11/1H	KWG1H00286	
Aroclor 1232	ND	U	9.2	2.8	1	12/30/13	01/11/1H	KWG1H00286	
Aroclor 12H2	ND	U	9.2	2.8	1	12/30/13	01/11/1H	KWG1H00286	
Aroclor 12H8	ND	U	9.2	2.8	1	12/30/13	01/11/1H	KWG1H00286	
Aroclor 124H	ND	U	9.2	2.8	1	12/30/13	01/11/1H	KWG1H00286	
Aroclor 1260	ND	U	9.2	2.8	1	12/30/13	01/11/1H	KWG1H00286	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	77	37-139	01/11/1H	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	9H Shell Mound Survey	**Date Collected:**	1Bg10gB013
Sample Matrix:	Animal tissue	**Date Received:**	1Bg12gB013

Polychlorinated Biphenyls (PCBs)

Sample Name:	REWF3	**Units:**	u4gK4
Lab Code:	K1313761-016	**Basis:**	/ et
Extraction Method:	EPA 3591	**Level:**	Low
Analysis Method:	808BA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	B.8	1	1Bg30gl3	01gl1gl9	K/ G1900B86	
Aroclor 1BBl	ND	U	B0	B.8	1	1Bg30gl3	01gl1gl9	K/ G1900B86	
Aroclor 1B3B	ND	U	10	B.8	1	1Bg30gl3	01gl1gl9	K/ G1900B86	
Aroclor 1B9B	ND	U	10	B.8	1	1Bg30gl3	01gl1gl9	K/ G1900B86	
Aroclor 1B98	ND	U	10	B.8	1	1Bg30gl3	01gl1gl9	K/ G1900B86	
Aroclor 1B59	ND	U	10	B.8	1	1Bg30gl3	01gl1gl9	K/ G1900B86	
Aroclor 1B60	ND	U	10	B.8	1	1Bg30gl3	01gl1gl9	K/ G1900B86	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	80	37-132	01gl1gl9	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	BH Shell Mound Survey	**Date Collected:**	12g10g2013
Sample Matrix:	Animal tissue	**Date Received:**	12g19g2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	REWFB	**Units:**	u4gK4
Lab Code:	K1313761-017	**Basis:**	/ et
Extraction Method:	EPA 35Bl	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.9	2.8	1	12g30gl3	01gl1glB	K/ G1B00286	
Aroclor 1221	ND	U	20	2.8	1	12g30gl3	01gl1glB	K/ G1B00286	
Aroclor 1232	ND	U	9.9	2.8	1	12g30gl3	01gl1glB	K/ G1B00286	
Aroclor 12B2	ND	U	9.9	2.8	1	12g30gl3	01gl1glB	K/ G1B00286	
Aroclor 12B8	ND	U	9.9	2.8	1	12g30gl3	01gl1glB	K/ G1B00286	
Aroclor 125B	ND	U	9.9	2.8	1	12g30gl3	01gl1glB	K/ G1B00286	
Aroclor 1260	ND	U	9.9	2.8	1	12g30gl3	01gl1glB	K/ G1B00286	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	85	37-139	01gl1glB	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	Sh dLell Mounwdurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/1H/9013

Polychlorinated Biphenyls (PCBs)

Sample Name:	REF-B2	**Units:**	ug/Kg
Lab Code:	K1313761-014	**Basis:**	Wet
Extraction Method:	E8A 32S1	**Level:**	Po5
Analysis Method:	4049A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	H7	9.4	1	19/30/13	01/11/1S	KWG1S00946	
Aroclor 1991	ND	U	90	9.4	1	19/30/13	01/11/1S	KWG1S00946	
Aroclor 1939	ND	U	H7	9.4	1	19/30/13	01/11/1S	KWG1S00946	
Aroclor 19S9	ND	U	H7	9.4	1	19/30/13	01/11/1S	KWG1S00946	
Aroclor 19S4	ND	U	H7	9.4	1	19/30/13	01/11/1S	KWG1S00946	
Aroclor 192S	ND	U	H7	9.4	1	19/30/13	01/11/1S	KWG1S00946	
Aroclor 1960	ND	U	H7	9.4	1	19/30/13	01/11/1S	KWG1S00946	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
DecacLlorobipLenyl	HB	37-13H	01/11/1S	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	NA

Polychlorinated Biphenyls (PCBs)

Sample Name:	Method Blank	**Units:**	ug/Kg
Lab Code:	KWG1400286-4	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	6.2	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1221	ND	U	13	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1232	ND	U	6.2	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1242	ND	U	6.2	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1248	ND	U	6.2	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1254	ND	U	6.2	2.8	1	12/30/13	01/10/14	KWG1400286	
Aroclor 1260	ND	U	6.2	2.8	1	12/30/13	01/10/14	KWG1400286	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	82	37-139	01/10/14	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client: AMEC Environment & Infrastructure, Inc. **Service Request:** K1313761
Project: 4H Shell Mound Survey
Sample Matrix: Animal tissue

Surrogate Recovery Summary
Polychlorinated Biphenyls (PCBs)

Extraction Method: EPA 3541 **Units:** Percent
Analysis Method: 8082A **Level:** Low

Sample Name	Lab Code	Sur1
HEI-C1	K1313761-001	77
HEI-C2	K1313761-002	87
HEI-C3	K1313761-003	92
HEI-C4	K1313761-004	87
HEI-C5	K1313761-005	81
HOP-C1	K1313761-006	88
HOP-C2	K1313761-007	87
HOP-C3	K1313761-008	90
HOP-C4	K1313761-009	87
REF-A1	K1313761-010	77
REF-A2	K1313761-011	81
REF-A3	K1313761-012	80
REF-A4	K1313761-013	66
REF-B1	K1313761-014	72
REF-B2	K1313761-015	77
REF-B3	K1313761-016	80
REF-B4	K1313761-017	85
REF-B5	K1313761-018	93
Method Blank	KWG1400286-4	82
REF-B5MS	KWG1400286-1	67
REF-B5DMS	KWG1400286-2	76
Lab Control Sample	KWG1400286-3	68

Surrogate Recovery Control Limits (%)

Sur1 = Decachlorobiphenyl 37-139

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Extracted:**	12/30/2013
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/11/2014

Matrix Spike/Duplicate Matrix Spike Summary
Polychlorinated Biphenyls (PCBs)

Sample Name:	REF-B5	**Units:**	ug/Kg
Lab Code:	K1313761-018	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A	**Extraction Lot:**	KWG1400286

		REF-B5MS KWG1400286-1 **Matrix Spike**			REF-B5DMS KWG1400286-2 **Duplicate Matrix Spike**					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Aroclor 1016	ND	162	198	82	163	196	83	46-128	1	40
Aroclor 1260	ND	136	198	69	142	196	72	46-128	4	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Extracted:**	12/30/2013
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/10/2014

Lab Control Spike Summary
Polychlorinated Biphenyls (PCBs)

Extraction Method:	EPA 3541	**Units:**	ug/Kg
Analysis Method:	8082A	**Basis:**	Wet
		Level:	Low
		Extraction Lot:	KWG1400286

	Lab Control Sample KWG1400286-3 Lab Control Spike			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
Aroclor 1016	164	196	84	46-128
Aroclor 1260	140	196	72	46-128

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HEI-C1	**Units:**	ug/Kg
Lab Code:	K1313761-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	9.3	1.4	1	12/28/13	01/09/14	KWG1314064	
2-Methylnaphthalene	ND	U	9.3	1.2	1	12/28/13	01/09/14	KWG1314064	
Acenaphthylene	**0.45**	J	4.7	0.43	1	12/28/13	01/09/14	KWG1314064	
Acenaphthene	ND	U	4.7	0.44	1	12/28/13	01/09/14	KWG1314064	
Dibenzofuran	**0.51**	J	4.7	0.42	1	12/28/13	01/09/14	KWG1314064	
Fluorene	**0.54**	J	4.7	0.49	1	12/28/13	01/09/14	KWG1314064	
Phenanthrene	**1.1**	J	4.7	0.61	1	12/28/13	01/09/14	KWG1314064	*
Anthracene	ND	U	4.7	0.36	1	12/28/13	01/09/14	KWG1314064	*
Fluoranthene	ND	U	4.7	0.46	1	12/28/13	01/09/14	KWG1314064	
Pyrene	ND	U	4.7	0.47	1	12/28/13	01/09/14	KWG1314064	
Benz(a)anthracene	**0.55**	J	4.7	0.36	1	12/28/13	01/09/14	KWG1314064	*
Chrysene	ND	U	4.7	0.51	1	12/28/13	01/09/14	KWG1314064	*
Benzo(b)fluoranthene	ND	U	4.7	0.61	1	12/28/13	01/09/14	KWG1314064	*
Benzo(k)fluoranthene	ND	U	4.7	0.53	1	12/28/13	01/09/14	KWG1314064	
Benzo(a)pyrene	ND	U	4.7	0.68	1	12/28/13	01/09/14	KWG1314064	
Indeno(1,2,3-cd)pyrene	ND	U	4.7	0.89	1	12/28/13	01/09/14	KWG1314064	
Dibenz(a,h)anthracene	ND	U	4.7	0.80	1	12/28/13	01/09/14	KWG1314064	
Benzo(g,h,i)perylene	ND	U	4.7	0.88	1	12/28/13	01/09/14	KWG1314064	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	73	39-96	01/09/14	Acceptable
Fluoranthene-d10	80	41-100	01/09/14	Acceptable
Terphenyl-d14	82	39-111	01/09/14	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HEI-C2	**Units:**	ug/Kg
Lab Code:	K1313761-002	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	9.9	1.5	1	12/28/13	01/09/14	KWG1314064	
2-Methylnaphthalene	ND	U	9.9	1.2	1	12/28/13	01/09/14	KWG1314064	
Acenaphthylene	ND	U	5.0	0.46	1	12/28/13	01/09/14	KWG1314064	
Acenaphthene	ND	U	5.0	0.47	1	12/28/13	01/09/14	KWG1314064	
Dibenzofuran	ND	U	5.0	0.45	1	12/28/13	01/09/14	KWG1314064	
Fluorene	ND	U	5.0	0.52	1	12/28/13	01/09/14	KWG1314064	
Phenanthrene	ND	U	5.0	0.65	1	12/28/13	01/09/14	KWG1314064	*
Anthracene	ND	U	5.0	0.38	1	12/28/13	01/09/14	KWG1314064	*
Fluoranthene	ND	U	5.0	0.49	1	12/28/13	01/09/14	KWG1314064	
Pyrene	ND	U	5.0	0.50	1	12/28/13	01/09/14	KWG1314064	
Benz(a)anthracene	ND	U	5.0	0.38	1	12/28/13	01/09/14	KWG1314064	*
Chrysene	ND	U	5.0	0.54	1	12/28/13	01/09/14	KWG1314064	*
Benzo(b)fluoranthene	ND	U	5.0	0.65	1	12/28/13	01/09/14	KWG1314064	*
Benzo(k)fluoranthene	ND	U	5.0	0.56	1	12/28/13	01/09/14	KWG1314064	
Benzo(a)pyrene	ND	U	5.0	0.72	1	12/28/13	01/09/14	KWG1314064	
Indeno(1,2,3-cd)pyrene	ND	U	5.0	0.95	1	12/28/13	01/09/14	KWG1314064	
Dibenz(a,h)anthracene	ND	U	5.0	0.85	1	12/28/13	01/09/14	KWG1314064	
Benzo(g,h,i)perylene	ND	U	5.0	0.94	1	12/28/13	01/09/14	KWG1314064	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	74	39-96	01/09/14	Acceptable
Fluoranthene-d10	80	41-100	01/09/14	Acceptable
Terphenyl-d14	86	39-111	01/09/14	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HEI-C3	**Units:**	ug/Kg
Lab Code:	K1313761-003	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	9.5	1.5	1	12/28/13	01/09/14	KWG1314064	
2-Methylnaphthalene	ND	U	9.5	1.2	1	12/28/13	01/09/14	KWG1314064	
Acenaphthylene	ND	U	4.8	0.44	1	12/28/13	01/09/14	KWG1314064	
Acenaphthene	ND	U	4.8	0.45	1	12/28/13	01/09/14	KWG1314064	
Dibenzofuran	ND	U	4.8	0.43	1	12/28/13	01/09/14	KWG1314064	
Fluorene	**0.50**	JX	4.8	0.50	1	12/28/13	01/09/14	KWG1314064	
Phenanthrene	ND	U	4.8	0.63	1	12/28/13	01/09/14	KWG1314064	*
Anthracene	ND	U	4.8	0.37	1	12/28/13	01/09/14	KWG1314064	*
Fluoranthene	ND	U	4.8	0.47	1	12/28/13	01/09/14	KWG1314064	
Pyrene	ND	U	4.8	0.48	1	12/28/13	01/09/14	KWG1314064	
Benz(a)anthracene	ND	U	4.8	0.37	1	12/28/13	01/09/14	KWG1314064	*
Chrysene	ND	U	4.8	0.53	1	12/28/13	01/09/14	KWG1314064	*
Benzo(b)fluoranthene	ND	U	4.8	0.63	1	12/28/13	01/09/14	KWG1314064	*
Benzo(k)fluoranthene	ND	U	4.8	0.55	1	12/28/13	01/09/14	KWG1314064	
Benzo(a)pyrene	ND	U	4.8	0.70	1	12/28/13	01/09/14	KWG1314064	
Indeno(1,2,3-cd)pyrene	ND	U	4.8	0.92	1	12/28/13	01/09/14	KWG1314064	
Dibenz(a,h)anthracene	ND	U	4.8	0.82	1	12/28/13	01/09/14	KWG1314064	
Benzo(g,h,i)perylene	ND	U	4.8	0.91	1	12/28/13	01/09/14	KWG1314064	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	79	39-96	01/09/14	Acceptable
Fluoranthene-d10	85	41-100	01/09/14	Acceptable
Terphenyl-d14	89	39-111	01/09/14	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	g2 Shell Mound Survey	**Date Collected:**	19W10W9013
Sample Matrix:	Animal tissue	**Date Received:**	19W14W9013

Polynuclear Aromatic Hydrocarbons

Sample Name:	2 EI-Cg	**Units:**	u/ WK/
Lab Code:	K1313761-00g	**Basis:**	H et
Extraction Method:	EPA 35g1	**Level:**	Low
Analysis Method:	8970D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	4.4	1.5	1	19W08W13	01W04W1g	KH G131g06g	
9-Methylnaphthalene	ND	U	4.4	1.9	1	19W08W13	01W04W1g	KH G131g06g	
Acenaphthylene	ND	U	5.0	0.g6	1	19W08W13	01W04W1g	KH G131g06g	
Acenaphthene	ND	U	5.0	0.g7	1	19W08W13	01W04W1g	KH G131g06g	
DiJenbofuran	ND	U	5.0	0.g5	1	19W08W13	01W04W1g	KH G131g06g	
zluorene	ND	U	5.0	0.59	1	19W08W13	01W04W1g	KH G131g06g	
Phenanthrene	**0.55**	F	5.0	0.66	1	19W08W13	01W04W1g	KH G131g06g	*
Anthracene	ND	U	5.0	0.38	1	19W08W13	01W04W1g	KH G131g06g	*
zluoranthene	ND	U	5.0	0.g4	1	19W08W13	01W04W1g	KH G131g06g	
Pyrene	ND	U	5.0	0.50	1	19W08W13	01W04W1g	KH G131g06g	
Benb(a)anthracene	ND	U	5.0	0.38	1	19W08W13	01W04W1g	KH G131g06g	*
Chrysene	ND	U	5.0	0.55	1	19W08W13	01W04W1g	KH G131g06g	*
Benbo(J)fluoranthene	ND	U	5.0	0.66	1	19W08W13	01W04W1g	KH G131g06g	*
Benbo(k)fluoranthene	ND	U	5.0	0.57	1	19W08W13	01W04W1g	KH G131g06g	
Benbo(a)pyrene	ND	U	5.0	0.79	1	19W08W13	01W04W1g	KH G131g06g	
Indeno(1,9,3-cd)pyrene	ND	U	5.0	0.45	1	19W08W13	01W04W1g	KH G131g06g	
DiJenb(a,h)anthracene	ND	U	5.0	0.85	1	19W08W13	01W04W1g	KH G131g06g	
Benbo(/,h,i)perylene	ND	U	5.0	0.4g	1	19W08W13	01W04W1g	KH G131g06g	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
zluorene-d10	76	34-46	01W04W1g	AcceptaJle
zluoranthene-d10	83	g1-100	01W04W1g	AcceptaJle
Terphenyl-d1g	84	34-111	01W04W1g	AcceptaJle

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	SH hdell MounL hurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HEI-C2	**Units:**	ug/Kg
Lab Code:	K1313761-002	**Basis:**	Wet
Extraction Method:	E5A 32S1	**Level:**	woP
Analysis Method:	8970D hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Napdtdalene	ND	U	4.2	1.2	1	19/98/13	01/04/1S	KWG131S06S	
9-Metdylnapdtdalene	ND	U	4.2	1.9	1	19/98/13	01/04/1S	KWG131S06S	
Acenapdtdylene	ND	U	S.8	0.SS	1	19/98/13	01/04/1S	KWG131S06S	
Acenapdtdene	ND	U	S.8	0.S2	1	19/98/13	01/04/1S	KWG131S06S	
Dibenzofuran	ND	U	S.8	0.S3	1	19/98/13	01/04/1S	KWG131S06S	
Fluorene	ND	U	S.8	0.20	1	19/98/13	01/04/1S	KWG131S06S	
5denantdrene	ND	U	S.8	0.63	1	19/98/13	01/04/1S	KWG131S06S	*
Antdracene	ND	U	S.8	0.36	1	19/98/13	01/04/1S	KWG131S06S	*
Fluorantdene	ND	U	S.8	0.S7	1	19/98/13	01/04/1S	KWG131S06S	
5yrene	ND	U	S.8	0.S8	1	19/98/13	01/04/1S	KWG131S06S	
Benz(a)antdracene	ND	U	S.8	0.36	1	19/98/13	01/04/1S	KWG131S06S	*
Cdrysene	ND	U	S.8	0.29	1	19/98/13	01/04/1S	KWG131S06S	*
Benzo(b)fluorantdene	ND	U	S.8	0.63	1	19/98/13	01/04/1S	KWG131S06S	*
Benzo(k)fluorantdene	ND	U	S.8	0.2S	1	19/98/13	01/04/1S	KWG131S06S	
Benzo(a)pyrene	ND	U	S.8	0.64	1	19/98/13	01/04/1S	KWG131S06S	
InLeno(1,9,3-cL)pyrene	ND	U	S.8	0.41	1	19/98/13	01/04/1S	KWG131S06S	
Dibenz(a,d)antdracene	ND	U	S.8	0.89	1	19/98/13	01/04/1S	KWG131S06S	
Benzo(g,d,i)perylene	ND	U	S.8	0.40	1	19/98/13	01/04/1S	KWG131S06S	

* hee Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-L10	79	34-46	01/04/1S	Acceptable
Fluorantdene-L10	77	S1-100	01/04/1S	Acceptable
Terpdenyl-L1S	86	34-111	01/04/1S	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HOP-C1	**Units:**	ug/Kg
Lab Code:	K1313761-006	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	10	1.5	1	12/28/13	01/09/14	KWG1314064	
2-Methylnaphthalene	ND	U	10	1.2	1	12/28/13	01/09/14	KWG1314064	
Acenaphthylene	ND	U	5.0	0.46	1	12/28/13	01/09/14	KWG1314064	
Acenaphthene	ND	U	5.0	0.47	1	12/28/13	01/09/14	KWG1314064	
Dibenzofuran	ND	U	5.0	0.45	1	12/28/13	01/09/14	KWG1314064	
Fluorene	ND	U	5.0	0.52	1	12/28/13	01/09/14	KWG1314064	
Phenanthrene	**0.69**	J	5.0	0.66	1	12/28/13	01/09/14	KWG1314064	*
Anthracene	ND	U	5.0	0.38	1	12/28/13	01/09/14	KWG1314064	*
Fluoranthene	ND	U	5.0	0.49	1	12/28/13	01/09/14	KWG1314064	
Pyrene	ND	U	5.0	0.50	1	12/28/13	01/09/14	KWG1314064	
Benz(a)anthracene	ND	U	5.0	0.38	1	12/28/13	01/09/14	KWG1314064	*
Chrysene	ND	U	5.0	0.55	1	12/28/13	01/09/14	KWG1314064	*
Benzo(b)fluoranthene	ND	U	5.0	0.66	1	12/28/13	01/09/14	KWG1314064	*
Benzo(k)fluoranthene	ND	U	5.0	0.57	1	12/28/13	01/09/14	KWG1314064	
Benzo(a)pyrene	ND	U	5.0	0.73	1	12/28/13	01/09/14	KWG1314064	
Indeno(1,2,3-cd)pyrene	ND	U	5.0	0.96	1	12/28/13	01/09/14	KWG1314064	
Dibenz(a,h)anthracene	ND	U	5.0	0.86	1	12/28/13	01/09/14	KWG1314064	
Benzo(g,h,i)perylene	ND	U	5.0	0.95	1	12/28/13	01/09/14	KWG1314064	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	77	39-96	01/09/14	Acceptable
Fluoranthene-d10	86	41-100	01/09/14	Acceptable
Terphenyl-d14	94	39-111	01/09/14	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HOP-C2	**Units:**	ug/Kg
Lab Code:	K1313761-007	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	**1.5**	U	9.9	1.5	1	12/28/13	01/09/14	KWG1314064	
2-Methylnaphthalene	ND	b	9.9	1.2	1	12/28/13	01/09/14	KWG1314064	
Acenaphthylene	ND	b	5.0	0.46	1	12/28/13	01/09/14	KWG1314064	
Acenaphthene	ND	b	5.0	0.47	1	12/28/13	01/09/14	KWG1314064	
DizenFofuran	ND	b	5.0	0.45	1	12/28/13	01/09/14	KWG1314064	
J luorene	ND	b	5.0	0.52	1	12/28/13	01/09/14	KWG1314064	
Phenanthrene	**0.77**	U	5.0	0.66	1	12/28/13	01/09/14	KWG1314064	*
Anthracene	ND	b	5.0	0.38	1	12/28/13	01/09/14	KWG1314064	*
J luoranthene	ND	b	5.0	0.49	1	12/28/13	01/09/14	KWG1314064	
Pyrene	ND	b	5.0	0.50	1	12/28/13	01/09/14	KWG1314064	
BenF(a)anthracene	ND	b	5.0	0.38	1	12/28/13	01/09/14	KWG1314064	*
Chrysene	ND	b	5.0	0.55	1	12/28/13	01/09/14	KWG1314064	*
BenFo(z)fluoranthene	ND	b	5.0	0.66	1	12/28/13	01/09/14	KWG1314064	*
BenFo(k)fluoranthene	ND	b	5.0	0.57	1	12/28/13	01/09/14	KWG1314064	
BenFo(a)pyrene	ND	b	5.0	0.73	1	12/28/13	01/09/14	KWG1314064	
Indeno(1,2,3-cd)pyrene	ND	b	5.0	0.95	1	12/28/13	01/09/14	KWG1314064	
DizenF(a,h)anthracene	ND	b	5.0	0.86	1	12/28/13	01/09/14	KWG1314064	
BenFo(g,h,i)perylene	ND	b	5.0	0.94	1	12/28/13	01/09/14	KWG1314064	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
J luorene-d10	78	39-96	01/09/14	Acceptazle
J luoranthene-d10	84	41-100	01/09/14	Acceptazle
Terphenyl-d14	92	39-111	01/09/14	Acceptazle

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HOP-C3	**Units:**	ug/Kg
Lab Code:	K1313761-008	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	9.9	1.5	1	12/28/13	01/09/14	KWG1314064	
2-Methylnaphthalene	ND	U	9.9	1.2	1	12/28/13	01/09/14	KWG1314064	
Acenaphthylene	ND	U	5.0	0.46	1	12/28/13	01/09/14	KWG1314064	
Acenaphthene	ND	U	5.0	0.47	1	12/28/13	01/09/14	KWG1314064	
Dibenzofuran	ND	U	5.0	0.45	1	12/28/13	01/09/14	KWG1314064	
Fluorene	ND	U	5.0	0.52	1	12/28/13	01/09/14	KWG1314064	
Phenanthrene	ND	U	5.0	0.66	1	12/28/13	01/09/14	KWG1314064	*
Anthracene	ND	U	5.0	0.38	1	12/28/13	01/09/14	KWG1314064	*
Fluoranthene	ND	U	5.0	0.49	1	12/28/13	01/09/14	KWG1314064	
Pyrene	ND	U	5.0	0.50	1	12/28/13	01/09/14	KWG1314064	
Benz(a)anthracene	ND	U	5.0	0.38	1	12/28/13	01/09/14	KWG1314064	*
Chrysene	ND	U	5.0	0.55	1	12/28/13	01/09/14	KWG1314064	*
Benzo(b)fluoranthene	ND	U	5.0	0.66	1	12/28/13	01/09/14	KWG1314064	*
Benzo(k)fluoranthene	ND	U	5.0	0.57	1	12/28/13	01/09/14	KWG1314064	
Benzo(a)pyrene	ND	U	5.0	0.73	1	12/28/13	01/09/14	KWG1314064	
Indeno(1,2,3-cd)pyrene	ND	U	5.0	0.95	1	12/28/13	01/09/14	KWG1314064	
Dibenz(a,h)anthracene	ND	U	5.0	0.85	1	12/28/13	01/09/14	KWG1314064	
Benzo(g,h,i)perylene	ND	U	5.0	0.94	1	12/28/13	01/09/14	KWG1314064	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	77	39-96	01/09/14	Acceptable
Fluoranthene-d10	86	41-100	01/09/14	Acceptable
Terphenyl-d14	94	39-111	01/09/14	Acceptable

Comments:

Analytical Results

Client: AMEC Environment & Infrastructure, Inc.
Project: 2H 4Sell Mounh 4urvey
Sample Matrix: Animal tissue

Service Request: K1313761
Date Collected: 19/10/9013
Date Received: 19/18/9013

Polynuclear Aromatic Hydrocarbons

Sample Name: HOP-C2
Lab Code: K1313761-008
Extraction Method: EPA 3w21
Analysis Method: 5970D 4IM

Units: ug/Kg
Basis: Wet
Level: doL

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
NapStSalene	ND	U	10	1.w	1	19/95/13	01/08/12	KWG1312062	
9-MetSylnapStSalene	ND	U	10	1.9	1	19/95/13	01/08/12	KWG1312062	
AcenapStSylene	ND	U	w.0	0.26	1	19/95/13	01/08/12	KWG1312062	
AcenapStSene	ND	U	w.0	0.27	1	19/95/13	01/08/12	KWG1312062	
Dibenzofuran	ND	U	w.0	0.2w	1	19/95/13	01/08/12	KWG1312062	
Fluorene	ND	U	w.0	0.w9	1	19/95/13	01/08/12	KWG1312062	
PSenantSrene	ND	U	w.0	0.66	1	19/95/13	01/08/12	KWG1312062	*
AntSracene	ND	U	w.0	0.35	1	19/95/13	01/08/12	KWG1312062	*
FluorantSene	ND	U	w.0	0.28	1	19/95/13	01/08/12	KWG1312062	
Pyrene	ND	U	w.0	0.w0	1	19/95/13	01/08/12	KWG1312062	
Benz(a)antSracene	ND	U	w.0	0.35	1	19/95/13	01/08/12	KWG1312062	*
CSrysene	ND	U	w.0	0.ww	1	19/95/13	01/08/12	KWG1312062	*
Benzo(b)fluorantSene	ND	U	w.0	0.66	1	19/95/13	01/08/12	KWG1312062	*
Benzo(k)fluorantSene	ND	U	w.0	0.w7	1	19/95/13	01/08/12	KWG1312062	
Benzo(a)pyrene	ND	U	w.0	0.73	1	19/95/13	01/08/12	KWG1312062	
Inheno(1,9,3-ch)pyrene	ND	U	w.0	0.86	1	19/95/13	01/08/12	KWG1312062	
Dibenz(a,S)antSracene	ND	U	w.0	0.56	1	19/95/13	01/08/12	KWG1312062	
Benzo(g,S,i)perylene	ND	U	w.0	0.8w	1	19/95/13	01/08/12	KWG1312062	

* 4ee Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-h10	73	38-86	01/08/12	Acceptable
FluorantSene-h10	78	21-100	01/08/12	Acceptable
TerpSenyl-h12	55	38-111	01/08/12	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4S hdell MounL hurvey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	REH-A1	**Units:**	ug/Kg
Lab Code:	K1313761-010	**Basis:**	Wet
Extraction Method:	E5A 3841	**Level:**	woP
Analysis Method:	D270G hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p aJ dtdalene	p G	N	9.7	1.8	1	12/2D13	01/10/14	KWU1314064	
2-MetdylnaJ dtdalene	p G	N	9.7	1.2	1	12/2D13	01/10/14	KWU1314064	
AcenaJ dtdylene	p G	N	4.9	0.48	1	12/2D13	01/10/14	KWU1314064	
AcenaJ dtdene	p G	N	4.9	0.46	1	12/2D13	01/10/14	KWU1314064	
Gibenzofuran	p G	N	4.9	0.44	1	12/2D13	01/10/14	KWU1314064	
Hluorene	p G	N	4.9	0.81	1	12/2D13	01/10/14	KWU1314064	
5denantdrene	**0.76**	F	4.9	0.64	1	12/2D13	01/10/14	KWU1314064	*
Antdracene	p G	N	4.9	0.37	1	12/2D13	01/10/14	KWU1314064	*
Hluorantdene	p G	N	4.9	0.4D	1	12/2D13	01/10/14	KWU1314064	
5yrene	p G	N	4.9	0.49	1	12/2D13	01/10/14	KWU1314064	
Benz(a)antdracene	p G	N	4.9	0.37	1	12/2D13	01/10/14	KWU1314064	*
Cdrysene	p G	N	4.9	0.84	1	12/2D13	01/10/14	KWU1314064	*
Benzo(b)fluorantdene	p G	N	4.9	0.64	1	12/2D13	01/10/14	KWU1314064	*
Benzo(k)fluorantdene	p G	N	4.9	0.86	1	12/2D13	01/10/14	KWU1314064	
Benzo(a)J yrene	p G	N	4.9	0.71	1	12/2D13	01/10/14	KWU1314064	
InLeno(1,2,3-cL)J yrene	p G	N	4.9	0.94	1	12/2D13	01/10/14	KWU1314064	
Gibenz(a,d)antdracene	p G	N	4.9	0.D4	1	12/2D13	01/10/14	KWU1314064	
Benzo(g,d,i)J erylene	p G	N	4.9	0.93	1	12/2D13	01/10/14	KWU1314064	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Hluorene-L10	76	39-96	01/10/14	AcceJ table
Hluorantdene-L10	D2	41-100	01/10/14	AcceJ table
TerJ denyl-L14	D9	39-111	01/10/14	AcceJ table

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4S hdell MounL hurvey	**Date Collected:**	1Hg10gH013
Sample Matrix:	Animal tissue	**Date Received:**	1Hg19gH013

Polynuclear Aromatic Hydrocarbons

Sample Name:	REWAH	**Units:**	u2gK2
Lab Code:	K1313761-011	**Basis:**	/ et
Extraction Method:	E5A 3841	**Level:**	woP
Analysis Method:	DH70G hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p abdtdalene	p G	N	D.8	1.3	1	1HgHDg13	01g10g14	K/ U1314064	
H-Metdylnabdtdalene	p G	N	D.8	1.1	1	1HgHDg13	01g10g14	K/ U1314064	
Acenabdtdylene	p G	N	4.3	0.39	1	1HgHDg13	01g10g14	K/ U1314064	
Acenabdtdene	p G	N	4.3	0.40	1	1HgHDg13	01g10g14	K/ U1314064	
GizenFofuran	p G	N	4.3	0.39	1	1HgHDg13	01g10g14	K/ U1314064	
Wuorene	p G	N	4.3	0.48	1	1HgHDg13	01g10g14	K/ U1314064	
5denantdrene	p G	N	4.3	0.86	1	1HgHDg13	01g10g14	K/ U1314064	*
Antdracene	p G	N	4.3	0.33	1	1HgHDg13	01g10g14	K/ U1314064	*
Wuorantdene	p G	N	4.3	0.4H	1	1HgHDg13	01g10g14	K/ U1314064	
5yrene	p G	N	4.3	0.43	1	1HgHDg13	01g10g14	K/ U1314064	
BenF(a)antdracene	p G	N	4.3	0.33	1	1HgHDg13	01g10g14	K/ U1314064	*
Cdrysene	p G	N	4.3	0.47	1	1HgHDg13	01g10g14	K/ U1314064	*
BenFo(z)fluorantdene	p G	N	4.3	0.86	1	1HgHDg13	01g10g14	K/ U1314064	*
BenFo(k)fluorantdene	p G	N	4.3	0.49	1	1HgHDg13	01g10g14	K/ U1314064	
BenFo(a)byrene	p G	N	4.3	0.6H	1	1HgHDg13	01g10g14	K/ U1314064	
InLeno(1,H,3-cL)byrene	p G	N	4.3	0.DH	1	1HgHDg13	01g10g14	K/ U1314064	
GizenF(a,d)antdracene	p G	N	4.3	0.73	1	1HgHDg13	01g10g14	K/ U1314064	
BenFo(2,d,i)berylene	p G	N	4.3	0.D1	1	1HgHDg13	01g10g14	K/ U1314064	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Wuorene-L10	74	39-96	01g10g14	Accebtazle
Wuorantdene-L10	D1	41-100	01g10g14	Accebtazle
Terbdenyl-L14	D9	39-111	01g10g14	Accebtazle

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4S hdell MounL hurvey	**Date Collected:**	1gW0Wg013
Sample Matrix:	Animal tissue	**Date Received:**	1gW9Wg013

Polynuclear Aromatic Hydrocarbons

Sample Name:	RE2-A3	**Units:**	u/ WK/
Lab Code:	K1313761-01g	**Basis:**	H et
Extraction Method:	E5A 3841	**Level:**	woP
Analysis Method:	Dg70G hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p aJ dtdalene	p G	N	9.D	1.8	1	1gWgDW3	01W0W4	KH U1314064	
g-MetdylnaJ dtdalene	p G	N	9.D	1.g	1	1gWgDW3	01W0W4	KH U1314064	
AcenaJ dtdylene	p G	N	4.9	0.48	1	1gWgDW3	01W0W4	KH U1314064	
AcenaJ dtdene	p G	N	4.9	0.46	1	1gWgDW3	01W0W4	KH U1314064	
Gibenzofuran	p G	N	4.9	0.44	1	1gWgDW3	01W0W4	KH U1314064	
2luorene	p G	N	4.9	0.81	1	1gWgDW3	01W0W4	KH U1314064	
5denantdrene	**1.1**	F	4.9	0.68	1	1gWgDW3	01W0W4	KH U1314064	*
Antdracene	p G	N	4.9	0.37	1	1gWgDW3	01W0W4	KH U1314064	*
2luorantdene	p G	N	4.9	0.4D	1	1gWgDW3	01W0W4	KH U1314064	
5yrene	p G	N	4.9	0.49	1	1gWgDW3	01W0W4	KH U1314064	
Benz(a)antdracene	p G	N	4.9	0.37	1	1gWgDW3	01W0W4	KH U1314064	*
Cdrysene	p G	N	4.9	0.84	1	1gWgDW3	01W0W4	KH U1314064	*
Benzo(b)fluorantdene	p G	N	4.9	0.68	1	1gWgDW3	01W0W4	KH U1314064	*
Benzo(k)fluorantdene	p G	N	4.9	0.86	1	1gWgDW3	01W0W4	KH U1314064	
Benzo(a)J yrene	p G	N	4.9	0.7g	1	1gWgDW3	01W0W4	KH U1314064	
InLeno(1,g,3-cL)J yrene	p G	N	4.9	0.94	1	1gWgDW3	01W0W4	KH U1314064	
Gibenz(a,d)antdracene	p G	N	4.9	0.D4	1	1gWgDW3	01W0W4	KH U1314064	
Benzo(/ ,d,i)J erylene	p G	N	4.9	0.93	1	1gWgDW3	01W0W4	KH U1314064	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2luorene-L10	7D	39-96	01W0W4	AcceJ table
2luorantdene-L10	D6	41-100	01W0W4	AcceJ table
TerJ denyl-L14	94	39-111	01W0W4	AcceJ table

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	HS hdell MounL hurvey	**Date Collected:**	19g10g9013
Sample Matrix:	Animal tissue	**Date Received:**	19g14g9013

Polynuclear Aromatic Hydrocarbons

Sample Name:	REWAH	**Units:**	u2gK2
Lab Code:	K1313761-013	**Basis:**	/ et
Extraction Method:	E5A 38H1	**Level:**	woP
Analysis Method:	D970G hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p abdtdalene	p G	N	4.8	1.8	1	19g9Dg13	01g10g1H	K/ U131H06H	
9-Metdylnabdtdalene	p G	N	4.8	1.9	1	19g9Dg13	01g10g1H	K/ U131H06H	
Acenabdtdylene	p G	N	HD	0.HH	1	19g9Dg13	01g10g1H	K/ U131H06H	
Acenabdtdene	p G	N	HD	0.H8	1	19g9Dg13	01g10g1H	K/ U131H06H	
GizenFofuran	p G	N	HD	0.H3	1	19g9Dg13	01g10g1H	K/ U131H06H	
Wuorene	p G	N	HD	0.80	1	19g9Dg13	01g10g1H	K/ U131H06H	
5denantdrene	p G	N	HD	0.63	1	19g9Dg13	01g10g1H	K/ U131H06H	*
Antdracene	p G	N	HD	0.37	1	19g9Dg13	01g10g1H	K/ U131H06H	*
Wuorantdene	p G	N	HD	0.H7	1	19g9Dg13	01g10g1H	K/ U131H06H	
5yrene	p G	N	HD	0.HD	1	19g9Dg13	01g10g1H	K/ U131H06H	
BenF(a)antdracene	p G	N	HD	0.37	1	19g9Dg13	01g10g1H	K/ U131H06H	*
Cdrysene	p G	N	HD	0.83	1	19g9Dg13	01g10g1H	K/ U131H06H	*
BenFo(z)fluorantdene	p G	N	HD	0.63	1	19g9Dg13	01g10g1H	K/ U131H06H	*
BenFo(k)fluorantdene	p G	N	HD	0.88	1	19g9Dg13	01g10g1H	K/ U131H06H	
BenFo(a)byrene	p G	N	HD	0.70	1	19g9Dg13	01g10g1H	K/ U131H06H	
InLeno(1,9,3-cL)byrene	p G	N	HD	0.49	1	19g9Dg13	01g10g1H	K/ U131H06H	
GizenF(a,d)antdracene	p G	N	HD	0.D9	1	19g9Dg13	01g10g1H	K/ U131H06H	
BenFo(2,d,i)berylene	p G	N	HD	0.41	1	19g9Dg13	01g10g1H	K/ U131H06H	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Wuorene-L10	89	34-46	01g10g1H	Accebtazle
Wuorantdene-L10	8D	H1-100	01g10g1H	Accebtazle
Terbdenyl-L1H	63	34-111	01g10g1H	Accebtazle

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	gh dLell Mounwdurvey	**Date Collected:**	14W0W4013
Sample Matrix:	Animal tissue	**Date Received:**	14WSW4013

Polynuclear Aromatic Hydrocarbons

Sample Name:	RE2-9 1	**Units:**	u/ WK/
Lab Code:	K1313761-01g	**Basis:**	H et
Extraction Method:	E8A 3Dg1	**Level:**	Po5
Analysis Method:	G470U dIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
J abLtLalene	J U	p	S.D	1.D	1	14W4GW3	01W0Wg	KH N131g06g	
4-MetLylnabLtLalene	J U	p	S.D	1.4	1	14W4GW3	01W0Wg	KH N131g06g	
AcenabLtLylene	J U	p	g.G	0.gg	1	14W4GW3	01W0Wg	KH N131g06g	
AcenabLtLene	**0.74**	z	g.G	0.gD	1	14W4GW3	01W0Wg	KH N131g06g	
UiFen*ofuran	J U	p	g.G	0.g3	1	14W4GW3	01W0Wg	KH N131g06g	
2luorene	**0.52**	z	g.G	0.D0	1	14W4GW3	01W0Wg	KH N131g06g	
8LenantLrene	J U	p	g.G	0.63	1	14W4GW3	01W0Wg	KH N131g06g	B
AntLracene	J U	p	g.G	0.37	1	14W4GW3	01W0Wg	KH N131g06g	B
2luorantLene	J U	p	g.G	0.g7	1	14W4GW3	01W0Wg	KH N131g06g	
8yrene	J U	p	g.G	0.gG	1	14W4GW3	01W0Wg	KH N131g06g	
9 en*(a)antLracene	J U	p	g.G	0.37	1	14W4GW3	01W0Wg	KH N131g06g	B
CLrysene	J U	p	g.G	0.D3	1	14W4GW3	01W0Wg	KH N131g06g	B
9 en*o(F)fluorantLene	J U	p	g.G	0.63	1	14W4GW3	01W0Wg	KH N131g06g	B
9 en*o(k)fluorantLene	J U	p	g.G	0.DD	1	14W4GW3	01W0Wg	KH N131g06g	
9 en*o(a)byrene	J U	p	g.G	0.70	1	14W4GW3	01W0Wg	KH N131g06g	
Inweno(1,4,3-cw)byrene	J U	p	g.G	0.S4	1	14W4GW3	01W0Wg	KH N131g06g	
UiFen*(a,L)antLracene	J U	p	g.G	0.G4	1	14W4GW3	01W0Wg	KH N131g06g	
9 en*o(/ ,L,i)berylene	J U	p	g.G	0.S1	1	14W4GW3	01W0Wg	KH N131g06g	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2luorene-wl0	70	3S-S6	01W0Wg	AccebtaFle
2luorantLene-wl0	77	g1-100	01W0Wg	AccebtaFle
TerbLenyl-wlg	Gl	3S-111	01W0Wg	AccebtaFle

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	hd Lwell MounP Lurvey	**Date Collected:**	14/10/4013
Sample Matrix:	Animal tissue	**Date Received:**	14/1S/4013

Polynuclear Aromatic Hydrocarbons

Sample Name:	REH-9 4	**Units:**	ug/Kg
Lab Code:	K1313761-012	**Basis:**	Wet
Extraction Method:	EDA 32h1	**Level:**	5 o8
Analysis Method:	G470U LIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
b azwtwalene	b U	p	S.4	1.h	1	14/4G/13	01/10/1h	KWN131h06h	
4-Metwylnazwtwalene	b U	p	S.4	1.1	1	14/4G/13	01/10/1h	KWN131h06h	
Acenazwtwylene	b U	p	h.6	0.h3	1	14/4G/13	01/10/1h	KWN131h06h	
Acenazwtwene	b U	p	h.6	0.hh	1	14/4G/13	01/10/1h	KWN131h06h	
UiFen*ofuran	b U	p	h.6	0.h4	1	14/4G/13	01/10/1h	KWN131h06h	
Hluorene	b U	p	h.6	0.hG	1	14/4G/13	01/10/1h	KWN131h06h	
Dwenantwrene	b U	p	h.6	0.61	1	14/4G/13	01/10/1h	KWN131h06h	B
Antwracene	b U	p	h.6	0.32	1	14/4G/13	01/10/1h	KWN131h06h	B
Hluorantwene	b U	p	h.6	0.h2	1	14/4G/13	01/10/1h	KWN131h06h	
Dyrene	b U	p	h.6	0.h6	1	14/4G/13	01/10/1h	KWN131h06h	
9 en*(a)antwracene	b U	p	h.6	0.32	1	14/4G/13	01/10/1h	KWN131h06h	B
Cwrysene	b U	p	h.6	0.21	1	14/4G/13	01/10/1h	KWN131h06h	B
9 en*o(F)fluorantwene	b U	p	h.6	0.61	1	14/4G/13	01/10/1h	KWN131h06h	B
9 en*o(k)fluorantwene	b U	p	h.6	0.23	1	14/4G/13	01/10/1h	KWN131h06h	
9 en*o(a)zyrene	b U	p	h.6	0.67	1	14/4G/13	01/10/1h	KWN131h06h	
InPeno(1,4,3-cP)zyrene	b U	p	h.6	0.GG	1	14/4G/13	01/10/1h	KWN131h06h	
UiFen*(a,w)antwracene	b U	p	h.6	0.7S	1	14/4G/13	01/10/1h	KWN131h06h	
9 en*o(g,w,i)zerylene	b U	p	h.6	0.GG	1	14/4G/13	01/10/1h	KWN131h06h	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Hluorene-P10	7G	3S-S6	01/10/1h	AcceztaFle
Hluorantwene-P10	Gh	h1-100	01/10/1h	AcceztaFle
Terzwenyl-P1h	S1	3S-111	01/10/1h	AcceztaFle

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	Sh dLell Mounwdurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Polynuclear Aromatic Hydrocarbons

Sample Name:	REH-2 3	**Units:**	ug/Kg
Lab Code:	K1313761-016	**Basis:**	Wet
Extraction Method:	E8A 3DS1	**Level:**	Po5
Analysis Method:	G970U dIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
J abLtLalene	J U	p	4.6	1.D	1	19/9G/13	01/10/1S	KWN131S06S	
9-MetLylnabLtLalene	J U	p	4.6	1.9	1	19/9G/13	01/10/1S	KWN131S06S	
AcenabLtLylene	J U	p	S.G	0.SS	1	19/9G/13	01/10/1S	KWN131S06S	
AcenabLtLene	J U	p	S.G	0.SD	1	19/9G/13	01/10/1S	KWN131S06S	
UizenFofuran	J U	p	S.G	0.S3	1	19/9G/13	01/10/1S	KWN131S06S	
Hluorene	J U	p	S.G	0.D0	1	19/9G/13	01/10/1S	KWN131S06S	
8LenantLrene	**0.79**	*	S.G	0.63	1	19/9G/13	01/10/1S	KWN131S06S	B
AntLracene	J U	p	S.G	0.37	1	19/9G/13	01/10/1S	KWN131S06S	B
HluorantLene	J U	p	S.G	0.S7	1	19/9G/13	01/10/1S	KWN131S06S	
8yrene	**0.56**	*	S.G	0.SG	1	19/9G/13	01/10/1S	KWN131S06S	
2 enF(a)antLracene	J U	p	S.G	0.37	1	19/9G/13	01/10/1S	KWN131S06S	B
CLrysene	J U	p	S.G	0.D3	1	19/9G/13	01/10/1S	KWN131S06S	B
2 enFo(z)fluorantLene	J U	p	S.G	0.63	1	19/9G/13	01/10/1S	KWN131S06S	B
2 enFo(k)fluorantLene	J U	p	S.G	0.DD	1	19/9G/13	01/10/1S	KWN131S06S	
2 enFo(a)byrene	J U	p	S.G	0.70	1	19/9G/13	01/10/1S	KWN131S06S	
Inweno(1,9,3-cw)byrene	J U	p	S.G	0.49	1	19/9G/13	01/10/1S	KWN131S06S	
UizenF(a,L)antLracene	J U	p	S.G	0.G9	1	19/9G/13	01/10/1S	KWN131S06S	
2 enFo(g,L,i)berylene	J U	p	S.G	0.41	1	19/9G/13	01/10/1S	KWN131S06S	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Hluorene-w10	7D	34-46	01/10/1S	Accebtazle
HluorantLene-w10	G0	S1-100	01/10/1S	Accebtazle
TerbLenyl-w1S	G6	34-111	01/10/1S	Accebtazle

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	9h dLell Mounwdurvey	**Date Collected:**	14gl0g4013
Sample Matrix:	Animal tissue	**Date Received:**	14gl Sg4013

Polynuclear Aromatic Hydrocarbons

Sample Name:	REWH9	**Units:**	u2gK2
Lab Code:	K1313761-017	**Basis:**	/ et
Extraction Method:	E8A 3D91	**Level:**	Po5
Analysis Method:	G470U dIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
b azLtLalene	b U	p	S.3	1.9	1	14g4Cgl3	01gl0gl9	K/ N1319069	
4-MetLylnazLtLalene	b U	p	S.3	1.4	1	14g4Cgl3	01gl0gl9	K/ N1319069	
AcenazLtLylene	b U	p	9.7	0.93	1	14g4Cgl3	01gl0gl9	K/ N1319069	
AcenazLtLene	b U	p	9.7	0.99	1	14g4Cgl3	01gl0gl9	K/ N1319069	
UiFen*ofuran	b U	p	9.7	0.94	1	14g4Cgl3	01gl0gl9	K/ N1319069	
Wuorene	b U	p	9.7	0.9S	1	14g4Cgl3	01gl0gl9	K/ N1319069	
8LenantLrene	b U	p	9.7	0.64	1	14g4Cgl3	01gl0gl9	K/ N1319069	B
AntLracene	b U	p	9.7	0.36	1	14g4Cgl3	01gl0gl9	K/ N1319069	B
WuorantLene	b U	p	9.7	0.96	1	14g4Cgl3	01gl0gl9	K/ N1319069	
8yrene	b U	p	9.7	0.97	1	14g4Cgl3	01gl0gl9	K/ N1319069	
Hen*(a)antLracene	b U	p	9.7	0.36	1	14g4Cgl3	01gl0gl9	K/ N1319069	B
CLrysene	b U	p	9.7	0.D4	1	14g4Cgl3	01gl0gl9	K/ N1319069	B
Hen*o(F)fluorantLene	b U	p	9.7	0.64	1	14g4Cgl3	01gl0gl9	K/ N1319069	B
Hen*o(k)fluorantLene	b U	p	9.7	0.D3	1	14g4Cgl3	01gl0gl9	K/ N1319069	
Hen*o(a)zyrene	b U	p	9.7	0.6G	1	14g4Cgl3	01gl0gl9	K/ N1319069	
Inweno(1,4,3-cw)zyrene	b U	p	9.7	0.S0	1	14g4Cgl3	01gl0gl9	K/ N1319069	
UiFen*(a,L)antLracene	b U	p	9.7	0.G0	1	14g4Cgl3	01gl0gl9	K/ N1319069	
Hen*o(2,L,i)zerylene	b U	p	9.7	0.GS	1	14g4Cgl3	01gl0gl9	K/ N1319069	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Wuorene-wl0	79	3S-S6	01gl0gl9	AcceztaFle
WuorantLene-wl0	G3	91-100	01gl0gl9	AcceztaFle
TerzLenyl-wl9	GS	3S-111	01gl0gl9	AcceztaFle

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	dL wPell Moun5 wurvey	**Date Collected:**	1SW0WS013
Sample Matrix:	Animal tissue	**Date Received:**	1SWhWS013

Polynuclear Aromatic Hydrocarbons

Sample Name:	RE2-9 4	**Units:**	u/ WK/
Lab Code:	K1313761-01g	**Basis:**	H et
Extraction Method:	EGA 34d1	**Level:**	8 oD
Analysis Method:	gS70U wIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
J abPtPalene	J U	p	h.6	1.4	1	1SWSgW3	01WhWd	KH N131d06d	
S-MetPylnabPtPalene	J U	p	h.6	1.S	1	1SWSgW3	01WhWd	KH N131d06d	
AcenabPtPylene	J U	p	d.g	0.dd	1	1SWSgW3	01WhWd	KH N131d06d	
AcenabPtPene	**0.68**	z	d.g	0.d4	1	1SWSgW3	01WhWd	KH N131d06d	
UiFen*ofuran	J U	p	d.g	0.d3	1	1SWSgW3	01WhWd	KH N131d06d	
2luorene	J U	p	d.g	0.40	1	1SWSgW3	01WhWd	KH N131d06d	
GPenantPrene	J U	p	d.g	0.63	1	1SWSgW3	01WhWd	KH N131d06d	B
AntPracene	J U	p	d.g	0.37	1	1SWSgW3	01WhWd	KH N131d06d	B
2luorantPene	J U	p	d.g	0.d7	1	1SWSgW3	01WhWd	KH N131d06d	
Gyrene	J U	p	d.g	0.dg	1	1SWSgW3	01WhWd	KH N131d06d	
9 en*(a)antPracene	**0.60**	z	d.g	0.37	1	1SWSgW3	01WhWd	KH N131d06d	B
CPrysene	J U	p	d.g	0.43	1	1SWSgW3	01WhWd	KH N131d06d	B
9 en*o(F)fluorantPene	J U	p	d.g	0.63	1	1SWSgW3	01WhWd	KH N131d06d	B
9 en*o(k)fluorantPene	J U	p	d.g	0.44	1	1SWSgW3	01WhWd	KH N131d06d	
9 en*o(a)byrene	J U	p	d.g	0.70	1	1SWSgW3	01WhWd	KH N131d06d	
In5eno(1,S,3-c5)byrene	**1.4**	z	d.g	0.hS	1	1SWSgW3	01WhWd	KH N131d06d	
UiFen*(a,P)antPracene	**1.2**	z	d.g	0.gS	1	1SWSgW3	01WhWd	KH N131d06d	
9 en*o(/ ,P,i)berylene	**2.1**	z	d.g	0.h1	1	1SWSgW3	01WhWd	KH N131d06d	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2luorene-510	73	3h-h6	01WhWd	AccebtaFle
2luorantPene-510	g0	d1-100	01WhWd	AccebtaFle
TerbPenyl-51d	g3	3h-111	01WhWd	AccebtaFle

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	gw P4ell MounS Purvey	**Date Collected:**	LA
Sample Matrix:	Animal tissue	**Date Received:**	LA

Polynuclear Aromatic Hydrocarbons

Sample Name:	Met4oS h land	**Units:**	u29K2
Lab Code:	K- 0 131g/ 6gWH	**Basis:**	- et
Extraction Method:	EDA 3Hg1	**Level:**	5o8
Analysis Method:	GU7/ N PIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Lab4t4alene	LN	J	GH	1.3	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
UWMet4ylnab4t4alene	LN	J	GH	1.1	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
Acenab4t4ylene	LN	J	g.3	/ .3p	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
Acenab4t4ene	LN	J	g.3	/ .g/	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
NizenFofuran	LN	J	g.3	/ .3p	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
*luorene	LN	J	g.3	/ .gH	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
D4enant4rene	LN	J	g.3	/ .H6	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	B
Ant4racene	LN	J	g.3	/ .33	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	B
*luorant4ene	LN	J	g.3	/ .gU	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
Dyrene	LN	J	g.3	/ .g3	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
h enF)akant4racene	**0.54**	(	g.3	/ .33	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	B
C4rysene	LN	J	g.3	/ .g7	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	B
h enFo)zkfluorant4ene	LN	J	g.3	/ .H6	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	B
h enFo)dkfluorant4ene	LN	J	g.3	/ .gp	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
h enFo)akbyrene	LN	J	g.3	/ .6U	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
InSeno)1,U,3WcSkbyrene	**1.0**	(	g.3	/ .GU	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
NizenF)a,4kant4racene	**0.85**	(	g.3	/ .73	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	
h enFo)2,4,ikberylene	**1.6**	(	g.3	/ .G1	1	1U9UG913	/ 19/ p91g	K- 0 131g/ 6g	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
*luoreneWS1/	7p	3pWp6	/ 19/ p91g	Accebtazle
*luorant4eneWS1/	Gp	g1W/ /	/ 19/ p91g	Accebtazle
Terb4enylWS1g	pG	3pW11	/ 19/ p91g	Accebtazle

Comments:

Client: AMEC Environment & Infrastructure, Inc. **Service Request:** K1313761
Project: 4H Shell Mound Survey
Sample Matrix: Animal tissue

Surrogate Recovery Summary
Polynuclear Aromatic Hydrocarbons

Extraction Method: EPA 3541 **Units:** Percent
Analysis Method: 8270D SIM **Level:** Low

Sample Name	Lab Code	Sur1	Sur2	Sur3
HEI-C1	K1313761-001	73	80	82
HEI-C2	K1313761-002	74	80	86
HEI-C3	K1313761-003	79	85	89
HEI-C4	K1313761-004	76	83	89
HEI-C5	K1313761-005	72	77	86
HOP-C1	K1313761-006	77	86	94
HOP-C2	K1313761-007	78	84	92
HOP-C3	K1313761-008	77	86	94
HOP-C4	K1313761-009	73	79	88
REF-A1	K1313761-010	76	82	89
REF-A2	K1313761-011	74	81	89
REF-A3	K1313761-012	78	86	94
REF-A4	K1313761-013	52	58	63
REF-B1	K1313761-014	70	77	81
REF-B2	K1313761-015	78	84	91
REF-B3	K1313761-016	75	80	86
REF-B4	K1313761-017	74	83	89
REF-B5	K1313761-018	73	80	83
Method Blank	KWG1314064-5	79	89	98
REF-B5MS	KWG1314064-1	79	90	94
REF-B5DMS	KWG1314064-2	77	88	92
Lab Control Sample	KWG1314064-3	73	89	95
Duplicate Lab Control Sample	KWG1314064-4	80	96	102

Surrogate Recovery Control Limits (%)

Sur1	=	Fluorene-d10	39-96
Sur2	=	Fluoranthene-d10	41-100
Sur3	=	Terphenyl-d14	39-111

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313761
Project:	4H Shell Mound Survey	**Date Extracted:**	12/28/2013
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/09/2014

Matrix Spike/Duplicate Matrix Spike Summary
Polynuclear Aromatic Hydrocarbons

Sample Name:	REF-B5	**Units:**	ug/Kg
Lab Code:	K1313761-018	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM	**Extraction Lot:**	KWG1314064

		REF-B5MS KWG1314064-1 **Matrix Spike**			REF-B5DMS KWG1314064-2 **Duplicate Matrix Spike**					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Naphthalene	ND	429	457	94	397	467	85	43-102	8	40
2-Methylnaphthalene	ND	409	457	90	392	467	84	43-114	4	40
Acenaphthylene	ND	445	457	97	428	467	92	53-100	4	40
Acenaphthene	0.68	457	457	100	443	467	95	52-101	3	40
Dibenzofuran	ND	452	457	99	442	467	95	55-103	2	40
Fluorene	ND	459	457	100	444	467	95	56-104	3	40
Phenanthrene	ND	479	457	105 *	462	467	99	54-100	4	40
Anthracene	ND	498	457	109 *	477	467	102	57-103	4	40
Fluoranthene	ND	477	457	104	456	467	98	55-108	4	40
Pyrene	ND	470	457	103	452	467	97	48-117	4	40
Benz(a)anthracene	0.60	489	457	107 *	472	467	101	55-105	4	40
Chrysene	ND	533	457	117 *	513	467	110	58-112	4	40
Benzo(b)fluoranthene	ND	513	457	112 *	495	467	106	60-107	4	40
Benzo(k)fluoranthene	ND	502	457	110	480	467	103	58-115	5	40
Benzo(a)pyrene	ND	518	457	113 *	495	467	106	56-110	5	40
Indeno(1,2,3-cd)pyrene	1.4	575	457	125 *	544	467	116	50-117	6	40
Dibenz(a,h)anthracene	1.2	584	457	127 *	546	467	117 *	52-112	7	40
Benzo(g,h,i)perylene	2.1	580	457	126 *	547	467	117	56-117	6	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	A1 3C 3f7vrofs eft 6 0f8rm2trEi tEreD0fi S	**Service Request:**	u . F. Fg5.
Project:	-4 aHem1 oEfh aEr7ed	**Date Extracted:**	. l /l Wl B. F
Sample Matrix:	Af vs mntv22Ee	**Date Analyzed:**	B. /By/l B. -

Lab Control Spike/Duplicate Lab Control Spike Summary
Polynuclear Aromatic Hydrocarbons

Extraction Method:	3 9A FP- .	**Units:**	EL/u L
Analysis Method:	WgBMa 0l	**Basis:**	c et
		Level:	&ow
		Extraction Lot:	u c , . F. - B5-

	&ml Cof trona ns pre u c , . F. - B5- KF **Lab Control Spike**			MEpmi nte &ml Cof trona ns pre u c , . F. - B5- K. **Duplicate Lab Control Spike**					
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
GmpHHmefe	- - g	PBB	Wy	- gB	PBB	y-	- FK Bl	P	- B
l Kl etHdnf mpHHmefe	- Fl	PBB	W5	- Fg	PBB	Wg	- FK . -	.	- B
Ai ef mpHHdnefe	- 5P	PBB	yF	- gy	PBB	y5	PFK BB	F	- B
Ai ef mpHHefe	- WB	PBB	y5	- y-	PBB	yy	Pl K B.	F	- B
MM ef No8Ermf	- gP	PBB	yP	- yB	PBB	yW	PPK BF	F	- B
bnEorefe	- gP	PBB	yP	- y5	PBB	yy	P5K B-	-	- B
9HefmftHrefe	- Wg	PBB	yg	PBy	PBB	. Bl z	P- K BB	-	- B
AftHmiefe	PB5	PBB	. B.	Pl g	PBB	. BP z	PgK BF	-	- B
bnEornftHefe	P. W	PBB	. B-	PF5	PBB	. Bg	PPK BW	F	- B
9drefe	P. W	PBB	. B-	PFg	PBB	. Bg	- WK . g	F	- B
* ef N(m)mftHmiefe	P- .	PBB	. BW z	P- P	PBB	. By z	PPK BP	.	- B
CHrd2efe	P5P	PBB	. . F z	P5y	PBB	. . - z	PWK . l	.	- B
* ef No(I)8rEornftHefe	PFW	PBB	. BW z	PP.	PBB	. . B z	5BK Bg	l	- B
* ef No(k)8rEornftHefe	Pl .	PBB	. B-	PFW	PBB	. BW	PWK . P	F	- B
* ef No(m)pdrefe	P- .	PBB	. BW	P- g	PBB	. By	P5K . B	.	- B
0fhefo(. DDFKh)pdrefe	Pl -	PBB	. BP	P. P	PBB	. BF	PBK . g	l	- B
MM ef N(mDD)mftHmiefe	Pl P	PBB	. BP	Pl B	PBB	. B-	Pl K . l	.	- B
* ef No(LDDD)perdnefe	- yl	PBB	yW	- WP	PBB	yg	P5K . g	.	- B

Results flagged with an asterisk (*) indicate values outside control criteria.

9eri ef t rei o7erve2 mfh remtv7e peri ef t hv88erefi e2 (R9M) mre heters vfeh I d tHe 2o8twmre E2vf L 7mrEe2 vf tHe i mi Emtvof wHvi H Hm7e f ot I eef roEfhehS

January 21, 2014 Analytical Report for Service Request No: K1313762

Michael Henry
AMEC Environment & Infrastructure, Inc.
10670 White Rock Road, Suite 100
Rancho Cordova, CA 95670-6032

RE: 4H Shell Mound Survey

Dear Michael:

Enclosed are the results of the samples submitted to our laboratory on December 19, 2013. For your reference, these analyses have been assigned our service request number K1313762.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3293. You may also contact me via Email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA Corp. dba ALS Environmental

Shar Samy, Ph.D.
Project Manager

SS/mj

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2286
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L12-28
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Georgia DNR	http://www.gaepd.org/Documents/techguide_pcb.html#cel	881
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
Indiana DOH	http://www.in.gov/isdh/24859.htm	C-WA-01
ISO 17025	http://www.pjlabs.com/	L12-27
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	3016
Maine DHS	Not available	WA0035
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-368
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA35
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA200001
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427-08-TX
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C1203
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.caslab.com or at the accreditation bodies web site

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

ALS ENVIRONMENTAL

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request No.:**	K1313762
Project:	4H Shell Mound Survey	**Date Received:**	12/19/13
Sample Matrix:	Animal Tissue		

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), Matrix/Duplicate Matrix Spike (MS/DMS), Laboratory Control Sample (LCS), and Laboratory/Duplicate Laboratory Control Sample (LCS/DLCS).

Sample Receipt

Twenty animal tissue samples were received for analysis at ALS Environmental on 12/19/13. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at –20ºC upon receipt at the laboratory.

Total Metals

Matrix Spike Recovery Exceptions:
The matrix spike recovery of Silver for sample HEI-B1 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. The matrix spike outlier suggested a potential low bias in this matrix. No further corrective action was appropriate.

Relative Percent Difference Exceptions:
The Relative Percent Difference (RPD) for the replicate analysis of Chromium and Nickel in sample HEI-B1 was outside the Method control limits. The variability in the results was attributed to the heterogeneous distribution of Chromium and Nickel in the sample. Freeze drying, grinding in combination with standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

No other anomalies associated with the analysis of these samples were observed.

Organochlorine Pesticides by EPA Method 8081

Matrix Spike Recovery Exceptions:
Insufficient sample volume was received to perform a Matrix Spike/Matrix Spike Duplicate (MS/MSD). A Laboratory Control Sample/Duplicate Laboratory Control Sample (LCS/DLCS) was analyzed and reported in lieu of the MS/MSD for Toxaphene in these samples.

Elevated Detection Limits:
The detection limit was elevated for at least one analyte in several field samples. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compounds at the normal limit. The results were flagged to indicate the matrix interference.

Sample Confirmation Notes:
The confirmation comparison criteria of 40% difference for 4,4'-DDE was exceeded in sample HOP-B2. The lower of the two values was reported because no evidence of a matrix interference was observed.

No other anomalies associated with the analysis of these samples were observed.

Approved by____

PCB Aroclors by EPA Method 8082

Second Source Exceptions:
The analysis of PCB Aroclors by EPA 8082 requires the use of dual column confirmation. When the Initial Calibration Verification (ICV) criteria are met for both columns, the lower of the two sample results is generally reported. The criteria were not met for Aroclor 1268 in CAL 12999. The data quality was not affected. No further corrective action was necessary.

No other anomalies associated with the analysis of these samples were observed.

Polynuclear Aromatic Hydrocarbons by EPA Method 8270

Matrix Spike Recovery Exceptions:
The upper control criterion was exceeded for various analytes in the Matrix Spike (MS) of sample HOP-B4. The analytes in question were not detected at levels greater than the MRL in the associated field samples. The error associated with elevated recovery indicated a high bias. The sample data was not significantly affected. No further corrective action was appropriate.

The upper control criterion was exceeded for Dibenz(a,h)anthracene in the Matrix Spike Duplicate (MSD) of sample HOP-B4. The analyte in question was not detected at levels greater than the MRL in the associated field samples. The error associated with elevated recovery indicated a high bias. The sample data was not significantly affected. No further corrective action was appropriate.

Lab Control Sample Exceptions:
The upper control criterion was exceeded by 1% for Benz(a)anthracene and Benzo(b)fluoranthene in the replicate Laboratory Control Samples (LCS/DLCS) KWG1314065-6 and KWG1314065-7. The analytes in question were not detected at levels greater than the MRL in the associated field samples. The error associated with elevated recovery indicated a high bias. The sample data was not significantly affected. No further corrective action was appropriate.

Elevated Detection Limits:
The detection limit was elevated for Pyrene in samples HEI-A1, HEI-A4, HEI-A5, HOP-A1, HOP-A3, HOP-A4, HEI-B1, and HEI-B5. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compound at the normal limit. The results were flagged to indicate the matrix interference.

The detection limit was elevated for Fluorene and Pyrene in samples HOP-B1, HOP-B2, and HOP-B3. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compound(s) at the normal limit. The result(s) was/were flagged to indicate the matrix interference.

The detection limit was elevated for Benzo(a)pyrene in sample HOP-B4. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compound at the normal limit. The result was flagged to indicate the matrix interference.

The detection limit was elevated for Benz(a)anthracene in sample HOP-B5. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compound at the normal limit. The result was flagged to indicate the matrix interference.

Sample Notes and Discussion:
The results reported for Acenaphthene in samples HEI-B3, HOP-B1, HOP-B2, and HOP-B3 may contain a slight bias. The chromatogram indicated the presence of non-target background components. The matrix interference may have resulted in a slight high bias in the affected samples. The results were flagged with “X” to indicate the issue.

No other anomalies associated with the analysis of these samples were observed.

Approved by____

ALS Environmental
1317 South 13th Ave
Kelso, WA 98626
(Tel) 360.577.7222
(Fax) 360.636.1068

Chain of Custody Form

Page 1 of 4

K1313762

ALS Project Manager:		ALS Work Order #:	

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	4H Shell Mound Survey	A	CAM-17 Metals - 6010C, 6020A, 7471B
Work Order		Project Number		B	PAHs by CC/MS SIM - 8270D
Company Name	AMEC	Bill To Company		C	PCBs by GC - 8082A
Send Report To	Michael Henry	Invoice Attn.		D	Organochlorine Pesticides- 8081B
Address	10670 White Rock Rd. Suite 100	Address		E	lipids
				F	freeze dry
City/State/Zip	Rancho Cordova/CA/95670-6032	City/State/Zip		G	de-shell (back and claw) and homogenize composited tissue (crabs)
Phone	916-853-8947	Phone		H	whole body homogenization (sea cucumbers and bat stars)
Fax	916-636-3208	Fax		I	fillet (skin on) and homogenize tissue (fish)
e-Mail Address	michael.henry@amec.com			J	

No.	Sample Description	Date	Time	Matrix	Pres. Key Numbers	# Bags	A	B	C	D	E	F	G	H	I	J	Hold
1	HEI-A1 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
2	HEI-A2 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
3	HEI-A3 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
4	HEI-A4 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
5	HEI-A5 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
6	HOP-A1 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
7	HOP-A2 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
8	HOP-A3 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
9	HOP-A4 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
10	HOP-A5 (sea cucumber)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			

Sampler(s): Please Print & Sign [signature]
Bonnie Luke (Marine Research Specialists)

Shipment Method: Fed Ex overnight

Required Turnaround Time: (Check Box) ☐ 10 Wk Days ☐ 5 Wk Days ☐ 3 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☑ Other

Results Due Date:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Notes:
[signature] Bonnie Luke (Marine Research Specialists)	12/18/13	15:00:00	[signature]	12/19/13	1210	
Relinquished by:	Date:	Time:	Received by (Laboratory):	Date:	Time:	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):			

ALS Cooler ID	Cooler Temp	QC Package: (Check Box Below)
		☑ Level II: Standard QC ☐ Level III: Raw Data
		☐ TRRP LRC ☐ TRRP Level IV
		☐ Level IV: SW846 Methods/CLP like
		☐ Other:

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C

Note: Any changes must be made in writing once samples and COC Form have been submitted to ALS.

ALS Environmental
1317 South 13th Ave
Kelso, WA 98626
(Tel) 360.577.7222
(Fax) 360.636.1068

Chain of Custody Form

ALS Project Manager:		ALS Work Order #:	

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	4H Shell Mound Survey	A	CAM-17 Metals - 6010C, 6020A, 7471B
Work Order		Project Number		B	PAHs by CC/MS SIM - 8270D
Company Name	AMEC	Bill To Company		C	PCBs by GC - 8082A
Send Report To	Michael Henry	Invoice Attn.		D	Organochlorine Pesticides- 8081B
Address	10670 White Rock Rd. Suite 100	Address		E	lipids
				F	freeze dry
City/State/Zip	Rancho Cordova/CA/95670-6032	City/State/Zip		G	de-shell (back and claw) and homogenize composited tissue (crabs)
Phone	916-853-8947	Phone		H	whole body homogenization (sea cucumbers and bat stars)
Fax	916-636-3208	Fax		I	fillet (skin on) and homogenize tissue (fish)
e-Mail Address	michael.henry@amec.com			J	

No.	Sample Description	Date	Time	Matrix	Pres. Key Numbers	# Bags	A	B	C	D	E	F	G	H	I	J	Hold
1	HEI-B1 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
2	HEI-B2 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
3	HEI-B3 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
4	HEI-B4 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
5	HEI-B5 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
6	HOP-B1 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
7	HOP-B2 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
8	HOP-B3 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
9	HOP-B4 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
10	HOP-B5 (bat stars)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			

Sampler(s): Please Print & Sign	Shipment Method:	Required Turnaround Time: (Check Box)	Results Due Date:
Bonnie Luke (Marine Research Specialists)	Fed Ex overnight	☐ 10 Wk Days ☐ 5 Wk Days ☐ 3 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☑ Other ____	

Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Notes:
Bonnie Luke (Marine Research Specialists)	12/18/13	15:00:00				
Relinquished by:	Date:	Time:	Received by (Laboratory):	Date:	Time:	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):			

ALS Cooler ID	Cooler Temp	QC Package: (Check Box Below)	
		☑ Level II: Standard QC	☐ Level III: Raw Data
		☐ TRRP LRC	☐ TRRP Level IV
		☐ Level IV: SW846 Methods/CLP like	
		☐ Other: ____	

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C

Note: Any changes must be made in writing once samples and COC Form have been submitted to ALS.

PC Shaw

Cooler Receipt and Preservation Form

Client / Project: HCS Service Request K13 13762

Received: 12/19/13 Opened: 12/19/13 By: AK Unloaded: 12/19/13 By: AK

1. Samples were received via? Mail (Fed Ex) UPS DHL PDX Courier Hand Delivered
2. Samples were received in: (circle) Cooler (Box) Envelope Other ______ NA
3. Were custody seals on coolers? NA Y (N) If yes, how many and where? ______
   If present, were custody seals intact? Y N If present, were they signed and dated? Y (N)

Raw Cooler Temp	Corrected. Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID (NA)	Tracking Number	NA	Filed
-26	-26	—	—	0.0	316		7974 5115 8826		
-30	-29.9	—	—	-0.1	345		" 5120 3251		

4. Packing material: Inserts Baggies Bubble Wrap Gel Packs Wet Ice Dry Ice Sleeves DRY ICE
5. Were custody papers properly filled out (ink, signed, etc.)? NA (Y) N
6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA (Y) N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* (NA) Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* (NA) Y N
12. Was C12/Res negative? (NA) Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions:

Page ____ of ____

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/13
Sample Matrix:	Tissue	**Date Received:**	12/19/13

Solids, Total

Prep Method:	NONE	Units:	PERCENT
Analysis Method:	Freeze Dry	Basis:	Wet
Test Notes:			

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
HEI-A1	K1313762-001	12/31/13	9.19	
HEI-A2	K1313762-002	12/31/13	6.55	
HEI-A3	K1313762-003	12/31/13	7.31	
HEI-A4	K1313762-004	12/31/13	12.2	
HEI-A5	K1313762-005	12/31/13	6.51	
HOP-A1	K1313762-006	12/31/13	7.22	
HOP-A2	K1313762-007	12/31/13	7.29	
HOP-A3	K1313762-008	12/31/13	6.35	
HOP-A4	K1313762-009	12/31/13	5.94	
HOP-A5	K1313762-010	12/31/13	7.93	
HEI-B1	K1313762-011	12/31/13	42.0	
HEI-B2	K1313762-012	12/31/13	39.0	
HEI-B3	K1313762-013	12/31/13	45.5	
HEI-B4	K1313762-014	12/31/13	43.7	
HEI-B5	K1313762-015	12/31/13	41.8	
HOP-B1	K1313762-016	12/31/13	40.5	
HOP-B2	K1313762-017	12/31/13	42.6	
HOP-B3	K1313762-018	12/31/13	41.5	
HOP-B4	K1313762-019	12/31/13	43.5	
HOP-B5	K1313762-020	12/31/13	41.3	

COLUMBIA ANALYTICAL SERVICES, INC.
Now part of the ALS Group
QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/13
Sample Matrix:	Tissue	**Date Received:**	12/19/13
		Date Extracted:	NA
		Date Analyzed:	12/31/13

Duplicate Summary

Sample Name:	HOP-B2	Units:	PERCENT
Lab Code:	K1313762-017D	Basis:	Wet
Test Notes:			

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total	NA	Freeze Dry	42.6	42.2	42.4	<1	

ALS Group USA, Corp.
dba ALS Environmental

- Cover Page -
INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructure, Inc.
Project Name: 4H Shell Mound Survey
Project No.:

Service Request: K1313762

Sample Name:	Lab Code:
HEI-A1	K1313762-001
HEI-A2	K1313762-002
HEI-A3	K1313762-003
HEI-A4	K1313762-004
HEI-A5	K1313762-005
HOP-A1	K1313762-006
HOP-A2	K1313762-007
HOP-A3	K1313762-008
HOP-A4	K1313762-009
HOP-A5	K1313762-010
HEI-B1	K1313762-011
HEI-B1D	K1313762-011D
HEI-B1S	K1313762-011S
HEI-B2	K1313762-012
HEI-B3	K1313762-013
HEI-B4	K1313762-014
HEI-B5	K1313762-015
HOP-B1	K1313762-016
HOP-B2	K1313762-017
HOP-B3	K1313762-018
HOP-B4	K1313762-019
HOP-B5	K1313762-020
Method Blank	K1313762-MB

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HEI-A1
Lab Code: K1313762-001

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.015	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	3.85		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	23.5		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.019	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.219		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	8.48		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.273		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	2.68		
Lead	6020A	0.0197	0.0005	5.0	01/06/14	01/09/14	0.450		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.016	J	
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	1.330		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	4.58		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	7.5		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.030		N
Thallium	6020A	0.0197	0.0009	5.0	01/06/14	01/09/14	0.0047	J	
Vanadium	6020A	0.197	0.007	5.0	01/06/14	01/09/14	2.850		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	29.0		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HEI-A2
Lab Code: K1313762-002

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.018	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	5.79		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	13.9		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.017	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.266		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	4.44		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.215		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	1.64		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.336		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.012	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.797		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.30		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	7.3		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.052		N
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0041	J	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	2.720		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	30.7		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313762
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HEI-A3** **Lab Code:** **K1313762-003**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.017	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	5.05		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	11.1		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.016	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.215		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	4.04		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.174		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	1.37		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.260		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.012	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.814		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.55		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	8.4		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.023		N
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0026	J	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	1.940		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	35.1		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HEI-A4
Lab Code: K1313762-004

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.045	0.002	5.0	01/06/14	01/09/14	0.013	J	
Arsenic	6020A	0.45	0.02	5.0	01/06/14	01/09/14	2.27		
Barium	6020A	0.045	0.004	5.0	01/06/14	01/09/14	3.100		
Beryllium	6020A	0.018	0.003	5.0	01/06/14	01/09/14	0.004	J	
Cadmium	6020A	0.018	0.002	5.0	01/06/14	01/09/14	0.210		
Chromium	6020A	0.18	0.02	5.0	01/06/14	01/09/14	0.67		*
Cobalt	6020A	0.018	0.003	5.0	01/06/14	01/09/14	0.042		
Copper	6020A	0.09	0.02	5.0	01/06/14	01/09/14	0.82		
Lead	6020A	0.0179	0.0004	5.0	01/06/14	01/09/14	0.162		
Mercury	7470A	0.036	0.007	4.0	01/06/14	01/13/14	0.007	U	
Molybdenum	6020A	0.045	0.007	5.0	01/06/14	01/09/14	0.252		
Nickel	6020A	0.18	0.02	5.0	01/06/14	01/09/14	0.33		*
Selenium	6020A	0.9	0.2	5.0	01/06/14	01/09/14	3.0		
Silver	6020A	0.018	0.005	5.0	01/06/14	01/09/14	0.019		N
Thallium	6020A	0.0179	0.0008	5.0	01/06/14	01/09/14	0.0008	U	
Vanadium	6020A	0.179	0.006	5.0	01/06/14	01/09/14	0.634		
Zinc	6020A	0.45	0.05	5.0	01/06/14	01/09/14	14.7		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HEI-A5 **Lab Code:** K1313762-005

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.015	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	6.06		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	8.800		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.012	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.533		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.53		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.138		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	1.64		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.248		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.012	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.574		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.78		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	9.8		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.079		N
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0021	J	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	1.720		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	33.5		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313762
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HOP-A1** **Lab Code:** **K1313762-006**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.025	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	5.04		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	37.9		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.031		
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.500		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	8.00		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.349		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	30.1		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	1.45		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.024	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.787		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	4.08		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	6.6		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.013	J	N
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0070	J	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	3.730		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	41.9		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HOP-A2** **Lab Code:** **K1313762-007**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.023	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	8.84		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	31.6		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.040		
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.376		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	5.70		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.420		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	24.7		
Lead	6020A	0.0197	0.0005	5.0	01/06/14	01/09/14	2.09		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.020	J	
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.433		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.72		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	7.6		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.007	J	N
Thallium	6020A	0.0197	0.0009	5.0	01/06/14	01/09/14	0.0104	J	
Vanadium	6020A	0.197	0.007	5.0	01/06/14	01/09/14	4.810		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	39.1		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313762
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HOP-A3** **Lab Code:** **K1313762-008**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.025	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	7.91		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	1.890		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.233		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.48		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.030		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	4.27		
Lead	6020A	0.0198	0.0005	5.0	01/06/14	01/09/14	0.260		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.012	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.596		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.32		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	8.8		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.006	U	N
Thallium	6020A	0.0198	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.198	0.007	5.0	01/06/14	01/09/14	0.607		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	24.7		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313762
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HOP-A4** **Lab Code:** **K1313762-009**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.051	0.002	5.0	01/06/14	01/09/14	0.052		
Arsenic	6020A	0.51	0.02	5.0	01/06/14	01/09/14	15.8		
Barium	6020A	0.051	0.005	5.0	01/06/14	01/09/14	2.420		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.007	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	1.350		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.76		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.121		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	24.6		
Lead	6020A	0.0203	0.0005	5.0	01/06/14	01/09/14	1.04		
Mercury	7470A	0.041	0.008	4.0	01/06/14	01/13/14	0.028	J	
Molybdenum	6020A	0.051	0.008	5.0	01/06/14	01/09/14	0.465		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.38		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	14.6		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.026		N
Thallium	6020A	0.0203	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.203	0.007	5.0	01/06/14	01/09/14	0.756		
Zinc	6020A	0.51	0.06	5.0	01/06/14	01/09/14	50.4		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HOP-A5** **Lab Code:** **K1313762-010**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.035	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	9.61		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	76.4		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.077		
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.342		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	8.61		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.821		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	6.18		
Lead	6020A	0.0196	0.0005	5.0	01/06/14	01/09/14	1.32		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.012	J	
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.698		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	4.33		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	9.8		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.024		N
Thallium	6020A	0.0196	0.0009	5.0	01/06/14	01/09/14	0.0242		
Vanadium	6020A	0.196	0.007	5.0	01/06/14	01/09/14	9.700		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	36.4		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur | **Service Request:** K1313762
Project No.: NA | **Date Collected:** 12/10/13
Project Name: 4H Shell Mound Survey | **Date Received:** 12/19/13
Matrix: TISSUE | **Units:** mg/Kg
Basis: DRY

Sample Name: HEI-B1 | **Lab Code:** K1313762-011

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.012	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	2.85		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	6.130		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.004	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	17.7		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.63		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.080		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	11.8		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.230		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.024	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.194		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.22		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.5		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.315		N
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.410		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	13.7		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HEI-B2** **Lab Code:** **K1313762-012**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.035	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	2.95		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	5.480		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.005	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	15.4		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.79		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.087		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	10.8		
Lead	6020A	0.0196	0.0005	5.0	01/06/14	01/09/14	0.238		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.020	J	
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.206		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.88		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.9		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.305		N
Thallium	6020A	0.0196	0.0009	5.0	01/06/14	01/09/14	0.0048	J	
Vanadium	6020A	0.196	0.007	5.0	01/06/14	01/09/14	0.442		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	11.4		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur | **Service Request:** K1313762
Project No.: NA | **Date Collected:** 12/10/13
Project Name: 4H Shell Mound Survey | **Date Received:** 12/19/13
Matrix: TISSUE | **Units:** mg/Kg
Basis: DRY

Sample Name: HEI-B3 **Lab Code:** K1313762-013

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.014	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	2.93		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	6.030		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.005	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	13.7		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	3.33		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.087		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	9.57		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.212		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.012	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.202		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.55		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.4		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.267		N
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.426		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	12.3		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313762
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HEI-B4** **Lab Code:** **K1313762-014**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.014	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	3.81		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	5.770		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	21.0		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	3.60		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.098		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	10.7		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.281		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.040		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.198		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.65		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.4		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.324		N
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.660		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	13.7		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313762
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HEI-B5** **Lab Code:** **K1313762-015**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.012	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	2.68		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	5.780		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	16.6		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.95		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.081		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	10.9		
Lead	6020A	0.0198	0.0005	5.0	01/06/14	01/09/14	0.261		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.016	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.171		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.37		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.5		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.276		N
Thallium	6020A	0.0198	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.198	0.007	5.0	01/06/14	01/09/14	0.383		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	13.0		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HOP-B1** **Lab Code:** **K1313762-016**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.027	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	4.54		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	6.800		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.018	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	25.4		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.18		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.105		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	26.7		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.529		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.036	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.262		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.10		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.9		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.320		N
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0258		
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.732		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	22.1		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HOP-B2** **Lab Code:** **K1313762-017**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.034	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	4.81		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	6.070		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.004	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	20.5		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	3.34		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.095		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	24.2		
Lead	6020A	0.0197	0.0005	5.0	01/06/14	01/09/14	0.856		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.028	J	
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.396		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.76		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.6		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.293		N
Thallium	6020A	0.0197	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.197	0.007	5.0	01/06/14	01/09/14	0.604		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	20.1		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HOP-B3** **Lab Code:** **K1313762-018**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.032	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	4.55		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	6.470		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	19.9		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.58		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.087		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	19.8		
Lead	6020A	0.0198	0.0005	5.0	01/06/14	01/09/14	0.888		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.024	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.313		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.34		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.9		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.300		N
Thallium	6020A	0.0198	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.198	0.007	5.0	01/06/14	01/09/14	0.467		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	20.0		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313762
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HOP-B4** **Lab Code:** **K1313762-019**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.015	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	5.59		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	5.740		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	28.1		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	3.39		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.098		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	18.5		
Lead	6020A	0.0197	0.0005	5.0	01/06/14	01/09/14	0.395		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.035	J	
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.273		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.65		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	2.2		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.361		N
Thallium	6020A	0.0197	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.197	0.007	5.0	01/06/14	01/09/14	0.513		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	18.6		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313762
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HOP-B5 **Lab Code:** K1313762-020

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.028	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	4.35		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	5.740		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	21.9		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.70		*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.082		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	19.4		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	1.26		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.028	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.247		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.33		*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	1.9		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.305		N
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.429		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	19.7		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur **Service Request:** K1313762
Project No.: NA **Date Collected:**
Project Name: 4H Shell Mound Survey **Date Received:**
Matrix: TISSUE **Units:** mg/Kg
Basis: DRY

Sample Name: **Method Blank** **Lab Code:** **K1313762-MB**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.002	U	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	0.02	U	
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	0.005	U	
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.002	U	
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.02	U	*
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.004	J	
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	0.02	U	
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.0006	J	
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.008	U	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.008	U	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.02	U	*
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/09/14	0.2	U	
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.006	U	N
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0012	J	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.007	U	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	0.06	U	

Comments:

Metals
- 5A -
SPIKE SAMPLE RECOVERY

Client: AMEC Environment & Infrastructur **Service Request:** K1313762

Project No.: NA **Units:** MG/KG

Project Name: 4H Shell Mound Survey **Basis:** DRY

Matrix: TISSUE

Sample Name: HEI-B1S **Lab Code:** K1313762-011S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Antimony	75 - 125	47.340		0.012	J	49.834	95.0		6020A
Arsenic	75 - 125	22.94		2.85		16.64	120.7		6020A
Barium	75 - 125	221.304		6.126		199.336	107.9		6020A
Beryllium	75 - 125	4.350		0.004	J	4.983	87.2		6020A
Cadmium	75 - 125	23.260		17.700		4.983	111.6		6020A
Chromium	75 - 125	25.95		2.63		19.93	117.0		6020A
Cobalt	75 - 125	53.937		0.080		49.834	108.1		6020A
Copper	75 - 125	35.23		11.81		24.92	94.0		6020A
Lead	75 - 125	45.0968		0.2295		49.8339	90.0		6020A
Mercury	80 - 120	2.03		0.024	J	1.99	100.8		7470A
Molybdenum	75 - 125	18.668		0.194		16.645	111.0		6020A
Nickel	75 - 125	51.72		1.22		49.83	101.3		6020A
Selenium	75 - 125	20.5		1.5		16.6	114.5		6020A
Silver	75 - 125	3.096		0.315		4.983	55.8	N	6020A
Thallium	75 - 125	15.6426		0.0009	U	16.6445	94.0		6020A
Vanadium	75 - 125	61.066		0.410		49.834	121.7		6020A
Zinc	75 - 125	58.79		13.68		49.83	90.5		6020A

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

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DUPLICATES

Client: AMEC Environment & Infrastructur **Service Request:** K1313762

Project No.: NA **Units:** MG/KG

Project Name: 4H Shell Mound Survey **Basis:** DRY

Matrix: TISSUE

Sample Name: HEI-B1D **Lab Code:** K1313762-011D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Antimony		0.012	J	0.012	J	0.0		6020A
Arsenic	20	2.85		2.86		0.4		6020A
Barium	20	6.126		6.595		7.4		6020A
Beryllium		0.004	J	0.003	U	200.0		6020A
Cadmium	20	17.700		16.778		5.3		6020A
Chromium	20	2.63		3.42		26.1	*	6020A
Cobalt		0.080		0.086		7.2		6020A
Copper	20	11.81		11.09		6.3		6020A
Lead	20	0.2295		0.2383		3.8		6020A
Mercury		0.024	J	0.016	J	40.0		7470A
Molybdenum		0.194		0.194		0.0		6020A
Nickel	20	1.22		1.55		23.8	*	6020A
Selenium		1.5		1.6		6.5		6020A
Silver	20	0.315		0.323		2.5		6020A
Thallium		0.0009	U	0.0009	U			6020A
Vanadium		0.410		0.403		1.7		6020A
Zinc	20	13.68		14.66		6.9		6020A

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals
-7-
LABORATORY CONTROL SAMPLE

Client: AMEC Environment & Infrastructur **Service Request:** K1313762

Project No.: NA

Project Name: 4H Shell Mound Survey

Aqueous LCS Source: CAS MIXED **Solid LCS Source:**

Analyte	Aqueous (ug/L) True	Aqueous (ug/L) Found	Aqueous (ug/L) %R	Solid (mg/kg) True	Solid (mg/kg) Found	C	Limits		%R
Antimony	500.0	496.3	99.3						
Arsenic	167.0	186.2	111.5						
Barium	2000.0	2033.8	101.7						
Beryllium	50.0	49.6	99.2						
Cadmium	50.0	51.0	102.0						
Chromium	200.0	201.2	100.6						
Cobalt	500.0	505.0	101.0						
Copper	250.0	253.8	101.5						
Lead	500.0	522.5	104.5						
Mercury	20	20.4	102.0						
Molybdenum	167.0	174.1	104.3						
Nickel	500.0	511.1	102.2						
Selenium	167.0	193.5	115.9						
Silver	50.0	48.0	96.0						
Thallium	167.0	168.3	100.8						
Vanadium	500.0	507.5	101.5						
Zinc	500.0	518.1	103.6						

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	4H Shell Mound Survey	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	01/06/14
		Date Analyzed:	01/09/14

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1313762-SRM1	Basis:	Dry
Test Notes:			

Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	6020A	6.80	7.85	115	4.93 - 8.93	
Cadmium	PSEP Tissue	6020A	0.306	0.328	107	0.233 - 0.385	
Chromium	PSEP Tissue	6020A	1.87	1.65	88	1.37 - 2.44	
Copper	PSEP Tissue	6020A	15.9	15.6	98	12.0 - 20.2	
Lead	PSEP Tissue	6020A	0.416	0.341	82	0.290 - 0.563	
Nickel	PSEP Tissue	6020A	1.36	1.29	95	0.912 - 1.90	
Selenium	PSEP Tissue	6020A	3.56	4.14	116	2.58-4.68	
Zinc	PSEP Tissue	6020A	52.2	55.1	106	39.2 - 66.5	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	4H Shell Mound Survey	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	01/06/14
		Date Analyzed:	01/09,13/14

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1313762-SRM2	Basis:	Dry
Test Notes:			

Source: N.R.C.C. Tort-2

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	6020A	21.6	23.6	109	15.8-28.1	
Cadmium	PSEP Tissue	6020A	26.7	28.7	107	20.9-32.8	
Chromium	PSEP Tissue	6020A	0.77	0.68	88	0.5-1.1	
Cobalt	PSEP Tissue	6020A	0.51	0.51	100	0.34-0.72	
Copper	PSEP Tissue	6020A	106	101	95	77-139	
Lead	PSEP Tissue	6020A	0.35	0.43	123	0.18-0.58	
Mercury	PSEP Tissue	7470A	0.27	0.28	104	0.17-0.40	
Molybdenum	PSEP Tissue	6020A	0.95	1.07	113	0.68-1.26	
Nickel	PSEP Tissue	6020A	2.5	2.32	93	1.85-3.23	
Selenium	PSEP Tissue	6020A	5.63	6.71	119	3.97-7.56	
Vanadium	PSEP Tissue	6020A	1.64	1.80	110	1.46-2.2	
Zinc	PSEP Tissue	6020A	180	196	109	139-223	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Lipids, Total

Prep Method:	EPA 3541	Units:	PERCENT
Analysis Method:	NOAA	Basis:	Wet Weight
Test Notes:			

Sample Name	Lab Code	MRL	Date Extracted	Date Analyzed	Result	Result Notes
HEI-A1	K1313762-001	0.05	12/27/2013	12/30/2013	0.09	
HEI-A2	K1313762-002	0.05	12/27/2013	12/30/2013	0.08	
HEI-A3	K1313762-003	0.04	12/27/2013	12/30/2013	0.14	
HEI-A4	K1313762-004	0.05	12/27/2013	12/30/2013	0.05	U
HEI-A5	K1313762-005	0.05	12/27/2013	12/30/2013	0.08	
HOP-A1	K1313762-006	0.04	12/27/2013	12/30/2013	0.20	
HOP-A2	K1313762-007	0.05	12/27/2013	12/30/2013	0.07	
HOP-A3	K1313762-008	0.05	12/27/2013	12/30/2013	3.8	
HOP-A4	K1313762-009	0.10	12/27/2013	12/30/2013	2.7	
HOP-A5	K1313762-010	0.04	12/27/2013	12/30/2013	0.04	
HEI-B1	K1313762-011	0.05	12/27/2013	12/30/2013	0.31	
HEI-B2	K1313762-012	0.05	12/27/2013	12/30/2013	0.26	
HEI-B3	K1313762-013	0.05	12/27/2013	12/30/2013	0.31	
HEI-B4	K1313762-014	0.05	12/27/2013	12/30/2013	0.31	
HEI-B5	K1313762-015	0.05	12/27/2013	12/30/2013	0.31	
HOP-B1	K1313762-016	0.04	12/27/2013	12/30/2013	0.36	
HOP-B2	K1313762-017	0.04	12/27/2013	12/30/2013	0.38	
HOP-B3	K1313762-018	0.05	12/27/2013	12/30/2013	0.35	
HOP-B4	K1313762-019	0.05	12/27/2013	12/30/2013	0.32	
HOP-B5	K1313762-020	0.04	12/27/2013	12/30/2013	0.39	
Method Blank	K1313762-MB	0.04	12/27/2013	12/30/2013	0.04	U

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013
		Date Extracted:	12/27/2013
		Date Analyzed:	12/30/2013

Triplicate Summary
Lipids, Total

Sample Name:	HOP-B4	Units:	PERCENT
Lab Code:	K1313762-019 TRP	Basis:	Wet Weight
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Triplicate Sample Result	Average	Percent Relative Standard Deviation	Result Notes
Lipids, Total	EPA 3541	NOAA	0.05	0.32	0.43	0.42	0.39	16	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	4H Shell Mound Survey	**Date Collected:**	NA
Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	12/27/2013
		Date Analyzed:	12/30/2013

Laboratory Control Sample
Lipids, Total

Sample Name: K1313762-LCS

Units: % (percent)
Basis: Wet Weight

Test Notes:

Analyte	Prep Method	Analysis Method	Spike Level Percent	Result	CAS Advisory Limits	Result Notes
Lipids, Total	EPA 3541	NOAA	100	91	70-130	

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	42 Shell Mound Survey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W9Wg13

Organochlorine Pesticides

Sample Name:	2 EI0A1	**Units:**	u/ WK/
Lab Code:	K131376-0gg1	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8g81B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha0B2 C	ND	U	1.g	g.16	1	1-W1W3	g1Wg8W4	KH G14gg-38	
beta0B2 C	ND	U	1.g	g.41	1	1-W1W3	g1Wg8W4	KH G14gg-38	
/ amma0B2 C (Lindane)	ND	U	1.g	g.-1	1	1-W1W3	g1Wg8W4	KH G14gg-38	
delta0B2 C	ND	U	1.g	g.-g	1	1-W1W3	g1Wg8W4	KH G14gg-38	
2 eptachlor	ND	U	1.g	g.-7	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Aldrin	ND	U	1.g	g.74	1	1-W1W3	g1Wg8W4	KH G14gg-38	
2 eptachlor Epoxide	ND	U	1.g	g.18	1	1-W1W3	g1Wg8W4	KH G14gg-38	
/ amma0Chlordane†	ND	U	1.g	g.-6	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Endosulfan I	ND	U	1.g	g.--	1	1-W1W3	g1Wg8W4	KH G14gg-38	
alpha0Chlordane	ND	U	1.g	g.-5	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Dieldrin	ND	U	1.g	g.-g	1	1-W1W3	g1Wg8W4	KH G14gg-38	
4,4'0DDE	**1.6**		1.g	g.45	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Endrin	ND	U	1.g	g.-8	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Endosulfan II	ND	U	1.g	g.-4	1	1-W1W3	g1Wg8W4	KH G14gg-38	
4,4'0DDD	ND	U	1.g	g.55	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Endrin Aldehyde	ND	U	1.g	g.6-	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Endosulfan Sulfate	ND	U	1.g	g.53	1	1-W1W3	g1Wg8W4	KH G14gg-38	
4,4'0DDT	ND	U	1.g	g.49	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Endrin Ketone	ND	U	1.g	g.39	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Methoxychlor	ND	U	1.g	g.48	1	1-W1W3	g1Wg8W4	KH G14gg-38	
Toxaphene	ND	U	5g	13	1	1-W1W3	g1Wg8W4	KH G14gg-38	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro0m0xylene	77	-9011 7	g1Wg8W4	Acceptable
Decachlorobiphenyl	86	--01-1	g1Wg8W4	Acceptable

† Analyte Comments

/ amma0Chlordane — For this analyte (CAS Re/ istry No. 51g30740-), USEPA has corrected the name to be beta0Chlordane, also known as trans0Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	42 Shell Mound Survey	**Date Collected:**	1-W1gW-g13
Sample Matrix:	Animal tissue	**Date Received:**	1-W19W-g13

Organochlorine Pesticides

Sample Name:	2 EI0A-	**Units:**	u/ WK/
Lab Code:	K131376-0gg-	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8g81B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha0B2 C	ND	U	g.91	g.16	1	1-W31W13	g1Wg8W14	KH G14gg-38	
beta0B2 C	ND	U	g.91	g.41	1	1-W31W13	g1Wg8W14	KH G14gg-38	
/ amma0B2 C (Lindane)	ND	U	g.91	g.-1	1	1-W31W13	g1Wg8W14	KH G14gg-38	
delta0B2 C	ND	U	g.91	g.-g	1	1-W31W13	g1Wg8W14	KH G14gg-38	
2 eptachlor	ND	U	g.91	g.-7	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Aldrin	ND	U	g.91	g.74	1	1-W31W13	g1Wg8W14	KH G14gg-38	
2 eptachlor Epoxide	ND	U	g.91	g.18	1	1-W31W13	g1Wg8W14	KH G14gg-38	
/ amma0Chlordane†	ND	U	g.91	g.-6	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Endosulfan I	ND	U	g.91	g.--	1	1-W31W13	g1Wg8W14	KH G14gg-38	
alpha0Chlordane	ND	U	g.91	g.-5	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Dieldrin	ND	U	g.91	g.-g	1	1-W31W13	g1Wg8W14	KH G14gg-38	
4,4'0DDE	**1.4**		g.91	g.45	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Endrin	ND	U	g.91	g.-8	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Endosulfan II	ND	U	g.91	g.-4	1	1-W31W13	g1Wg8W14	KH G14gg-38	
4,4'0DDD	ND	U	g.91	g.55	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Endrin Aldehyde	ND	U	g.91	g.6-	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Endosulfan Sulfate	ND	U	g.91	g.53	1	1-W31W13	g1Wg8W14	KH G14gg-38	
4,4'0DDT	ND	U	g.91	g.49	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Endrin Ketone	ND	U	g.91	g.39	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Methoxychlor	ND	U	g.91	g.48	1	1-W31W13	g1Wg8W14	KH G14gg-38	
Toxaphene	ND	U	46	13	1	1-W31W13	g1Wg8W14	KH G14gg-38	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro0m0xylene	64	-9011 7	g1Wg8W14	Acceptable
Decachlorobiphenyl	7g	--01-1	g1Wg8W14	Acceptable

† Analyte Comments

/ amma0Chlordane	For this analyte (CAS Re/ istry No. 51g30740-), USEPA has corrected the name to be beta0Chlordane, also known as trans0Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	42 Shell Mound Survey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W9Wg13

Organochlorine Pesticides

Sample Name:	2 EI0A3	**Units:**	u/ WK/
Lab Code:	K131376-0gg3	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8g81B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha0B2 C	ND	U	g.98	g.16	1	1-W31W3	g1Wg8W4	KH G14gg-38	
beta0B2 C	ND	U	g.98	g.41	1	1-W31W3	g1Wg8W4	KH G14gg-38	
/ amma0B2 C (Lindane)	ND	U	g.98	g.-1	1	1-W31W3	g1Wg8W4	KH G14gg-38	
delta0B2 C	ND	U	g.98	g.-g	1	1-W31W3	g1Wg8W4	KH G14gg-38	
2 eptachlor	ND	U	g.98	g.-7	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Aldrin	ND	U	g.98	g.74	1	1-W31W3	g1Wg8W4	KH G14gg-38	
2 eptachlor Epoxide	ND	U	g.98	g.18	1	1-W31W3	g1Wg8W4	KH G14gg-38	
/ amma0Chlordane†	ND	U	g.98	g.-6	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Endosulfan I	ND	U	g.98	g.--	1	1-W31W3	g1Wg8W4	KH G14gg-38	
alpha0Chlordane	ND	U	g.98	g.-5	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Dieldrin	ND	U	g.98	g.-g	1	1-W31W3	g1Wg8W4	KH G14gg-38	
4,4'0DDE	**2.4**		g.98	g.45	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Endrin	ND	U	g.98	g.-8	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Endosulfan II	ND	U	g.98	g.-4	1	1-W31W3	g1Wg8W4	KH G14gg-38	
4,4'0DDD	ND	U	g.98	g.55	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Endrin Aldehyde	ND	U	g.98	g.6-	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Endosulfan Sulfate	ND	U	g.98	g.53	1	1-W31W3	g1Wg8W4	KH G14gg-38	
4,4'0DDT	ND	U	g.98	g.49	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Endrin Ketone	ND	U	g.98	g.39	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Methoxychlor	ND	U	g.98	g.48	1	1-W31W3	g1Wg8W4	KH G14gg-38	
Toxaphene	ND	U	49	13	1	1-W31W3	g1Wg8W4	KH G14gg-38	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro0m0xylene	69	-9011 7	g1Wg8W4	Acceptable
Decachlorobiphenyl	74	--01-1	g1Wg8W4	Acceptable

† Analyte Comments

/ amma0Chlordane	For this analyte (CAS Re/ istry No. 51g30740-), USEPA has corrected the name to be beta0Chlordane, also known as trans0Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	g2 Shell Mound Survey	**Date Collected:**	1- W4W413
Sample Matrix:	Animal tissue	**Date Received:**	1- W9W413

Organochlorine Pesticides

Sample Name:	2 EI0Ag	**Units:**	u/ WK/
Lab Code:	K131376- 044g	**Basis:**	H et
Extraction Method:	EPA 35g1	**Level:**	Low
Analysis Method:	8481B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha0B2 C	ND	U	4.99	4.16	1	1- W1W3	41W8Wg	KH G1g44- 38	
beta0B2 C	ND	U	4.99	4.g1	1	1- W1W3	41W8Wg	KH G1g44- 38	
/ amma0B2 C (Lindane)	ND	U	4.99	4.- 1	1	1- W1W3	41W8Wg	KH G1g44- 38	
delta0B2 C	ND	U	4.99	4.- 4	1	1- W1W3	41W8Wg	KH G1g44- 38	
2 eptachlor	ND	U	4.99	4.- 7	1	1- W1W3	41W8Wg	KH G1g44- 38	
Aldrin	ND	U	4.99	4.7g	1	1- W1W3	41W8Wg	KH G1g44- 38	
2 eptachlor Epoxide	ND	U	4.99	4.18	1	1- W1W3	41W8Wg	KH G1g44- 38	
/ amma0Chlordane†	ND	U	4.99	4.- 6	1	1- W1W3	41W8Wg	KH G1g44- 38	
Endosulfan I	ND	U	4.99	4.- -	1	1- W1W3	41W8Wg	KH G1g44- 38	
alpha0Chlordane	ND	U	4.99	4.- 5	1	1- W1W3	41W8Wg	KH G1g44- 38	
Dieldrin	ND	U	4.99	4.- 4	1	1- W1W3	41W8Wg	KH G1g44- 38	
g,g'0DDE	**0.68**	J	4.99	4.g5	1	1- W1W3	41W8Wg	KH G1g44- 38	
Endrin	ND	U	4.99	4.- 8	1	1- W1W3	41W8Wg	KH G1g44- 38	
Endosulfan II	ND	U	4.99	4.- g	1	1- W1W3	41W8Wg	KH G1g44- 38	
g,g'0DDD	ND	U	4.99	4.55	1	1- W1W3	41W8Wg	KH G1g44- 38	
Endrin Aldehyde	ND	U	4.99	4.6-	1	1- W1W3	41W8Wg	KH G1g44- 38	
Endosulfan Sulfate	ND	U	4.99	4.53	1	1- W1W3	41W8Wg	KH G1g44- 38	
g,g'0DDT	ND	U	4.99	4.g9	1	1- W1W3	41W8Wg	KH G1g44- 38	
Endrin Ketone	ND	U	4.99	4.39	1	1- W1W3	41W8Wg	KH G1g44- 38	
Methoxychlor	ND	U	4.99	4.g8	1	1- W1W3	41W8Wg	KH G1g44- 38	
Toxaphene	ND	U	54	13	1	1- W1W3	41W8Wg	KH G1g44- 38	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro0m0xylene	71	- 9011 7	41W8Wg	Acceptable
Decachlorobiphenyl	79	- - 01- 1	41W8Wg	Acceptable

† **Analyte Comments**

/ amma0Chlordane	For this analyte (CAS Re/ istry No. 514307g0-), USEPA has corrected the name to be beta0Chlordane, also known as trans0Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: AMEC Environment & Infrastructure, Inc.
Project: S2 hdell MounL hurvey
Sample Matrix: Animal tissue

Service Request: K131376-
Date Collected: 1- W4W413
Date Received: 1- W9W413

Organochlorine Pesticides

Sample Name: 2 EI0Ag
Lab Code: K131376- 044g

Extraction Method: E5A 3gS1
Analysis Method: 8481B

Units: u/ WK/
Basis: H et
Level: woP

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda0B2 C	ND	U	4.66	4.16	1	1- W31W13	41W48W1S	KH G1S44- 38	
beta0B2 C	ND	U	4.66	4.S1	1	1- W31W13	41W48W1S	KH G1S44- 38	
/ amma0B2 C (winLane)	ND	U	4.66	4.- 1	1	1- W31W13	41W48W1S	KH G1S44- 38	
Lelta0B2 C	ND	U	4.66	4.- 4	1	1- W31W13	41W48W1S	KH G1S44- 38	
2 eptacdlor	ND	U	4.66	4.- 7	1	1- W31W13	41W48W1S	KH G1S44- 38	
AlLrin	ND	U	4.7S	4.7S	1	1- W31W13	41W48W1S	KH G1S44- 38	
2 eptacdlor EpoxiLe	ND	U	4.66	4.18	1	1- W31W13	41W48W1S	KH G1S44- 38	
/ amma0CdlorLane†	ND	U	4.66	4.- 6	1	1- W31W13	41W48W1S	KH G1S44- 38	
EnLosulfan I	ND	U	4.66	4.- -	1	1- W31W13	41W48W1S	KH G1S44- 38	
alpda0CdlorLane	ND	U	4.66	4.- g	1	1- W31W13	41W48W1S	KH G1S44- 38	
DielLrin	ND	U	4.66	4.- 4	1	1- W31W13	41W48W1S	KH G1S44- 38	
S,SJ0DDE	**1.1**		4.66	4.Sg	1	1- W31W13	41W48W1S	KH G1S44- 38	
EnLrin	ND	U	4.66	4.- 8	1	1- W31W13	41W48W1S	KH G1S44- 38	
EnLosulfan II	ND	U	4.66	4.- S	1	1- W31W13	41W48W1S	KH G1S44- 38	
S,SJ0DDD	ND	U	4.66	4.gg	1	1- W31W13	41W48W1S	KH G1S44- 38	
EnLrin AlLedyLe	ND	U	4.66	4.6-	1	1- W31W13	41W48W1S	KH G1S44- 38	
EnLosulfan hulfate	ND	U	4.66	4.g3	1	1- W31W13	41W48W1S	KH G1S44- 38	
S,SJ0DD'	ND	U	4.66	4.S9	1	1- W31W13	41W48W1S	KH G1S44- 38	
EnLrin Ketone	ND	U	4.66	4.39	1	1- W31W13	41W48W1S	KH G1S44- 38	
Metdoxycdlor	**0.52**	T	4.66	4.S8	1	1- W31W13	41W48W1S	KH G1S44- 38	
' oxapdene	ND	U	33	13	1	1- W31W13	41W48W1S	KH G1S44- 38	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
' etracdloro0m0xylene	6g	- 90117	41W48W1S	Acceptable
Decacdlorobipdenyl	73	- - 01- 1	41W48W1S	Acceptable

† Analyte Comments

/ amma0CdlorLane	For tdis analyte (CAh Re/ istry No. g14307S0-), UhE5A das correcteL tde name to be beta0CdlorLane, also knoP n as trans0CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	9H 4Sell Mounh 4urvey	**Date Collected:**	1-/18/-813
Sample Matrix:	Animal tissue	**Date Received:**	1-/12/-813

Organochlorine Pesticides

Sample Name:	HOP0A1	**Units:**	ug/Kg
Lab Code:	K131376-0886	**Basis:**	Wet
Extraction Method:	EPA 3w91	**Level:**	doL
Analysis Method:	5851B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpSa0BHC	ND	U	8.23	8.16	1	1-/31/13	81/85/19	KWG1988-35	
beta0BHC	ND	U	8.23	8.91	1	1-/31/13	81/85/19	KWG1988-35	
gamma0BHC (dinhane)	ND	U	8.23	8.-1	1	1-/31/13	81/85/19	KWG1988-35	
helta0BHC	ND	U	8.23	8.-8	1	1-/31/13	81/85/19	KWG1988-35	
HeptacSlor	ND	U	8.23	8.-7	1	1-/31/13	81/85/19	KWG1988-35	
Alhrin	ND	U	8.23	8.79	1	1-/31/13	81/85/19	KWG1988-35	
HeptacSlor Epoxihe	ND	U	8.23	8.15	1	1-/31/13	81/85/19	KWG1988-35	
gamma0CSlorhane†	ND	U	8.23	8.-6	1	1-/31/13	81/85/19	KWG1988-35	
Enhosulfan I	ND	U	8.23	8.--	1	1-/31/13	81/85/19	KWG1988-35	
alpSa0CSlorhane	ND	U	8.23	8.-w	1	1-/31/13	81/85/19	KWG1988-35	
Dielhrin	ND	U	8.23	8.-8	1	1-/31/13	81/85/19	KWG1988-35	
9,9'0DDE	**2.5**		8.23	8.9w	1	1-/31/13	81/85/19	KWG1988-35	
Enhrin	ND	U	8.23	8.-5	1	1-/31/13	81/85/19	KWG1988-35	
Enhosulfan II	ND	U	8.23	8.-9	1	1-/31/13	81/85/19	KWG1988-35	
9,9'0DDD	ND	U	8.23	8.ww	1	1-/31/13	81/85/19	KWG1988-35	
Enhrin AlheSyhe	ND	U	8.23	8.6-	1	1-/31/13	81/85/19	KWG1988-35	
Enhosulfan 4ulfate	ND	U	8.23	8.w3	1	1-/31/13	81/85/19	KWG1988-35	
9,9'0DDT	ND	U	8.23	8.92	1	1-/31/13	81/85/19	KWG1988-35	
Enhrin Ketone	ND	U	8.23	8.32	1	1-/31/13	81/85/19	KWG1988-35	
MetSoxycSlor	ND	U	8.23	8.95	1	1-/31/13	81/85/19	KWG1988-35	
ToxapSene	ND	U	97	13	1	1-/31/13	81/85/19	KWG1988-35	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracSloro0m0xylene	73	-20117	81/85/19	Acceptable
DecacSlorobipSenyl	75	--01-1	81/85/19	Acceptable

† **Analyte Comments**

gamma0CSlorhane	For tSis analyte (CA4 Registry No. wl830790-), U4EPA Sas correcteh tSe name to be beta0CSlorhane, also knoLn as trans0CSlorhane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	9H 4Sell Mounh 4urvey	**Date Collected:**	1-/18/-813
Sample Matrix:	Animal tissue	**Date Received:**	1-/12/-813

Organochlorine Pesticides

Sample Name:	HOP0A-	**Units:**	ug/Kg
Lab Code:	K131376-0887	**Basis:**	Wet
Extraction Method:	EPA 3w91	**Level:**	doL
Analysis Method:	5851B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpSa0BHC	ND	U	8.22	8.16	1	1-/31/13	81/16/19	KWG1988-35	
beta0BHC	ND	U	8.22	8.91	1	1-/31/13	81/16/19	KWG1988-35	
gamma0BHC (dinhane)	ND	U	8.22	8.-1	1	1-/31/13	81/16/19	KWG1988-35	
helta0BHC	ND	U	8.22	8.-8	1	1-/31/13	81/16/19	KWG1988-35	
HeptacSlor	ND	U	8.22	8.-7	1	1-/31/13	81/16/19	KWG1988-35	
Alhrin	ND	U	8.22	8.79	1	1-/31/13	81/16/19	KWG1988-35	
HeptacSlor Epoxihe	ND	U	8.22	8.15	1	1-/31/13	81/16/19	KWG1988-35	
gamma0CSlorhane†	ND	U	8.22	8.-6	1	1-/31/13	81/16/19	KWG1988-35	
Enhosulfan I	ND	U	8.22	8.--	1	1-/31/13	81/16/19	KWG1988-35	
alpSa0CSlorhane	ND	U	8.22	8.-w	1	1-/31/13	81/16/19	KWG1988-35	
Dielhrin	ND	U	8.22	8.-8	1	1-/31/13	81/16/19	KWG1988-35	
9,9'0DDE	**1.1**		8.22	8.9w	1	1-/31/13	81/16/19	KWG1988-35	
Enhrin	ND	U	8.22	8.-5	1	1-/31/13	81/16/19	KWG1988-35	
Enhosulfan II	ND	U	8.22	8.-9	1	1-/31/13	81/16/19	KWG1988-35	
9,9'0DDD	ND	U	8.22	8.ww	1	1-/31/13	81/16/19	KWG1988-35	
Enhrin AlheSyhe	ND	U	8.22	8.6-	1	1-/31/13	81/16/19	KWG1988-35	
Enhosulfan 4ulfate	ND	U	8.22	8.w3	1	1-/31/13	81/16/19	KWG1988-35	
9,9'0DDT	ND	U	8.22	8.92	1	1-/31/13	81/16/19	KWG1988-35	
Enhrin Ketone	ND	U	8.22	8.32	1	1-/31/13	81/16/19	KWG1988-35	
MetSoxycSlor	ND	U	8.22	8.95	1	1-/31/13	81/16/19	KWG1988-35	
ToxapSene	ND	U	w8	13	1	1-/31/13	81/16/19	KWG1988-35	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracSloro0m0xylene	6w	-20117	81/16/19	Acceptable
DecacSlorobipSenyl	73	--01-1	81/16/19	Acceptable

† Analyte Comments

gamma0CSlorhane	For tSis analyte (CA4 Registry No. wl830790-), U4EPA Sas correcteh tSe name to be beta0CSlorhane, also knoLn as trans0CSlorhane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	4O Shell Mound Survey	**Date Collected:**	1- W8W813
Sample Matrix:	Animal tissue	**Date Received:**	1- W9W813

Organochlorine Pesticides

Sample Name:	OP 20A3	**Units:**	u/ WK/
Lab Code:	K131376- 088g	**Basis:**	H et
Extraction Method:	E2A 3541	**Level:**	Low
Analysis Method:	g8g1B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha0BOC	ND	U	8.6g	8.16	1	1- W31W3	81W8gW4	KH G1488- 3g	
beta0BOC	ND	U	8.6g	8.41	1	1- W31W3	81W8gW4	KH G1488- 3g	
/ amma0BOC (Lindane)	ND	U	8.6g	8.- 1	1	1- W31W3	81W8gW4	KH G1488- 3g	
delta0BOC	ND	U	8.6g	8.- 8	1	1- W31W3	81W8gW4	KH G1488- 3g	
Oeptachlor	ND	U	8.6g	8.- 7	1	1- W31W3	81W8gW4	KH G1488- 3g	
Aldrin	ND	U	8.74	8.74	1	1- W31W3	81W8gW4	KH G1488- 3g	
Oeptachlor Epoxide	ND	U	8.6g	8.1g	1	1- W31W3	81W8gW4	KH G1488- 3g	
/ amma0Chlordane†	ND	U	8.6g	8.- 6	1	1- W31W3	81W8gW4	KH G1488- 3g	
Endosulfan I	ND	U	8.6g	8.- -	1	1- W31W3	81W8gW4	KH G1488- 3g	
alpha0Chlordane	ND	U	8.6g	8.- 5	1	1- W31W3	81W8gW4	KH G1488- 3g	
Dieldrin	ND	U	8.6g	8.- 8	1	1- W31W3	81W8gW4	KH G1488- 3g	
4,4'0DDE	**0.94**		8.6g	8.45	1	1- W31W3	81W8gW4	KH G1488- 3g	
Endrin	ND	U	8.6g	8.- g	1	1- W31W3	81W8gW4	KH G1488- 3g	
Endosulfan II	ND	U	8.6g	8.- 4	1	1- W31W3	81W8gW4	KH G1488- 3g	
4,4'0DDD	ND	U	8.6g	8.55	1	1- W31W3	81W8gW4	KH G1488- 3g	
Endrin Aldehyde	ND	U	8.6g	8.6-	1	1- W31W3	81W8gW4	KH G1488- 3g	
Endosulfan Sulfate	ND	U	8.6g	8.53	1	1- W31W3	81W8gW4	KH G1488- 3g	
4,4'0DDT	ND	U	8.6g	8.49	1	1- W31W3	81W8gW4	KH G1488- 3g	
Endrin Ketone	ND	U	8.6g	8.39	1	1- W31W3	81W8gW4	KH G1488- 3g	
Methoxychlor	ND	U	8.6g	8.4g	1	1- W31W3	81W8gW4	KH G1488- 3g	
Toxaphene	ND	U	34	13	1	1- W31W3	81W8gW4	KH G1488- 3g	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro0m0xylene	65	- 9011 7	81W8gW4	Acceptable
Decachlorobiphenyl	73	- - 01- 1	81W8gW4	Acceptable

† Analyte Comments

/ amma0Chlordane — For this analyte (CAS Re/ istry No. 51830740-), USE2A has corrected the name to be beta0Chlordane, also known as trans0Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	9O 4Sell Mounh 4urvey	**Date Collected:**	1-W8W813
Sample Matrix:	Animal tissue	**Date Received:**	1-WgW813

Organochlorine Pesticides

Sample Name:	OP 20A9	**Units:**	u/ WK/
Lab Code:	K131376-088g	**Basis:**	H et
Extraction Method:	E2A 3w91	**Level:**	doL
Analysis Method:	5851B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpSa0BOC	ND	U	1.9	8.--	1	1-W31W3	81W8gW9	KH G1988-35	
beta0BOC	ND	U	1.9	8.w7	1	1-W31W3	81W8gW9	KH G1988-35	
/ amma0BOC (dinhane)	ND	U	1.9	8.-g	1	1-W31W3	81W8gW9	KH G1988-35	
helta0BOC	ND	U	1.9	8.-5	1	1-W31W3	81W8gW9	KH G1988-35	
OeptacSlor	ND	U	1.9	8.35	1	1-W31W3	81W8gW9	KH G1988-35	
Alhrin	ND	U	1.9	1.1	1	1-W31W3	81W8gW9	KH G1988-35	
OeptacSlor Epoxihe	ND	U	1.9	8.-w	1	1-W31W3	81W8gW9	KH G1988-35	
/ amma0CSlorhane†	ND	U	1.9	8.36	1	1-W31W3	81W8gW9	KH G1988-35	
Enhosulfan I	ND	U	1.9	8.31	1	1-W31W3	81W8gW9	KH G1988-35	
alpSa0CSlorhane	ND	U	1.9	8.3w	1	1-W31W3	81W8gW9	KH G1988-35	
Dielhrin	ND	U	1.9	8.-5	1	1-W31W3	81W8gW9	KH G1988-35	
9,9'0DDE	**1.6**		1.9	8.6-	1	1-W31W3	81W8gW9	KH G1988-35	
Enhrin	ND	U	1.9	8.3g	1	1-W31W3	81W8gW9	KH G1988-35	
Enhosulfan II	ND	U	1.9	8.33	1	1-W31W3	81W8gW9	KH G1988-35	
9,9'0DDD	ND	U	1.9	8.76	1	1-W31W3	81W8gW9	KH G1988-35	
Enhrin AlheSyhe	ND	U	1.9	8.56	1	1-W31W3	81W8gW9	KH G1988-35	
Enhosulfan 4ulfate	ND	U	1.9	8.73	1	1-W31W3	81W8gW9	KH G1988-35	
9,9'0DDT	ND	U	1.9	8.65	1	1-W31W3	81W8gW9	KH G1988-35	
Enhrin Ketone	ND	U	1.9	8.w9	1	1-W31W3	81W8gW9	KH G1988-35	
MetSoxycSlor	ND	U	1.9	8.66	1	1-W31W3	81W8gW9	KH G1988-35	
ToxapSene	ND	U	6g	15	1	1-W31W3	81W8gW9	KH G1988-35	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracSloro0m0xylene	7-	-g0117	81W8gW9	Acceptable
DecacSlorobipSenyl	58	--01-1	81W8gW9	Acceptable

† **Analyte Comments**

/ amma0CSlorhane	For tSis analyte (CA4 Re/ istry No. wl830790-), U4E2A Sas correcteh tSe name to be beta0CSlorhane, also knoL n as trans0CSlorhane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SO hdell MounL hurvey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- W4Wg13

Organochlorine Pesticides

Sample Name:	OP 20A9	**Units:**	u/ WK/
Lab Code:	K131376- 0g1g	**Basis:**	H et
Extraction Method:	E2A 39S1	**Level:**	wo5
Analysis Method:	8g81B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda0BOC	ND	U	1.g	g.16	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
beta0BOC	ND	U	1.g	g.S1	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
/ amma0BOC (winLane)	ND	U	1.g	g.- 1	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
Lelta0BOC	ND	U	1.g	g.- g	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
Oeptacdlor	ND	U	1.g	g.- 7	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
AlLrin	ND	U	1.g	g.7S	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
Oeptacdlor EpoxiLe	ND	U	1.g	g.18	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
/ amma0CdlorLane†	ND	U	1.g	g.- 6	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
EnLosulfan I	ND	U	1.g	g.- -	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
alpda0CdlorLane	ND	U	1.g	g.- 9	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
DielLrin	ND	U	1.g	g.- g	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
S,S'0DDE	**0.80**	J	1.g	g.S9	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
EnLrin	ND	U	1.g	g.- 8	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
EnLosulfan II	ND	U	1.g	g.- S	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
S,S'0DDD	ND	U	1.g	g.99	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
EnLrin AlLedyLe	ND	U	1.g	g.6-	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
EnLosulfan hulfate	ND	U	1.g	g.93	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
S,S'0DDT	ND	U	1.g	g.S4	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
EnLrin Ketone	ND	U	1.g	g.34	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
Metdoxycdlor	ND	U	1.g	g.S8	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	
Toxapdene	ND	U	9g	13	1	1- W1W3	g1Wg4WS	KH G1Sgg- 38	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro0m0xylene	64	- 4011 7	g1Wg4WS	Acceptable
Decacdlorobipdenyl	78	- - 01- 1	g1Wg4WS	Acceptable

† Analyte Comments

/ amma0CdlorLane	For tdis analyte (CAh Re/ istry No. 91g307S0-), UhE2A das correcteL tde name to be beta0CdlorLane, also kno5 n as trans0CdlorLane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	S2 hdell MounL hurvey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W4Wg13

Organochlorine Pesticides

Sample Name:	2 EI09 1	**Units:**	u/ WK/
Lab Code:	K131376-0g11	**Basis:**	H et
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	BgB19		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda09 2 C	ND	Ui	1.g	g.3g	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
beta09 2 C	ND	Ui	1.g	g.8-	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
/ amma09 2 C (winLane)	ND	Ui	1.g	g.38	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
Lelta09 2 C	ND	Ui	1.g	g.37	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
2 eptacdlor	ND	U	1.g	g.-7	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
AlLrin	ND	U	1.g	g.7S	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
2 eptacdlor EpoxiLe	ND	U	1.g	g.1B	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
/ amma0CdlorLane†	ND	U	1.g	g.-6	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
EnLosulfan I	ND	U	1.g	g.--	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
alpda0CdlorLane	ND	U	1.g	g.-8	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
DielLrin	ND	U	1.g	g.-g	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
S,S'0DDE	**1.3**		1.g	g.S8	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
EnLrin	ND	U	1.g	g.-B	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
EnLosulfan II	ND	U	1.g	g.-S	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
S,S'0DDD	ND	U	1.g	g.88	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
EnLrin AlLedyLe	ND	U	1.g	g.6-	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
EnLosulfan hulfate	ND	U	1.g	g.83	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
S,S'0DDT	ND	U	1.g	g.S4	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
EnLrin Ketone	ND	U	1.g	g.34	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
Metdoxycdlor	ND	U	1.g	g.SB	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	
Toxapdene	ND	U	8g	13	1	1-W81W3	g1Wg4WS	KH G1Sgg-3B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro0m0xylene	7B	-4011 7	g1Wg4WS	Acceptable
Decacdlorobipdenyl	77	--01-1	g1Wg4WS	Acceptable

† Analyte Comments

/ amma0CdlorLane	For tdis analyte (CAh Re/ istry No. 81g307S0-), UhE5A das correcteL tde name to be beta0CdlorLane, also knoP n as trans0CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	S2 hdell MounL hurvey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W4Wg13

Organochlorine Pesticides

Sample Name:	2 EI09 -	**Units:**	u/ WK/
Lab Code:	K131376- 0g1-	**Basis:**	H et
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	BgB19		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda09 2 C	ND	U	1.g	g.16	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
beta09 2 C	ND	Ui	1.g	g.S7	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
/ amma09 2 C (winLane)	ND	U	1.g	g.- 1	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
Lelta09 2 C	ND	Ui	1.g	g.S4	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
2 eptacdlor	ND	U	1.g	g.- 7	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
AlLrin	ND	U	1.g	g.7S	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
2 eptacdlor EpoxiLe	ND	U	1.g	g.1B	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
/ amma0CdlorLane†	ND	U	1.g	g.- 6	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
EnLosulfan I	ND	U	1.g	g.- -	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
alpda0CdlorLane	ND	U	1.g	g.- 8	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
DielLrin	ND	U	1.g	g.- g	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
S,S'0DDE	**1.2**		1.g	g.S8	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
EnLrin	ND	U	1.g	g.- B	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
EnLosulfan II	ND	U	1.g	g.- S	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
S,S'0DDD	ND	U	1.g	g.88	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
EnLrin AlLedyLe	ND	U	1.g	g.6-	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
EnLosulfan hulfate	ND	U	1.g	g.83	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
S,S'0DDT	ND	U	1.g	g.S4	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
EnLrin Ketone	ND	U	1.g	g.34	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
Metdoxycdlor	ND	U	1.g	g.SB	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	
Toxapdene	ND	U	8g	13	1	1-W8/1W3	g1Wg4WS	KH G1Sgg- 3B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro0m0xylene	7S	- 4011 7	g1Wg4WS	Acceptable
Decacdlorobipdenyl	78	- - 01- 1	g1Wg4WS	Acceptable

† **Analyte Comments**

/ amma0CdlorLane	For tdis analyte (CAh Re/ istry No. 81g307S0-), UhE5A das correcteL tde name to be beta0CdlorLane, also knoP n as trans0CdlorLane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SH hdell MounL hurvey	**Date Collected:**	1- /14/- 413
Sample Matrix:	Animal tissue	**Date Received:**	1- /19/- 413

Organochlorine Pesticides

Sample Name:	HEI02 3	**Units:**	ug/Kg
Lab Code:	K131376- 0413	**Basis:**	Wet
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	B4B12		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda02 HC	ND	U	1.4	4.16	1	1- /31/13	41/49/1S	KWG1S44- 3B	
beta02 HC	ND	U	1.4	4.S1	1	1- /31/13	41/49/1S	KWG1S44- 3B	
gamma02 HC (winLane)	ND	U	1.4	4.- 1	1	1- /31/13	41/49/1S	KWG1S44- 3B	
Lelta02 HC	ND	Ui	1.4	4.66	1	1- /31/13	41/49/1S	KWG1S44- 3B	
Heptacdlor	ND	U	1.4	4.- 7	1	1- /31/13	41/49/1S	KWG1S44- 3B	
AlLrin	ND	U	1.4	4.7S	1	1- /31/13	41/49/1S	KWG1S44- 3B	
Heptacdlor EpoxiLe	ND	U	1.4	4.1B	1	1- /31/13	41/49/1S	KWG1S44- 3B	
gamma0CdlorLane†	ND	U	1.4	4.- 6	1	1- /31/13	41/49/1S	KWG1S44- 3B	
EnLosulfan I	ND	U	1.4	4.- -	1	1- /31/13	41/49/1S	KWG1S44- 3B	
alpda0CdlorLane	ND	U	1.4	4.- 8	1	1- /31/13	41/49/1S	KWG1S44- 3B	
DielLrin	ND	U	1.4	4.- 4	1	1- /31/13	41/49/1S	KWG1S44- 3B	
S,S'0DDE	**0.87**	J	1.4	4.S8	1	1- /31/13	41/49/1S	KWG1S44- 3B	
EnLrin	ND	U	1.4	4.- B	1	1- /31/13	41/49/1S	KWG1S44- 3B	
EnLosulfan II	ND	U	1.4	4.- S	1	1- /31/13	41/49/1S	KWG1S44- 3B	
S,S'0DDD	ND	U	1.4	4.88	1	1- /31/13	41/49/1S	KWG1S44- 3B	
EnLrin AlLedyLe	ND	U	1.4	4.6-	1	1- /31/13	41/49/1S	KWG1S44- 3B	
EnLosulfan hulfate	ND	U	1.4	4.83	1	1- /31/13	41/49/1S	KWG1S44- 3B	
S,S'0DDT	ND	U	1.4	4.S9	1	1- /31/13	41/49/1S	KWG1S44- 3B	
EnLrin Ketone	ND	U	1.4	4.39	1	1- /31/13	41/49/1S	KWG1S44- 3B	
Metdoxycdlor	ND	U	1.4	4.SB	1	1- /31/13	41/49/1S	KWG1S44- 3B	
Toxapdene	ND	U	84	13	1	1- /31/13	41/49/1S	KWG1S44- 3B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro0m0xylene	73	- 9011 7	41/49/1S	Acceptable
Decacdlorobipdenyl	7B	- - 01- 1	41/49/1S	Acceptable

† **Analyte Comments**

gamma0CdlorLane	For tdis analyte (CAh Registry No. 81430̸7S0-), UhE5A das correcteL tde name to be beta0CdlorLane, also knoP n as trans0CdlorLane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	/9 hdell MounL hurvey	**Date Collected:**	1-HgHg13
Sample Matrix:	Animal tissue	**Date Received:**	1-HSHg13

Organochlorine Pesticides

Sample Name:	9 EI04/	**Units:**	uWHKW
Lab Code:	K131376-0g1/	**Basis:**	2 et
Extraction Method:	E5A 38/1	**Level:**	woP
Analysis Method:	BgB14		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda04 9 C	ND	U	g.SS	g.16	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
beta04 9 C	ND	Ui	g.SS	g.8g	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
Wamma04 9 C (winLane)	ND	U	g.SS	g.-1	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
Lelta04 9 C	ND	Ui	g.SS	g.7/	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
9 eptacdlor	ND	U	g.SS	g.-7	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
AlLrin	ND	U	g.SS	g.7/	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
9 eptacdlor EpoxiLe	ND	U	g.SS	g.1B	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
Wamma0CdlorLane†	ND	U	g.SS	g.-6	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
EnLosulfan I	ND	U	g.SS	g.--	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
alpda0CdlorLane	ND	U	g.SS	g.-8	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
DielLrin	ND	U	g.SS	g.-g	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
/,/'0DDE	**1.2**		g.SS	g./8	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
EnLrin	ND	U	g.SS	g.-B	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
EnLosulfan II	ND	U	g.SS	g.-/	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
/,/'0DDD	ND	U	g.SS	g.88	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
EnLrin AlLedyLe	ND	U	g.SS	g.6-	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
EnLosulfan hulfate	ND	U	g.SS	g.83	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
/,/'0DDT	ND	U	g.SS	g./S	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
EnLrin Ketone	ND	U	g.SS	g.3S	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
Metdoxycdlor	ND	U	g.SS	g./B	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	
Toxapdene	ND	U	8g	13	1	1-H31H3	g1HgSH/	K2 G1/gg-3B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro0m0xylene	73	-S0117	g1HgSH/	Acceptable
Decacdlorobipdenyl	78	--01-1	g1HgSH/	Acceptable

† Analyte Comments

Wamma0CdlorLane	For tdis analyte (CAh ReWstry No. 81g307/0-), UhE5A das correcteL tde name to be beta0CdlorLane, also knoP n as trans0CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	h2 dLell Mounwdurvey	**Date Collected:**	1-W4W413
Sample Matrix:	Animal tissue	**Date Received:**	1-WSW413

Organochlorine Pesticides

Sample Name:	2 EI09 g	**Units:**	u/ WK/
Lab Code:	K131376- 041g	**Basis:**	H et
Extraction Method:	E8A 3gh1	**Level:**	Po5
Analysis Method:	B4B19		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpLa09 2 C	ND	Ui	4.SS	4.17	1	1-W31W3	41W4SWh	KH G1h44- 3B	
beta09 2 C	ND	U	4.SS	4.h1	1	1-W31W3	41W4SWh	KH G1h44- 3B	
/ amma09 2 C (Pinwane)	ND	U	4.SS	4.- 1	1	1-W31W3	41W4SWh	KH G1h44- 3B	
welta09 2 C	ND	Ui	4.SS	4.hg	1	1-W31W3	41W4SWh	KH G1h44- 3B	
2 eptacLlor	ND	U	4.SS	4.- 7	1	1-W31W3	41W4SWh	KH G1h44- 3B	
Alwrin	ND	U	4.SS	4.7h	1	1-W31W3	41W4SWh	KH G1h44- 3B	
2 eptacLlor Epoxiwe	ND	U	4.SS	4.1B	1	1-W31W3	41W4SWh	KH G1h44- 3B	
/ amma0CLlorwane†	ND	U	4.SS	4.- 6	1	1-W31W3	41W4SWh	KH G1h44- 3B	
Enwosulfan I	ND	U	4.SS	4.- -	1	1-W31W3	41W4SWh	KH G1h44- 3B	
alpLa0CLlorwane	ND	U	4.SS	4.- g	1	1-W31W3	41W4SWh	KH G1h44- 3B	
Dielwrin	ND	U	4.SS	4.- 4	1	1-W31W3	41W4SWh	KH G1h44- 3B	
h,h'0DDE	**0.89**	J	4.SS	4.hg	1	1-W31W3	41W4SWh	KH G1h44- 3B	
Enwrin	ND	U	4.SS	4.- B	1	1-W31W3	41W4SWh	KH G1h44- 3B	
Enwosulfan II	ND	U	4.SS	4.- h	1	1-W31W3	41W4SWh	KH G1h44- 3B	
h,h'0DDD	ND	U	4.SS	4.gg	1	1-W31W3	41W4SWh	KH G1h44- 3B	
Enwrin AlweLywe	ND	U	4.SS	4.6-	1	1-W31W3	41W4SWh	KH G1h44- 3B	
Enwosulfan dulfate	ND	U	4.SS	4.g3	1	1-W31W3	41W4SWh	KH G1h44- 3B	
h,h'0DDT	ND	U	4.SS	4.hS	1	1-W31W3	41W4SWh	KH G1h44- 3B	
Enwrin Ketone	ND	U	4.SS	4.3S	1	1-W31W3	41W4SWh	KH G1h44- 3B	
MetLoxycLlor	ND	U	4.SS	4.hB	1	1-W31W3	41W4SWh	KH G1h44- 3B	
ToxapLene	ND	U	g4	13	1	1-W31W3	41W4SWh	KH G1h44- 3B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracLloro0m0xylene	6g	- S0117	41W4SWh	Acceptable
DecacLlorobipLenyl	66	- - 01- 1	41W4SWh	Acceptable

† Analyte Comments

/ amma0CLlorwane	For tLis analyte (CAd Re/ istry No. g14307h0-), UdE8A Las correctewtLe name to be beta0CLlorwane, also kno5 n as trans0CLlorwane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SO hdell MounL hurvey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W4Wg13

Organochlorine Pesticides

Sample Name:	OP 209 1	**Units:**	u/ WK/
Lab Code:	K131376-0g16	**Basis:**	H et
Extraction Method:	E2A 38S1	**Level:**	wo5
Analysis Method:	BgB19		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda09 OC	ND	Ui	g.4B	g.3g	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
beta09 OC	ND	Ui	g.4B	g.8B	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
/ amma09 OC (winLane)	ND	Ui	g.4B	g.-4	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
Lelta09 OC	ND	Ui	g.4B	g.63	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
Oeptacdlor	ND	U	g.4B	g.-7	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
AlLrin	ND	U	g.4B	g.7S	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
Oeptacdlor Epo†iLe	**0.19**	x2	g.4B	g.1B	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
/ amma0CdlorLaneJ	ND	U	g.4B	g.-6	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
EnLosulfan I	ND	U	g.4B	g.--	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
alpda0CdlorLane	ND	U	g.4B	g.-8	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
DielLrin	ND	U	g.4B	g.-g	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
S,S'0DDE	**1.3**		g.4B	g.S8	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
EnLrin	ND	U	g.4B	g.-B	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
EnLosulfan II	ND	U	g.4B	g.-S	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
S,S'0DDD	ND	U	g.4B	g.88	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
EnLrin AlLedyLe	ND	U	g.4B	g.6-	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
EnLosulfan hulfate	ND	U	g.4B	g.83	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
S,S'0DDT	ND	U	g.4B	g.S4	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
EnLrin Ketone	ND	U	g.4B	g.34	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
Metdo†ycdlor	ND	U	g.4B	g.SB	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	
To†apdene	ND	U	S4	13	1	1-W31W3	g1Wg4WS	KH G1Sgg-3B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro0m0†ylene	7S	-40117	g1Wg4WS	Acceptable
Decacdlorobipdenyl	64	--01-1	g1Wg4WS	Acceptable

† **Analyte Comments**

/ amma0CdlorLane	For tdis analyte (CAh Re/ istry No. 81g307S0-), UhE2A das correcteL tde name to be beta0CdlorLane, also kno5 n as trans0CdlorLane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SO hdell MounL hurvey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- W4Wg13

Organochlorine Pesticides

Sample Name:	OP 20 9 -	**Units:**	u/ WK/
Lab Code:	K131376- 0g17	**Basis:**	H et
Extraction Method:	E2A 38S1	**Level:**	wo5
Analysis Method:	BgB19		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda0 9 OC	ND	Ui	g.4B	g.37	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
beta0 9 OC	ND	Ui	g.4B	g.67	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
/ amma0 9 OC (winLane)	ND	Ui	g.4B	g.S7	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
Lelta0 9 OC	ND	Ui	g.4B	g.B-	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
Oeptacdlor	ND	U	g.4B	g.- 7	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
AlLrin	ND	U	g.4B	g.7S	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
Oeptacdlor Epo†iLe	**1.05**	x	g.4B	g.1B	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
/ amma0CdlorLaneJ	ND	Ui	g.4B	g.- 4	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
EnLosulfan I	ND	U	g.4B	g.- -	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
alpda0CdlorLane	ND	U	g.4B	g.- 8	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
DielLrin	ND	U	g.4B	g.- g	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
S,S'0DDE	**2.2**	2	g.4B	g.S8	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
EnLrin	ND	U	g.4B	g.- B	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
EnLosulfan II	ND	U	g.4B	g.- S	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
S,S'0DDD	ND	U	g.4B	g.88	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
EnLrin AlLedyLe	ND	U	g.4B	g.6-	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
EnLosulfan hulfate	ND	U	g.4B	g.83	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
S,S'0DDT	ND	U	g.4B	g.S4	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
EnLrin Ketone	ND	U	g.4B	g.34	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
Metdo†ycdlor	ND	U	g.4B	g.SB	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	
To†apdene	ND	U	S4	13	1	1- W31W3	g1 Wg4 WS	KH G1Sgg- 3B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro0m0†ylene	71	- 401 17	g1 Wg4 WS	Acceptable
Decacdlorobipdenyl	6S	- - 01- 1	g1 Wg4 WS	Acceptable

† **Analyte Comments**

/ amma0CdlorLane	For tdis analyte (CAh Re/ istry No. 81g307S0-), UhE2A das correcteL tde name to be beta0CdlorLane, also kno5 n as trans0CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	hP dLell Mounwdurvey	**Date Collected:**	1-HgHg13
Sample Matrix:	Animal tissue	**Date Received:**	1-HSHg13

Organochlorine Pesticides

Sample Name:	P 2 904 3	**Units:**	uWHKW
Lab Code:	K131376-0g1/	**Basis:**	O et
Extraction Method:	E9A 3Bh1	**Level:**	5o8
Analysis Method:	/g/14		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpLa04 P C	ND	Ui	g.S/	g.B3	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
beta04 P C	ND	Ui	g.S/	g.77	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Wamma04 P C (5inwane)	ND	Ui	g.S/	g.h/	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
welta04 P C	ND	Ui	g.S/	g.hS	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
P eptacLlor	ND	U	g.S/	g.-7	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Alwrin	ND	U	g.S/	g.7h	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
P eptacLlor Epo†iwe	**0.40**	x	g.S/	g.1/	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Wamma0CLlorwaneJ	ND	U	g.S/	g.-6	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Enwosulfan I	ND	U	g.S/	g.--	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
alpLa0CLlorwane	ND	U	g.S/	g.-B	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Dielwrin	ND	U	g.S/	g.-g	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
h,h'0DDE	**1.7**		g.S/	g.hB	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Enwrin	ND	U	g.S/	g.-/	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Enwosulfan II	ND	U	g.S/	g.-h	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
h,h'0DDD	ND	U	g.S/	g.BB	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Enwrin AlweLywe	ND	U	g.S/	g.6-	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Enwosulfan dulfate	ND	U	g.S/	g.B3	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
h,h'0DDT	ND	U	g.S/	g.hS	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
Enwrin Ketone	ND	U	g.S/	g.3S	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
MetLo†ycLlor	ND	U	g.S/	g.h/	1	1-B1H3	g1HgSHh	KO G1hgg-3/	
To†apLene	ND	U	hS	13	1	1-B1H3	g1HgSHh	KO G1hgg-3/	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracLloro0m0†ylene	7/	-S011 7	g1HgSHh	Acceptable
DecacLlorobipLenyl	6S	--01-1	g1HgSHh	Acceptable

† **Analyte Comments**

Wamma0CLlorwane	For tLis analyte (CAd ReWstry No. B1g307h0-), UdE9A Las correctewtLe name to be beta0CLlorwane, also kno8 n as trans0CLlorwane.

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SP hdell MounL hurvey	**Date Collected:**	1-Hg-Hg13
Sample Matrix:	Animal tissue	**Date Received:**	1-H/Hg13

Organochlorine Pesticides

Sample Name:	P 2 904 S	**Units:**	uWKW
Lab Code:	K131376-0g1/	**Basis:**	O et
Extraction Method:	E9A 38S1	**Level:**	wo5
Analysis Method:	BgB14		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda04 P C	ND	Ui	g.//	g.-8	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
beta04 P C	ND	Ui	g.//	g.B-	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
Wamma04 P C (winLane)	ND	Ui	g.//	g.S3	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
Lelta04 P C	ND	Ui	g.//	g.S3	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
P eptacdlor	ND	U	g.//	g.-7	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
AlLrin	ND	U	g.//	g.7S	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
P eptacdlor Epo†iLe	**0.27**	x	g.//	g.1B	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
Wamma0CdlorLaneJ	ND	U	g.//	g.-6	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
EnLosulfan I	ND	U	g.//	g.--	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
alpda0CdlorLane	ND	U	g.//	g.-8	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
DielLrin	ND	U	g.//	g.-g	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
S,S'0DDE	**1.5**		g.//	g.S8	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
EnLrin	ND	U	g.//	g.-B	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
EnLosulfan II	ND	U	g.//	g.-S	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
S,S'0DDD	ND	U	g.//	g.88	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
EnLrin AlLedyLe	ND	U	g.//	g.6-	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
EnLosulfan hulfate	ND	U	g.//	g.83	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
S,S'0DDT	ND	U	g.//	g.S/	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
EnLrin Ketone	ND	U	g.//	g.3/	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
Metdo†ycdlor	ND	U	g.//	g.SB	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	
To†apdene	ND	U	8g	13	1	1-H31H3	g1Hg/HS	KO G1Sgg-3B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro0m0†ylene	7S	-/01 17	g1Hg/HS	Acceptable
Decacdlorobipdenyl	6/	--01-1	g1Hg/HS	Acceptable

† Analyte Comments

Wamma0CdlorLane	For tdis analyte (CAh ReWstry No. 81g307S0-), UhE9A das correcteL tde name to be beta0CdlorLane, also kno5 n as trans0CdlorLane.

Comments:

Analytical Results

Client: AMEC Environment & Infrastructure, Inc.
Project: hO dLell Mounwdurvey
Sample Matrix: Animal tissue

Service Request: K131376-
Date Collected: 1-WgWg13
Date Received: 1-WSWg13

Organochlorine Pesticides

Sample Name: OP 209 4
Lab Code: K131376-0g-g
Extraction Method: E2A 34h1
Analysis Method: BgB19

Units: u/WK/
Basis: H et
Level: 5o8

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpLa09OC	ND	Ui	g.SS	g.-6	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
beta09OC	ND	Ui	g.SS	g.43	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
/amma09OC (5inwane)	ND	Ui	g.SS	g.3B	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
welta09OC	ND	Ui	g.SS	g.Bl	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
OeptacLlor	ND	U	g.SS	g.-7	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
Alwrin	ND	U	g.SS	g.7h	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
OeptacLlor Epo†iwe	**0.23**	x	g.SS	g.1B	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
/amma0CLlorwaneJ	ND	U	g.SS	g.-6	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
Enwosulfan I	ND	U	g.SS	g.--	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
alpLa0CLlorwane	ND	U	g.SS	g.-4	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
Dielwrin	ND	U	g.SS	g.-g	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
h,h'0DDE	**0.96**	x	g.SS	g.h4	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
Enwrin	ND	U	g.SS	g.-B	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
Enwosulfan II	ND	U	g.SS	g.-h	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
h,h'0DDD	ND	U	g.SS	g.44	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
Enwrin AlweLywe	ND	U	g.SS	g.6-	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
Enwosulfan dulfate	ND	U	g.SS	g.43	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
h,h'0DDT	ND	U	g.SS	g.hS	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
Enwrin Ketone	ND	U	g.SS	g.3S	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
MetLo†ycLlor	ND	U	g.SS	g.hB	1	1-W1W3	g1WgSWh	KHG1hgg-3B	
To†apLene	ND	U	4g	13	1	1-W1W3	g1WgSWh	KHG1hgg-3B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracLloro0m0†ylene	73	-S0117	g1WgSWh	Acceptable
DecacLlorobipLenyl	74	--01-1	g1WgSWh	Acceptable

† Analyte Comments

/amma0CLlorwane	For tLis analyte (CAd Re/istry No. 41g307h0-), UdE2A Las correctewtLe name to be beta0CLlorwane, also kno8n as trans0CLlorwane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	/ P 5Sell Mounh 5urvey	**Date Collected:**	wA
Sample Matrix:	Animal tissue	**Date Received:**	wA

Organochlorine Pesticides

Sample Name:	MetSoh d lanL	**Units:**	u94K9
Lab Code:	K0 g 1/ WW-3H26	**Basis:**	0 et
Extraction Method:	EGA 3U'1	**Level:**	8oB
Analysis Method:	HWH1d		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albSa2d P C	wp	D	W66	W16	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
(eta2d P C	wp	D	W66	W/ 1	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
9amma2d P C)8 inhanex	wp	D	W66	W- 1	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
helta2d P C	wp	D	W66	W- W	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
P ebtacSlor	wp	D	W66	W- 7	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
Alhrin	wp	D	W7/	W7/	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
P ebtacSlor Ebo†ihe	wp	D	W66	W1H	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
9amma2CSlorhane'	wp	D	W66	W- 6	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
Enhosulfan I	wp	D	W66	W- -	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
albSa2CSlorhane	wp	D	W66	W- U	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
p ielhrin	wp	D	W66	W- W	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
/ ,/ T2p p E	wp	D	W66	W/ U	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
Enhrin	wp	D	W66	W- H	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
Enhosulfan II	wp	D	W66	W- /	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
/ ,/ T2p p p	wp	D	W66	WUU	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
Enhrin AlheSyhe	wp	D	W66	W6-	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
Enhosulfan 5ulfate	wp	D	W66	WU3	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
/ ,/ T2p p F	wp	D	W66	W/ N	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
Enhrin Ketone	wp	D	W66	W3N	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
MetSo†ycSlor	wp	D	W66	W/ H	1	1-431413	W14WW41/	K0 g 1/ WW-3H	
Fo†abSene	wp	D	33	13	1	1-431413	W14WW41/	K0 g 1/ WW-3H	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
FetracSloro2m2†ylene	7-	-N2117	W14WW41/	Accebta(le
p ecacSloro(ibSenyl	H1	- - 21- 1	W14WW41/	Accebta(le

† Analyte Comments

9amma2CSlorhane	kor tSis analyte)CA5 Re9istry wo. U1W327/ 2- x, D5EGA Sas correcteh tSe name to (e (eta2CSlorhane, also LnoBn as trans2CSlorhane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client: AMEC Environment & Infrastructure, Inc. **Service Request:** K131376L
Project: HS hde44Mouny hurveP
Sample Matrix: Anima4tissue

Surrogate Recovery Summary
Organochlorine Pesticides

Extraction Method: E5A 38H1 **Units:** 5ercent
Analysis Method: 0B01- **Level:** wol

Sample Name	Lab Code	Sur1	Sur2
S EI9A1	K131376L9BB1	77	06
S EI9AL	K131376L9BBL	6H	7B
S EI9A3	K131376L9BB3	62	7H
S EI9AH	K131376L9BBH	71	72
S EI9A8	K131376L9BB8	68	73
S O59A1	K131376L9BB6	73	70
S O59AL	K131376L9BB7	68	73
S O59A3	K131376L9BB0	68	73
S O59AH	K131376L9BB2	7L	0B
S O59A8	K131376L9B1B	62	70
S EI9- 1	K131376L9B11	70	77
S EI9- L	K131376L9B1L	7H	78
S EI9- 3	K131376L9B13	73	70
S EI9- H	K131376L9B1H	73	78
S EI9- 8	K131376L9B18	68	66
S O59- 1	K131376L9B16	7H	62
S O59- L	K131376L9B17	71	6H
S O59- 3	K131376L9B10	70	62
S O59- H	K131376L9B12	7H	62
S O59- 8	K131376L9BLB	73	78
Metdoy - 4anG	KF W1HBBL3096	7L	01
S O59- 3Mh	KF W1HBBL3091	76	62
S O59- 3k Mh	KF W1HBBL309L	76	71
waDContro4hamp4e	KF W1HBBL3093	7L	73
waDContro4hamp4e	KF W1HBBL309H	78	78
k up4icate waDContro4hamp4e	KF W1HBBL3098	73	73

Surrogate Recovery Control Limits (%)

hur1	=	Tetracd4oro9m9xP4ene	L29117
hurL	=	k ecacd4oroDipdenP4	LL91L1

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

QA/QC Report

Client: AMEC Environment & Infrastructure, Inc.
Project: 4H Shell Mound Survey
Sample Matrix: Animal tissue

Service Request: K1313762
Date Extracted: 12/31/2013
Date Analyzed: 01/09/2014

Matrix Spike/Duplicate Matrix Spike Summary
Organochlorine Pesticides

Sample Name: HOP-B3
Lab Code: K1313762-018

Units: ug/Kg
Basis: Wet

Extraction Method: EPA 3541
Analysis Method: 8081B

Level: Low
Extraction Lot: KWG1400238

		HOP-B3MS KWG1400238-1 Matrix Spike			HOP-B3DMS KWG1400238-2 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
alpha-BHC	ND	13.1	19.3	68	12.0	19.3	62	31-118	9	40
beta-BHC	ND	13.7	19.3	71	12.9	19.3	66	22-123	7	40
gamma-BHC (Lindane)	ND	13.0	19.3	67	11.9	19.3	62	34-123	8	40
delta-BHC	ND	15.4	19.3	79	14.5	19.3	75	38-133	6	40
Heptachlor	ND	11.7	19.3	60	10.8	19.3	56	37-122	7	40
Aldrin	ND	9.31	19.3	48	8.62	19.3	45	38-116	8	40
Heptachlor Epoxide	0.40	10.8	19.3	54	10.7	19.3	53	39-113	1	40
gamma-Chlordane	ND	13.0	19.3	67	12.3	19.3	64	34-123	6	40
Endosulfan I	ND	11.8	19.3	61	11.0	19.3	57	22-113	7	40
alpha-Chlordane	ND	12.6	19.3	65	11.7	19.3	60	39-113	8	40
Dieldrin	ND	11.5	19.3	60	10.9	19.3	56	33-120	6	40
4,4'-DDE	1.7	14.0	19.3	64	13.0	19.3	59	33-134	7	40
Endrin	ND	14.8	19.3	77	14.0	19.3	72	43-124	6	40
Endosulfan II	ND	12.2	19.3	63	12.1	19.3	62	28-120	1	40
4,4'-DDD	ND	13.9	19.3	72	13.1	19.3	68	35-126	6	40
Endrin Aldehyde	ND	11.4	19.3	59	10.6	19.3	55	10-118	8	40
Endosulfan Sulfate	ND	14.3	19.3	74	13.5	19.3	70	23-128	6	40
4,4'-DDT	ND	13.8	19.3	71	13.1	19.3	68	26-133	5	40
Endrin Ketone	ND	13.1	19.3	68	12.3	19.3	64	27-128	6	40
Methoxychlor	ND	14.9	19.3	77	13.9	19.3	72	27-148	7	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313768
Project:	2H GheSSMound Gurvey	**Date Extracted:**	18/31/8B13
Sample Matrix:	AnimaStissue	**Date Analyzed:**	B1/BP/8B12

Lab Control Spike Summary
Organochlorine Pesticides

Extraction Method:	E5A 3921	**Units:**	uWKW
Analysis Method:	0B01g	**Basis:**	L et
		Level:	bow
		Extraction Lot:	KL 4 12BB830

	bal ContrSGampSe KL 4 12BB830-3 Lab Control Spike			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
aSpha-g HC	13.8	1P.P	66	28-182
l eta-g HC	18.9	1P.P	63	3P-188
Wamma-g HC (b indane)	13.B	1P.P	69	22-183
deSta-g HC	18.6	1P.P	63	22-121
HeptachSor	11.9	1P.P	90	3P-186
ASdrin	P.6B	1P.P	20	26-116
HeptachSor Epoxide	18.1	1P.P	61	23-11P
Wamma-ChSordane	13.2	1P.P	67	30-181
EndosuSfan I	18.3	1P.P	68	83-116
aSpha-ChSordane	13.3	1P.P	67	2B-181
DieSdrin	18.9	1P.P	63	2B-18B
2,2'-DDE	18.3	1P.P	68	36-13P
Endrin	19.3	1P.P	77	22-13B
EndosuSfan II	18.6	1P.P	63	39-111
2,2'-DDD	12.9	1P.P	73	33-130
Endrin ASdehyde	18.1	1P.P	61	11-11B
EndosuSfan GuSfate	19.B	1P.P	79	36-187
2,2'-DDT	12.B	1P.P	71	2P-136
Endrin Ketone	13.8	1P.P	66	8P-133
MethoxychSor	12.P	1P.P	79	37-122

Results flagged with an asterisk (*) indicate values outside control criteria.

5ercent recoveries and reSative percent differences (R5D) are determined l y the software usinWvaSues in the caScuSation which have not l een rounded.

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1818362
Project:	4H Shell Mound Survey	**Date Extracted:**	12/81/2018
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/0P/2014

Lab Control Spike/Duplicate Lab Control Spike Summary
Organochlorine Pesticides

Extraction Method:	E9A 8541	**Units:**	ug/Kg
Analysis Method:	7071B	**Basis:**	Wet
		Level:	Low
		Extraction Lot:	KWG1400287

	Lab Control Sample KWG1400287-4 **Lab Control Spike**			Duplicate Lab Control Sample KWG1400287-5 **Duplicate Lab Control Spike**					
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Toxaphene	74.0	PP.P	74	75.4	PP.0	76	21-152	2	40

Results flagged with an asterisk (*) indicate values outside control criteria.

9ercent recoveries and relative percent differences (R9D) are determined by the software using values in the calculation which have not been rounded.

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	42 Shell Mound Survey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W9Wg13

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 EI0A1	**Units:**	u/ WK/
Lab Code:	K131376-0gg1	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8g8-A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	ND	U	1g	-.8	1	1-W31W3	g1Wg9W4	KH G14gg-39	
Aroclor 1--1	ND	U	-g	-.8	1	1-W31W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-3-	ND	U	1g	-.8	1	1-W31W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-4-	ND	U	1g	-.8	1	1-W31W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-48	ND	U	1g	-.8	1	1-W31W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-54	ND	U	1g	-.8	1	1-W31W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-6g	ND	U	1g	-.8	1	1-W31W3	g1Wg9W4	KH G14gg-39	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	8-	370139	g1Wg9W4	Acceptable

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	42 Shell Mound Survey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W9Wg13

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 EI0A-	**Units:**	u/ WK/
Lab Code:	K131376-0gg-	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8g8-A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	ND	U	9.1	-.8	1	1-W81W3	g1Wg9W4	KH G14gg-39	
Aroclor 1--1	ND	U	19	-.8	1	1-W81W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-3-	ND	U	9.1	-.8	1	1-W81W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-4-	ND	U	9.1	-.8	1	1-W81W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-48	ND	U	9.1	-.8	1	1-W81W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-54	ND	U	9.1	-.8	1	1-W81W3	g1Wg9W4	KH G14gg-39	
Aroclor 1-6g	ND	U	9.1	-.8	1	1-W81W3	g1Wg9W4	KH G14gg-39	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	71	370139	g1Wg9W4	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	42 Shell Mound Survey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- W9Wg13

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 EI0A3	**Units:**	u/ WK/
Lab Code:	K131376- 0gg3	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8g8- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	ND	U	9.8	- .8	1	1- W81W3	g1Wg9W4	KH G14gg- 39	
Aroclor 1- - 1	ND	U	- g	- .8	1	1- W81W3	g1Wg9W4	KH G14gg- 39	
Aroclor 1- 3-	ND	U	9.8	- .8	1	1- W81W3	g1Wg9W4	KH G14gg- 39	
Aroclor 1- 4-	ND	U	9.8	- .8	1	1- W81W3	g1Wg9W4	KH G14gg- 39	
Aroclor 1- 48	ND	U	9.8	- .8	1	1- W81W3	g1Wg9W4	KH G14gg- 39	
Aroclor 1- 54	ND	U	9.8	- .8	1	1- W81W3	g1Wg9W4	KH G14gg- 39	
Aroclor 1- 6g	ND	U	9.8	- .8	1	1- W81W3	g1Wg9W4	KH G14gg- 39	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	76	370139	g1Wg9W4	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	/ 9 Shell Mound Survey	**Date Collected:**	1- HgH-g13
Sample Matrix:	Animal tissue	**Date Received:**	1- H4H-g13

Polychlorinated Biphenyls (PCBs)

Sample Name:	9 EI0A/	**Units:**	uWHKW
Lab Code:	K131376- 0gg/	**Basis:**	2 et
Extraction Method:	EPA 35/ 1	**Level:**	Low
Analysis Method:	8g8- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	ND	U	4.4	- .8	1	1- H31H3	g1Hg4H/	K2 G1/ gg- 34	
Aroclor 1- - 1	ND	U	- g	- .8	1	1- H31H3	g1Hg4H/	K2 G1/ gg- 34	
Aroclor 1- 3-	ND	U	4.4	- .8	1	1- H31H3	g1Hg4H/	K2 G1/ gg- 34	
Aroclor 1- / -	ND	U	4.4	- .8	1	1- H31H3	g1Hg4H/	K2 G1/ gg- 34	
Aroclor 1- / 8	ND	U	4.4	- .8	1	1- H31H3	g1Hg4H/	K2 G1/ gg- 34	
Aroclor 1- 5/	ND	U	4.4	- .8	1	1- H31H3	g1Hg4H/	K2 G1/ gg- 34	
Aroclor 1- 6g	ND	U	4.4	- .8	1	1- H31H3	g1Hg4H/	K2 G1/ gg- 34	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	83	370134	g1Hg4H/	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	S9 hdell MounL hurvey	**Date Collected:**	1- HgHg13
Sample Matrix:	Animal tissue	**Date Received:**	1- H4Hg13

Polychlorinated Biphenyls (PCBs)

Sample Name:	9 EI0A/	**Units:**	uWHKW
Lab Code:	K131376- 0gg/	**Basis:**	2 et
Extraction Method:	E5A 3/ S1	**Level:**	woP
Analysis Method:	8g8- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	ND	U	6.6	- .8	1	1- H31H3	g1Hg4HS	K2 G1Sgg- 34	
Aroclor 1- - 1	ND	U	1S	- .8	1	1- H31H3	g1Hg4HS	K2 G1Sgg- 34	
Aroclor 1- 3-	ND	U	6.6	- .8	1	1- H31H3	g1Hg4HS	K2 G1Sgg- 34	
Aroclor 1- S-	ND	U	6.6	- .8	1	1- H31H3	g1Hg4HS	K2 G1Sgg- 34	
Aroclor 1- S8	ND	U	6.6	- .8	1	1- H31H3	g1Hg4HS	K2 G1Sgg- 34	
Aroclor 1- / S	ND	U	6.6	- .8	1	1- H31H3	g1Hg4HS	K2 G1Sgg- 34	
Aroclor 1- 6g	ND	U	6.6	- .8	1	1- H31H3	g1Hg4HS	K2 G1Sgg- 34	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	78	370l34	g1Hg4HS	Acceptable

Comments:

Analytical Results

Client: AMEC Environment & Infrastructure, Inc.
Project: h2 dLell Mounwdurvey
Sample Matrix: Animal tissue

Service Request: K131376-
Date Collected: 1-WgWg13
Date Received: 1-WSWg13

Polychlorinated Biphenyls (PCBs)

Sample Name: 2 9 40A1
Lab Code: K131376-0gg6
Extraction Method: E4A 38h1
Analysis Method: GgG-A

Units: u/ WK/
Basis: H et
Level: Po5

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	Dp	N	S.3	-.G	1	1-W81W3	g1WgSW1h	KH U1hgg-3S	
Aroclor 1--1	Dp	N	1S	-.G	1	1-W81W3	g1WgSW1h	KH U1hgg-3S	
Aroclor 1-3-	Dp	N	S.3	-.G	1	1-W81W3	g1WgSW1h	KH U1hgg-3S	
Aroclor 1-h-	Dp	N	S.3	-.G	1	1-W81W3	g1WgSW1h	KH U1hgg-3S	
Aroclor 1-hG	Dp	N	S.3	-.G	1	1-W81W3	g1WgSW1h	KH U1hgg-3S	
Aroclor 1-8h	Dp	N	S.3	-.G	1	1-W81W3	g1WgSW1h	KH U1hgg-3S	
Aroclor 1-6g	Dp	N	S.3	-.G	1	1-W81W3	g1WgSW1h	KH U1hgg-3S	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacLloro: ibLenyl	G6	370l3S	g1WgSW1h	Accebta: le

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	h2 dLell Mounwdurvey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-WSWg13

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 9 40A-	**Units:**	u/ WK/
Lab Code:	K131376-0gg7	**Basis:**	H et
Extraction Method:	E4A 38h1	**Level:**	Po5
Analysis Method:	CgG-A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	Dp	N	S.S	-.G	1	1-W81W3	g1WgSWh	KH U1hgg-3S	
Aroclor 1--1	Dp	N	-g	-.G	1	1-W81W3	g1WgSWh	KH U1hgg-3S	
Aroclor 1-3-	Dp	N	S.S	-.G	1	1-W81W3	g1WgSWh	KH U1hgg-3S	
Aroclor 1-h-	Dp	N	S.S	-.G	1	1-W81W3	g1WgSWh	KH U1hgg-3S	
Aroclor 1-hG	Dp	N	S.S	-.G	1	1-W81W3	g1WgSWh	KH U1hgg-3S	
Aroclor 1-8h	Dp	N	S.S	-.G	1	1-W81W3	g1WgSWh	KH U1hgg-3S	
Aroclor 1-6g	Dp	N	S.S	-.G	1	1-W81W3	g1WgSWh	KH U1hgg-3S	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacLloro: ibLenyl	Gl	370l3S	g1WgSWh	Accebta: le

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	d9 Lwell MounP Lurvey	**Date Collected:**	1-HgH-g13
Sample Matrix:	Animal tissue	**Date Received:**	1-HhH-g13

Polychlorinated Biphenyls (PCBs)

Sample Name:	9 4 S0A3	**Units:**	uWHKW
Lab Code:	K131376-0gg/	**Basis:**	2 et
Extraction Method:	ESA 3Gd1	**Level:**	5o8
Analysis Method:	/ g/ - A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	Dp	N	6./	- ./	1	1-H31H3	g1HghHd	K2 U1dgg-3h	
Aroclor 1- - 1	Dp	N	1d	- ./	1	1-H31H3	g1HghHd	K2 U1dgg-3h	
Aroclor 1-3-	Dp	N	6./	- ./	1	1-H31H3	g1HghHd	K2 U1dgg-3h	
Aroclor 1-d-	Dp	N	6./	- ./	1	1-H31H3	g1HghHd	K2 U1dgg-3h	
Aroclor 1-d/	Dp	N	6./	- ./	1	1-H31H3	g1HghHd	K2 U1dgg-3h	
Aroclor 1-Gd	Dp	N	6./	- ./	1	1-H31H3	g1HghHd	K2 U1dgg-3h	
Aroclor 1-6g	Dp	N	6./	- ./	1	1-H31H3	g1HghHd	K2 U1dgg-3h	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacwloro: ibwenyl	77	370l3h	g1HghHd	Accebta: le

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	h9 dLell Mounwdurvey	**Date Collected:**	1- HgH-g13
Sample Matrix:	Animal tissue	**Date Received:**	1- H/ H-g13

Polychlorinated Biphenyls (PCBs)

Sample Name:	9 4 S0Ah	**Units:**	uWHKW
Lab Code:	K131376- 0gg/	**Basis:**	2 et
Extraction Method:	ESA 38h1	**Level:**	Po5
Analysis Method:	CgG- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	Dp	N	1h	3./	1	1- H31H3	g1Hg/ Hh	K2 U1hgg- 3/	
Aroclor 1- - 1	Dp	N	- G	3./	1	1- H31H3	g1Hg/ Hh	K2 U1hgg- 3/	
Aroclor 1- 3-	Dp	N	1h	3./	1	1- H31H3	g1Hg/ Hh	K2 U1hgg- 3/	
Aroclor 1- h-	Dp	N	1h	3./	1	1- H31H3	g1Hg/ Hh	K2 U1hgg- 3/	
Aroclor 1- hG	Dp	N	1h	3./	1	1- H31H3	g1Hg/ Hh	K2 U1hgg- 3/	
Aroclor 1- 8h	Dp	N	1h	3./	1	1- H31H3	g1Hg/ Hh	K2 U1hgg- 3/	
Aroclor 1- 6g	Dp	N	1h	3./	1	1- H31H3	g1Hg/ Hh	K2 U1hgg- 3/	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacLLoro: ibLenyl	G8	370l3/	g1Hg/ Hh	Accebta: le

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	d2 Lwell MounP Lurvey	**Date Collected:**	1-W1gW-g13
Sample Matrix:	Animal tissue	**Date Received:**	1-WhW-g13

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 9 40AS	**Units:**	u/ WK/
Lab Code:	K131376-0g1g	**Basis:**	H et
Extraction Method:	E4A 3Sd1	**Level:**	5o8
Analysis Method:	CgG-A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1g16	Dp	N	1g	-.G	1	1-W31W13	g1WghW1d	KH U1dgg-3h	
Aroclor 1--1	Dp	N	-g	-.G	1	1-W31W13	g1WghW1d	KH U1dgg-3h	
Aroclor 1-3-	Dp	N	1g	-.G	1	1-W31W13	g1WghW1d	KH U1dgg-3h	
Aroclor 1-d-	Dp	N	1g	-.G	1	1-W31W13	g1WghW1d	KH U1dgg-3h	
Aroclor 1-dG	Dp	N	1g	-.G	1	1-W31W13	g1WghW1d	KH U1dgg-3h	
Aroclor 1-Sd	Dp	N	1g	-.G	1	1-W31W13	g1WghW1d	KH U1dgg-3h	
Aroclor 1-6g	Dp	N	1g	-.G	1	1-W31W13	g1WghW1d	KH U1dgg-3h	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacwloro: ibwenyl	Gd	370l3h	g1WghW1d	Accebta: le

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	9F HSell Mounh Hurvey	**Date Collected:**	1- /14/- 413
Sample Matrix:	Animal tissue	**Date Received:**	1- /12/- 413

Polychlorinated Biphenyls (PCBs)

Sample Name:	F EI0B1	**Units:**	ug/Kg
Lab Code:	K131376- 0411	**Basis:**	Wet
Extraction Method:	EwA 3P91	**Level:**	doL
Analysis Method:	545- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- - 1	UN	G	- 4	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 3-	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 9-	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 95	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- P9	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 64	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
NecacSloropiDSenyl	51	370132	41/42/19	AcceDaple

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	9F HSell Mounh Hurvey	**Date Collected:**	1- /14/- 413
Sample Matrix:	Animal tissue	**Date Received:**	1- /12/- 413

Polychlorinated Biphenyls (PCBs)

Sample Name:	F EI0B-	**Units:**	ug/Kg
Lab Code:	K131376- 041-	**Basis:**	Wet
Extraction Method:	EwA 3P91	**Level:**	doL
Analysis Method:	545- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- - 1	UN	G	- 4	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 3-	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 9-	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 95	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- P9	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 64	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
NecacSloropiDSenyl	54	370132	41/42/19	AcceDaple

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	9F HSell Mounh Hurvey	**Date Collected:**	1- /14/- 413
Sample Matrix:	Animal tissue	**Date Received:**	1- /12/- 413

Polychlorinated Biphenyls (PCBs)

Sample Name:	F EI0B3	**Units:**	ug/Kg
Lab Code:	K131376- 0413	**Basis:**	Wet
Extraction Method:	EwA 3P91	**Level:**	doL
Analysis Method:	545- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- - 1	UN	G	- 4	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 3-	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 9-	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 95	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- P9	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	
Aroclor 1- 64	UN	G	14	- .5	1	1- /31/13	41/42/19	KW8 1944- 32	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
NecacSloropiDSenyl	72	370132	41/42/19	AcceDtaple

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	gB HSell Mounh Hurvey	**Date Collected:**	1- W4W413
Sample Matrix:	Animal tissue	**Date Received:**	1- W9W413

Polychlorinated Biphenyls (PCBs)

Sample Name:	BEI02 g	**Units:**	u/ WK/
Lab Code:	K131376- 041g	**Basis:**	F et
Extraction Method:	EwA 3Pg1	**Level:**	doL
Analysis Method:	545- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	UN	G	9.9	- .5	1	1- W81W13	41W49Wg	KF 8 1g44- 39	
Aroclor 1- - 1	UN	G	- 4	- .5	1	1- W81W13	41W49Wg	KF 8 1g44- 39	
Aroclor 1- 3-	UN	G	9.9	- .5	1	1- W81W13	41W49Wg	KF 8 1g44- 39	
Aroclor 1- g-	UN	G	9.9	- .5	1	1- W81W13	41W49Wg	KF 8 1g44- 39	
Aroclor 1- g5	UN	G	9.9	- .5	1	1- W81W13	41W49Wg	KF 8 1g44- 39	
Aroclor 1- Pg	UN	G	9.9	- .5	1	1- W81W13	41W49Wg	KF 8 1g44- 39	
Aroclor 1- 64	UN	G	9.9	- .5	1	1- W81W13	41W49Wg	KF 8 1g44- 39	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
NecacSloropiDSenyl	79	370139	41W49Wg	AcceDaple

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	HB Shell Mound Survey	**Date Collected:**	1- W4W413
Sample Matrix:	Animal tissue	**Date Received:**	1- W9W413

Polychlorinated Biphenyls (PCBs)

Sample Name:	BEI02 g	**Units:**	u/ WK/
Lab Code:	K131376- 041g	**Basis:**	F et
Extraction Method:	EPA 3gH1	**Level:**	Low
Analysis Method:	545- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	UN	G	9.9	- .5	1	1- W81W3	41W49WH	KF 8 1H44- 39	
Aroclor 1- - 1	UN	G	- 4	- .5	1	1- W81W3	41W49WH	KF 8 1H44- 39	
Aroclor 1- 3-	UN	G	9.9	- .5	1	1- W81W3	41W49WH	KF 8 1H44- 39	
Aroclor 1- H-	UN	G	9.9	- .5	1	1- W81W3	41W49WH	KF 8 1H44- 39	
Aroclor 1- H5	UN	G	9.9	- .5	1	1- W81W3	41W49WH	KF 8 1H44- 39	
Aroclor 1- gH	UN	G	9.9	- .5	1	1- W81W3	41W49WH	KF 8 1H44- 39	
Aroclor 1- 64	UN	G	9.9	- .5	1	1- W81W3	41W49WH	KF 8 1H44- 39	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
NecachloropiDhenyl	71	370139	41W49WH	AcceDtaple

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SF hdell MounL hurvey	**Date Collected:**	1- /14/- 413
Sample Matrix:	Animal tissue	**Date Received:**	1- /1H- 413

Polychlorinated Biphenyls (PCBs)

Sample Name:	F B209 1	**Units:**	ug/Kg
Lab Code:	K131376- 0416	**Basis:**	Wet
Extraction Method:	E2A 35S1	**Level:**	woP
Analysis Method:	848- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- - 1	ND	U	- 4	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- 3-	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- S-	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- S8	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- 5S	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- 64	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	7S	370l3H	41/4H/1S	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SF hdell MounL hurvey	**Date Collected:**	1- /14/- 413
Sample Matrix:	Animal tissue	**Date Received:**	1- /1H/- 413

Polychlorinated Biphenyls (PCBs)

Sample Name:	F B209 -	**Units:**	ug/Kg
Lab Code:	K131376- 0417	**Basis:**	Wet
Extraction Method:	E2A 35S1	**Level:**	woP
Analysis Method:	848- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- - 1	ND	U	- 4	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- 3-	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- S-	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- S8	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- 5S	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	
Aroclor 1- 64	ND	U	H8	- .8	1	1- /31/13	41/4H/1S	KWG1S44- 3H	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	68	370l3H	41/4H/1S	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	hB dLell Mounwdurvey	**Date Collected:**	1- W4W413
Sample Matrix:	Animal tissue	**Date Received:**	1- WSW413

Polychlorinated Biphenyls (PCBs)

Sample Name:	B2 90H3	**Units:**	u/ WK/
Lab Code:	K131376- 041g	**Basis:**	F et
Extraction Method:	E9A 38h1	**Level:**	Po5
Analysis Method:	g4g- A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	ND	U	S.g	- .g	1	1- W1W3	41W4SWh	KF G1h44- 3S	
Aroclor 1- - 1	ND	U	- 4	- .g	1	1- W1W3	41W4SWh	KF G1h44- 3S	
Aroclor 1- 3-	ND	U	S.g	- .g	1	1- W1W3	41W4SWh	KF G1h44- 3S	
Aroclor 1- h-	ND	U	S.g	- .g	1	1- W1W3	41W4SWh	KF G1h44- 3S	
Aroclor 1- hg	ND	U	S.g	- .g	1	1- W1W3	41W4SWh	KF G1h44- 3S	
Aroclor 1- 8h	ND	U	S.g	- .g	1	1- W1W3	41W4SWh	KF G1h44- 3S	
Aroclor 1- 64	ND	U	S.g	- .g	1	1- W1W3	41W4SWh	KF G1h44- 3S	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
DecacLlorobipLenyl	76	370l3S	41W4SWh	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SB hdell MounL hurvey	**Date Collected:**	1-W4W413
Sample Matrix:	Animal tissue	**Date Received:**	1-WgW413

Polychlorinated Biphenyls (PCBs)

Sample Name:	B2 90HS	**Units:**	u/ WK/
Lab Code:	K131376-041g	**Basis:**	F et
Extraction Method:	E9A 35S1	**Level:**	woP
Analysis Method:	848-A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	ND	U	g.g	-.8	1	1-W1W3	41W4gWS	KF G1S44-3g	
Aroclor 1--1	ND	U	-4	-.8	1	1-W1W3	41W4gWS	KF G1S44-3g	
Aroclor 1-3-	ND	U	g.g	-.8	1	1-W1W3	41W4gWS	KF G1S44-3g	
Aroclor 1-S-	ND	U	g.g	-.8	1	1-W1W3	41W4gWS	KF G1S44-3g	
Aroclor 1-S8	ND	U	g.g	-.8	1	1-W1W3	41W4gWS	KF G1S44-3g	
Aroclor 1-5S	ND	U	g.g	-.8	1	1-W1W3	41W4gWS	KF G1S44-3g	
Aroclor 1-64	ND	U	g.g	-.8	1	1-W1W3	41W4gWS	KF G1S44-3g	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	7S	370l3g	41W4gWS	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	hF dLell Mounwdurvey	**Date Collected:**	1-/14/-413
Sample Matrix:	Animal tissue	**Date Received:**	1-/1S/-413

Polychlorinated Biphenyls (PCBs)

Sample Name:	F B209 H	**Units:**	ug/Kg
Lab Code:	K131376-04-4	**Basis:**	Wet
Extraction Method:	E2A 3Hh1	**Level:**	Po5
Analysis Method:	848-A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1416	ND	U	S.S	-.8	1	1-/31/13	41/4S/1h	KWG1h44-3S	
Aroclor 1--1	ND	U	-4	-.8	1	1-/31/13	41/4S/1h	KWG1h44-3S	
Aroclor 1-3-	ND	U	S.S	-.8	1	1-/31/13	41/4S/1h	KWG1h44-3S	
Aroclor 1-h-	ND	U	S.S	-.8	1	1-/31/13	41/4S/1h	KWG1h44-3S	
Aroclor 1-h8	ND	U	S.S	-.8	1	1-/31/13	41/4S/1h	KWG1h44-3S	
Aroclor 1-Hh	ND	U	S.S	-.8	1	1-/31/13	41/4S/1h	KWG1h44-3S	
Aroclor 1-64	ND	U	S.S	-.8	1	1-/31/13	41/4S/1h	KWG1h44-3S	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
DecacLlorobipLenyl	81	370l3S	41/4S/1h	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376W
Project:	0H Shell Mound Survey	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	NA

Polychlorinated Biphenyls (PCBs)

Sample Name:	Method Blank	**Units:**	ug/Kg
Lab Code:	KG 4 1022W38-0	**Basis:**	G et
Extraction Method:	EPA 3501	**Level:**	Low
Analysis Method:	U2UWA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1216	N9	D	6.6	WU	1	1W31/13	21/28/10	KG 4 1022W38	
Aroclor 1WWI	N9	D	10	WU	1	1W31/13	21/28/10	KG 4 1022W38	
Aroclor 1W3W	N9	D	6.6	WU	1	1W31/13	21/28/10	KG 4 1022W38	
Aroclor 1W0W	N9	D	6.6	WU	1	1W31/13	21/28/10	KG 4 1022W38	
Aroclor 1W0U	N9	D	6.6	WU	1	1W31/13	21/28/10	KG 4 1022W38	
Aroclor 1W50	N9	D	6.6	WU	1	1W31/13	21/28/10	KG 4 1022W38	
Aroclor 1W62	N9	D	6.6	WU	1	1W31/13	21/28/10	KG 4 1022W38	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
9 ecachlorobiphenyl	U6	37-138	21/28/10	Acceptable

Comments:

Client: AMEC Environment & Infrastructure, Inc. **Service Request:** K131376L
Project: HS hde44Mouny hurveP
Sample Matrix: Anima4tissue

Surrogate Recovery Summary
Polychlorinated Biphenyls (PCBs)

Extraction Method: E5A 38H1 **Units:** 5ercent
Analysis Method: 020LA **Level:** wol

Sample Name	Lab Code	Sur1
S EI-A1	K131376L-221	0L
S EI-AL	K131376L-22L	71
S EI-A3	K131376L-223	76
S EI-AH	K131376L-22H	03
S EI-A8	K131376L-228	70
S 9 5-A1	K131376L-226	06
S 9 5-AL	K131376L-227	01
S 9 5-A3	K131376L-220	77
S 9 5-AH	K131376L-22O	08
S 9 5-A8	K131376L-212	0H
S EI-F 1	K131376L-211	01
S EI-F L	K131376L-21L	02
S EI-F 3	K131376L-213	7O
S EI-F H	K131376L-21H	7O
S EI-F 8	K131376L-218	71
S 9 5-F 1	K131376L-216	7H
S 9 5-F L	K131376L-217	60
S 9 5-F 3	K131376L-210	76
S 9 5-F H	K131376L-21O	7H
S 9 5-F 8	K131376L-2L2	01
Metdoy F 4anG	KB Wl H22L3O-H	06
S 9 5-F 8Mh	KB Wl H22L3O-1	03
S 9 5-F 8k Mh	KB Wl H22L3O-L	7H
waDContro4hamp4e	KB Wl H22L3O-3	7H

Surrogate Recovery Control Limits (%)

hur1 = k ecacd4broDipdenP4 37-13O

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	3 7676082
Project:	SF hdewMouny hurveP	**Date Extracted:**	72/67/2g76
Sample Matrix:	Animawtissue	**Date Analyzed:**	g7/gG/2g7S

Matrix Spike/Duplicate Matrix Spike Summary
Polychlorinated Biphenyls (PCBs)

Sample Name:	F - B5K1	**Units:**	ul /3 l
Lab Code:	3 76760825g2g	**Basis:**	L et
Extraction Method:	EBA 61S7	**Level:**	4 oH
Analysis Method:	WgW2A	**Extraction Lot:**	3 L D7Sgg26G

		F - B5K1Mh 3 L D7Sgg26G57 Matrix Spike			F - B5K1NMh 3 L D7Sgg26G52 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Arocwor 7g78	9 N	7Wg	7G1	G6	788	7GG	W6	S8572W	W	Sg
Arocwor 728g	9 N	786	7G1	WS	7SG	7GG	01	S8572W	G	Sg

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Bercent recoveries any rewative percent yifferences (RBN) are yeterminey bP tde softHare usinl vawues in tde cawcuwation Hdicd dave not been rounyey.

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313768
Project:	4h Sdell Mouny SurveP	**Date Extracted:**	18/31/8213
Sample Matrix:	Animal tissue	**Date Analyzed:**	21/2- /8214

Lab Control Spike Summary
Polychlorinated Biphenyls (PCBs)

Extraction Method:	E5A 3941	**Units:**	ug/Kg
Analysis Method:	0208A	**Basis:**	Wet
		Level:	LoH
		Extraction Lot:	KWG142283-

	Lab Control Sample KWG142283-w3 Lab Control Spike			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
Aroclor 1216	174	1-9	0-	46w180
Aroclor 1862	140	1-9	76	46w180

Results flagged with an asterisk (*) indicate values outside control criteria.

5ercent recoveries any relative percent yifferences (R5D) are yeterminey bP tde softHare using values in tde calculation Hdicd dave not been rounyey.

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	42 Shell Mound Survey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- W9Wg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	2 EI0A1	**Units:**	u/ WK/
Lab Code:	K131376- 0gg1	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8- 7gD SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	1g	1.5	1	1- W7W3	g1WgW4	KH G1314g65	
- 0Methylnaphthalene	ND	U	1g	1.-	1	1- W7W3	g1WgW4	KH G1314g65	
Acenaphthylene	ND	U	5.g	g.46	1	1- W7W3	g1WgW4	KH G1314g65	
Acenaphthene	ND	U	5.g	g.47	1	1- W7W3	g1WgW4	KH G1314g65	
DiJ enbofuran	ND	U	5.g	g.45	1	1- W7W3	g1WgW4	KH G1314g65	
zluorene	ND	U	5.g	g.5-	1	1- W7W3	g1WgW4	KH G1314g65	
Phenanthrene	**1.5**	F	5.g	g.66	1	1- W7W3	g1WgW4	KH G1314g65	
Anthracene	ND	U	5.g	g.38	1	1- W7W3	g1WgW4	KH G1314g65	
zluoranthene	**1.7**	F	5.g	g.49	1	1- W7W3	g1WgW4	KH G1314g65	
Pyrene	**4.4**	F	5.g	g.5g	1	1- W7W3	g1WgW4	KH G1314g65	
Benb(a)anthracene	**0.66**	F	5.g	g.38	1	1- W7W3	g1WgW4	KH G1314g65	*
Chrysene	ND	U	5.g	g.55	1	1- W7W3	g1WgW4	KH G1314g65	
Benbo(J)fluoranthene	ND	U	5.g	g.66	1	1- W7W3	g1WgW4	KH G1314g65	*
Benbo(k)fluoranthene	ND	U	5.g	g.57	1	1- W7W3	g1WgW4	KH G1314g65	
Benbo(a)pyrene	ND	U	5.g	g.73	1	1- W7W3	g1WgW4	KH G1314g65	
Indeno(1,- ,30cd)pyrene	ND	U	5.g	g.96	1	1- W7W3	g1WgW4	KH G1314g65	
DiJ enb(a,h)anthracene	ND	U	5.g	g.86	1	1- W7W3	g1WgW4	KH G1314g65	
Benbo(/ ,h,i)perylene	ND	U	5.g	g.95	1	1- W7W3	g1WgW4	KH G1314g65	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
zluorene0d1g	77	39096	g1WgW4	AcceptaJ le
zluoranthene0d1g	86	4101gg	g1WgW4	AcceptaJ le
Terphenyl0d14	9-	390111	g1WgW4	AcceptaJ le

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	42 Shell Mound Survey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- W9Wg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	2 EI0A-	**Units:**	u/ WK/
Lab Code:	K131376- 0gg-	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8- 7gD SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	**1.6**	U	9.9	1.5	1	1- W7W3	g1WgW4	KH G1314g65	
- 0Methylnaphthalene	ND	J	9.9	1.-	1	1- W7W3	g1WgW4	KH G1314g65	
Acenaphthylene	ND	J	5.g	g.46	1	1- W7W3	g1WgW4	KH G1314g65	
Acenaphthene	ND	J	5.g	g.47	1	1- W7W3	g1WgW4	KH G1314g65	
Dibenzofuran	ND	J	5.g	g.45	1	1- W7W3	g1WgW4	KH G1314g65	
Fluorene	ND	J	5.g	g.5-	1	1- W7W3	g1WgW4	KH G1314g65	
Phenanthrene	**1.2**	U	5.g	g.66	1	1- W7W3	g1WgW4	KH G1314g65	
Anthracene	ND	J	5.g	g.38	1	1- W7W3	g1WgW4	KH G1314g65	
Fluoranthene	**0.89**	U	5.g	g.49	1	1- W7W3	g1WgW4	KH G1314g65	
Pyrene	ND	J i	5.g	1.1	1	1- W7W3	g1WgW4	KH G1314g65	
Benz(a)anthracene	**0.54**	U	5.g	g.38	1	1- W7W3	g1WgW4	KH G1314g65	*
Chrysene	ND	J	5.g	g.55	1	1- W7W3	g1WgW4	KH G1314g65	
Benzo(b)fluoranthene	ND	J	5.g	g.66	1	1- W7W3	g1WgW4	KH G1314g65	*
Benzo(k)fluoranthene	ND	J	5.g	g.57	1	1- W7W3	g1WgW4	KH G1314g65	
Benzo(a)pyrene	ND	J	5.g	g.73	1	1- W7W3	g1WgW4	KH G1314g65	
Indeno(1,- ,30cd)pyrene	ND	J	5.g	g.95	1	1- W7W3	g1WgW4	KH G1314g65	
Dibenz(a,h)anthracene	ND	J	5.g	g.85	1	1- W7W3	g1WgW4	KH G1314g65	
Benzo(/ ,h,i)perylene	ND	J	5.g	g.94	1	1- W7W3	g1WgW4	KH G1314g65	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene0d1g	75	39096	g1WgW4	Acceptable
Fluoranthene0d1g	85	4101gg	g1WgW4	Acceptable
Terphenyl0d14	9g	390111	g1WgW4	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	42 Shell Mound Survey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W9Wg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	2 EI0A3	**Units:**	u/ WK/
Lab Code:	K131376-0gg3	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8-7gD SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	8.8	1.4	1	1-W7W3	g1WgW4	KH G1314g65	
-0Methylnaphthalene	ND	U	8.8	1.1	1	1-W7W3	g1WgW4	KH G1314g65	
Acenaphthylene	ND	U	4.4	g.41	1	1-W7W3	g1WgW4	KH G1314g65	
Acenaphthene	ND	U	4.4	g.4-	1	1-W7W3	g1WgW4	KH G1314g65	
DiJenbofuran	ND	U	4.4	g.4g	1	1-W7W3	g1WgW4	KH G1314g65	
zluorene	ND	U	4.4	g.46	1	1-W7W3	g1WgW4	KH G1314g65	
Phenanthrene	**2.1**	F	4.4	g.59	1	1-W7W3	g1WgW4	KH G1314g65	
Anthracene	ND	U	4.4	g.34	1	1-W7W3	g1WgW4	KH G1314g65	
zluoranthene	**1.3**	F	4.4	g.44	1	1-W7W3	g1WgW4	KH G1314g65	
Pyrene	**2.2**	F	4.4	g.44	1	1-W7W3	g1WgW4	KH G1314g65	
Benb(a)anthracene	**0.55**	F	4.4	g.34	1	1-W7W3	g1WgW4	KH G1314g65	*
Chrysene	ND	U	4.4	g.49	1	1-W7W3	g1WgW4	KH G1314g65	
Benbo(J)fluoranthene	ND	U	4.4	g.59	1	1-W7W3	g1WgW4	KH G1314g65	*
Benbo(k)fluoranthene	ND	U	4.4	g.51	1	1-W7W3	g1WgW4	KH G1314g65	
Benbo(a)pyrene	ND	U	4.4	g.65	1	1-W7W3	g1WgW4	KH G1314g65	
Indeno(1,-,30cd)pyrene	ND	U	4.4	g.85	1	1-W7W3	g1WgW4	KH G1314g65	
DiJenb(a,h)anthracene	ND	U	4.4	g.76	1	1-W7W3	g1WgW4	KH G1314g65	
Benbo(/,h,i)perylene	ND	U	4.4	g.84	1	1-W7W3	g1WgW4	KH G1314g65	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
zluorene0d1g	8g	39096	g1WgW4	AcceptaJle
zluoranthene0d1g	86	4101gg	g1WgW4	AcceptaJle
Terphenyl0d14	96	390111	g1WgW4	AcceptaJle

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	/ 9 Shell Mound Survey	**Date Collected:**	1- HgHg13
Sample Matrix:	Animal tissue	**Date Received:**	1- H4Hg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	9 EI0A/	**Units:**	uWHKW
Lab Code:	K131376- 0gg/	**Basis:**	2 et
Extraction Method:	EPA 35/ 1	**Level:**	Low
Analysis Method:	8- 7gD SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	4.4	1.5	1	1- H7H3	g1HgH/	K2 G131/ g65	
- 0Methylnaphthalene	ND	U	4.4	1.-	1	1- H7H3	g1HgH/	K2 G131/ g65	
Acenaphthylene	ND	U	5.g	g./ 6	1	1- H7H3	g1HgH/	K2 G131/ g65	
Acenaphthene	ND	U	5.g	g./ 7	1	1- H7H3	g1HgH/	K2 G131/ g65	
DiJ enbofuran	ND	U	5.g	g./ 5	1	1- H7H3	g1HgH/	K2 G131/ g65	
zluorene	ND	U	5.g	g.5-	1	1- H7H3	g1HgH/	K2 G131/ g65	
Phenanthrene	**1.3**	F	5.g	g.66	1	1- H7H3	g1HgH/	K2 G131/ g65	
Anthracene	ND	U	5.g	g.38	1	1- H7H3	g1HgH/	K2 G131/ g65	
zluoranthene	**1.0**	F	5.g	g./ 4	1	1- H7H3	g1HgH/	K2 G131/ g65	
Pyrene	ND	Ui	5.g	1.3	1	1- H7H3	g1HgH/	K2 G131/ g65	
Benb(a)anthracene	**0.56**	F	5.g	g.38	1	1- H7H3	g1HgH/	K2 G131/ g65	*
Chrysene	ND	U	5.g	g.55	1	1- H7H3	g1HgH/	K2 G131/ g65	
Benbo(J)fluoranthene	ND	U	5.g	g.66	1	1- H7H3	g1HgH/	K2 G131/ g65	*
Benbo(k)fluoranthene	ND	U	5.g	g.57	1	1- H7H3	g1HgH/	K2 G131/ g65	
Benbo(a)pyrene	ND	U	5.g	g.73	1	1- H7H3	g1HgH/	K2 G131/ g65	
Indeno(1,- ,30cd)pyrene	ND	U	5.g	g.45	1	1- H7H3	g1HgH/	K2 G131/ g65	
DiJ enb(a,h)anthracene	ND	U	5.g	g.85	1	1- H7H3	g1HgH/	K2 G131/ g65	
Benbo(W,h,i)perylene	ND	U	5.g	g.4/	1	1- H7H3	g1HgH/	K2 G131/ g65	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
zluorene0d1g	7/	34046	g1HgH/	AcceptaJ le
zluoranthene0d1g	83	/ 10lgg	g1HgH/	AcceptaJ le
Terphenyl0d1/	87	340l11	g1HgH/	AcceptaJ le

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	S9 hdell MounL hurvey	**Date Collected:**	1- HgH-g13
Sample Matrix:	Animal tissue	**Date Received:**	1- H4H-g13

Polynuclear Aromatic Hydrocarbons

Sample Name:	9 EI0A/	**Units:**	uWHKW
Lab Code:	K131376- 0gg/	**Basis:**	2 et
Extraction Method:	E5A 3/ S1	**Level:**	woP
Analysis Method:	8- 7gD hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Napdtdalene	ND	U	4.3	1.S	1	1- H7H3	g1HgHS	K2 G131Sg6/	
- 0Metdylnapdtdalene	ND	U	4.3	1.-	1	1- H7H3	g1HgHS	K2 G131Sg6/	
Acenapdtdylene	ND	U	S.7	g.S3	1	1- H7H3	g1HgHS	K2 G131Sg6/	
Acenapdtdene	ND	U	S.7	g.SS	1	1- H7H3	g1HgHS	K2 G131Sg6/	
DiJ enbofuran	ND	U	S.7	g.S-	1	1- H7H3	g1HgHS	K2 G131Sg6/	
zluorene	ND	U	S.7	g.S8	1	1- H7H3	g1HgHS	K2 G131Sg6/	
5denantdrene	**0.87**	F	S.7	g.61	1	1- H7H3	g1HgHS	K2 G131Sg6/	
Antdracene	ND	U	S.7	g.3/	1	1- H7H3	g1HgHS	K2 G131Sg6/	
zluorantdene	ND	U	S.7	g.S6	1	1- H7H3	g1HgHS	K2 G131Sg6/	
5yrene	ND	Ui	S.7	g.S4	1	1- H7H3	g1HgHS	K2 G131Sg6/	
Benb(a)antdracene	ND	U	S.7	g.3/	1	1- H7H3	g1HgHS	K2 G131Sg6/	*
Cdrysene	ND	U	S.7	g./ 1	1	1- H7H3	g1HgHS	K2 G131Sg6/	
Benbo(J)fluorantdene	ND	U	S.7	g.61	1	1- H7H3	g1HgHS	K2 G131Sg6/	*
Benbo(k)fluorantdene	ND	U	S.7	g./ 3	1	1- H7H3	g1HgHS	K2 G131Sg6/	
Benbo(a)pyrene	ND	U	S.7	g.68	1	1- H7H3	g1HgHS	K2 G131Sg6/	
InLeno(1,- ,30cL)pyrene	ND	U	S.7	g.84	1	1- H7H3	g1HgHS	K2 G131Sg6/	
DiJ enb(a,d)antdracene	ND	U	S.7	g.8g	1	1- H7H3	g1HgHS	K2 G131Sg6/	
Benbo(W,d,i)perylene	ND	U	S.7	g.88	1	1- H7H3	g1HgHS	K2 G131Sg6/	

* hee Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
zluorene0L1g	6/	34046	g1HgHS	AcceptaJ le
zluorantdene0L1g	7-	S10lgg	g1HgHS	AcceptaJ le
Terpdenyl0L1S	76	340l11	g1HgHS	AcceptaJ le

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	4O Shell Mound Survey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- W9Wg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	OP 20A1	**Units:**	u/ WK/
Lab Code:	K131376- 0gg6	**Basis:**	H et
Extraction Method:	E2A 3541	**Level:**	Low
Analysis Method:	8- 7gD SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	8.7	1.3	1	1- W7W3	g1WgW4	KH G1314g65	
- 0Methylnaphthalene	ND	U	8.7	1.1	1	1- W7W3	g1WgW4	KH G1314g65	
Acenaphthylene	ND	U	4.4	g.4g	1	1- W7W3	g1WgW4	KH G1314g65	
Acenaphthene	ND	U	4.4	g.41	1	1- W7W3	g1WgW4	KH G1314g65	
Dibenzofuran	ND	U	4.4	g.39	1	1- W7W3	g1WgW4	KH G1314g65	
Fluorene	ND	U	4.4	g.46	1	1- W7W3	g1WgW4	KH G1314g65	
2henanthrene	**1.2**	J	4.4	g.58	1	1- W7W3	g1WgW4	KH G1314g65	
Anthracene	ND	U	4.4	g.33	1	1- W7W3	g1WgW4	KH G1314g65	
Fluoranthene	ND	U	4.4	g.43	1	1- W7W3	g1WgW4	KH G1314g65	
2yrene	ND	Ui	4.4	g.46	1	1- W7W3	g1WgW4	KH G1314g65	
Benz(a)anthracene	ND	U	4.4	g.33	1	1- W7W3	g1WgW4	KH G1314g65	*
Chrysene	ND	U	4.4	g.48	1	1- W7W3	g1WgW4	KH G1314g65	
Benzo(b)fluoranthene	ND	U	4.4	g.58	1	1- W7W3	g1WgW4	KH G1314g65	*
Benzo(k)fluoranthene	ND	U	4.4	g.5g	1	1- W7W3	g1WgW4	KH G1314g65	
Benzo(a)pyrene	ND	U	4.4	g.64	1	1- W7W3	g1WgW4	KH G1314g65	
Indeno(1,- ,30cd)pyrene	ND	U	4.4	g.84	1	1- W7W3	g1WgW4	KH G1314g65	
Dibenz(a,h)anthracene	ND	U	4.4	g.75	1	1- W7W3	g1WgW4	KH G1314g65	
Benzo(/ ,h,i)perylene	ND	U	4.4	g.83	1	1- W7W3	g1WgW4	KH G1314g65	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene0d1g	76	39096	g1WgW4	Acceptable
Fluoranthene0d1g	8-	4101gg	g1WgW4	Acceptable
Terphenyl0d14	88	390111	g1WgW4	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	4O Shell Mound Survey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- W9Wg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	OP 20A-	**Units:**	u/ WK/
Lab Code:	K131376- 0gg7	**Basis:**	H et
Extraction Method:	E2A 3541	**Level:**	Low
Analysis Method:	8- 7gD SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	9.1	1.4	1	1- W7W3	g1WgW4	KH G1314g65	
- 0Methylnaphthalene	ND	U	9.1	1.1	1	1- W7W3	g1WgW4	KH G1314g65	
Acenaphthylene	ND	U	4.6	g.4-	1	1- W7W3	g1WgW4	KH G1314g65	
Acenaphthene	ND	U	4.6	g.43	1	1- W7W3	g1WgW4	KH G1314g65	
Dibenzofuran	ND	U	4.6	g.41	1	1- W7W3	g1WgW4	KH G1314g65	
Fluorene	ND	U	4.6	g.48	1	1- W7W3	g1WgW4	KH G1314g65	
2henanthrene	**0.87**	J	4.6	g.6g	1	1- W7W3	g1WgW4	KH G1314g65	
Anthracene	ND	U	4.6	g.35	1	1- W7W3	g1WgW4	KH G1314g65	
Fluoranthene	**0.72**	J	4.6	g.45	1	1- W7W3	g1WgW4	KH G1314g65	
2yrene	**1.3**	J	4.6	g.46	1	1- W7W3	g1WgW4	KH G1314g65	
Benz(a)anthracene	ND	U	4.6	g.35	1	1- W7W3	g1WgW4	KH G1314g65	*
Chrysene	ND	U	4.6	g.5g	1	1- W7W3	g1WgW4	KH G1314g65	
Benzo(b)fluoranthene	ND	U	4.6	g.6g	1	1- W7W3	g1WgW4	KH G1314g65	*
Benzo(k)fluoranthene	ND	U	4.6	g.5-	1	1- W7W3	g1WgW4	KH G1314g65	
Benzo(a)pyrene	ND	U	4.6	g.67	1	1- W7W3	g1WgW4	KH G1314g65	
Indeno(1,- ,30cd)pyrene	ND	U	4.6	g.88	1	1- W7W3	g1WgW4	KH G1314g65	
Dibenz(a,h)anthracene	ND	U	4.6	g.79	1	1- W7W3	g1WgW4	KH G1314g65	
Benzo(/ ,h,i)perylene	ND	U	4.6	g.87	1	1- W7W3	g1WgW4	KH G1314g65	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene0d1g	65	39096	g1WgW4	Acceptable
Fluoranthene0d1g	76	4101gg	g1WgW4	Acceptable
Terphenyl0d14	79	390111	g1WgW4	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SP hdell MounL hurvey	**Date Collected:**	1- HgHg13
Sample Matrix:	Animal tissue	**Date Received:**	1- H4Hg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	P 2 90A3	**Units:**	uWHKW
Lab Code:	K131376- 0gg/	**Basis:**	O et
Extraction Method:	E9A 38S1	**Level:**	wo5
Analysis Method:	/ - 7gD hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Napdtdalene	ND	U	1g	1.8	1	1- H7H3	g1HgHS	KO G131Sg68	
- 0Metdylnapdtdalene	ND	U	1g	1.-	1	1- H7H3	g1HgHS	KO G131Sg68	
Acenapdtdylene	ND	U	8.g	g.S6	1	1- H7H3	g1HgHS	KO G131Sg68	
Acenapdtdene	ND	U	8.g	g.S7	1	1- H7H3	g1HgHS	KO G131Sg68	
Dibenzofuran	ND	U	8.g	g.S8	1	1- H7H3	g1HgHS	KO G131Sg68	
Fluorene	ND	U	8.g	g.8-	1	1- H7H3	g1HgHS	KO G131Sg68	
9denantdrene	**1.2**	J	8.g	g.66	1	1- H7H3	g1HgHS	KO G131Sg68	
Antdracene	ND	U	8.g	g.3/	1	1- H7H3	g1HgHS	KO G131Sg68	
Fluorantdene	**0.84**	J	8.g	g.S4	1	1- H7H3	g1HgHS	KO G131Sg68	
9yrene	ND	Ui	8.g	1.6	1	1- H7H3	g1HgHS	KO G131Sg68	
Benz(a)antdracene	ND	U	8.g	g.3/	1	1- H7H3	g1HgHS	KO G131Sg68	*
Cdrysene	ND	U	8.g	g.88	1	1- H7H3	g1HgHS	KO G131Sg68	
Benzo(b)fluorantdene	ND	U	8.g	g.66	1	1- H7H3	g1HgHS	KO G131Sg68	*
Benzo(k)fluorantdene	ND	U	8.g	g.87	1	1- H7H3	g1HgHS	KO G131Sg68	
Benzo(a)pyrene	ND	U	8.g	g.73	1	1- H7H3	g1HgHS	KO G131Sg68	
InLeno(1,- ,30cL)pyrene	ND	U	8.g	g.46	1	1- H7H3	g1HgHS	KO G131Sg68	
Dibenz(a,d)antdracene	ND	U	8.g	g./ 6	1	1- H7H3	g1HgHS	KO G131Sg68	
Benzo(W,d,i)perylene	ND	U	8.g	g.48	1	1- H7H3	g1HgHS	KO G131Sg68	

* hee Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene0L1g	66	34046	g1HgHS	Acceptable
Fluorantdene0L1g	73	S101gg	g1HgHS	Acceptable
Terpdenyl0L1S	7/	340111	g1HgHS	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	4P Shell Mound Survey	**Date Collected:**	1- HgHg13
Sample Matrix:	Animal tissue	**Date Received:**	1- H/ Hg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	P 2 90A4	**Units:**	uWHKW
Lab Code:	K131376- 0gg/	**Basis:**	O et
Extraction Method:	E9A 3541	**Level:**	Low
Analysis Method:	8- 7gD SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	**2.2**	U	/ .8	1.5	1	1- H7H3	g1HgH4	KO G1314g65	
- 0Methylnaphthalene	ND	b	/ .8	1.-	1	1- H7H3	g1HgH4	KO G1314g65	
Acenaphthylene	ND	b	4./	g.46	1	1- H7H3	g1HgH4	KO G1314g65	
Acenaphthene	ND	b	4./	g.47	1	1- H7H3	g1HgH4	KO G1314g65	
DizenFofuran	**0.49**	U	4./	g.45	1	1- H7H3	g1HgH4	KO G1314g65	
J luorene	ND	b	4./	g.51	1	1- H7H3	g1HgH4	KO G1314g65	
9henanthrene	**1.6**	U	4./	g.65	1	1- H7H3	g1HgH4	KO G1314g65	
Anthracene	ND	b	4./	g.38	1	1- H7H3	g1HgH4	KO G1314g65	
J luoranthene	ND	b	4./	g.48	1	1- H7H3	g1HgH4	KO G1314g65	
9yrene	ND	b i	4./	g.74	1	1- H7H3	g1HgH4	KO G1314g65	
BenF(a)anthracene	ND	b	4./	g.38	1	1- H7H3	g1HgH4	KO G1314g65	*
Chrysene	ND	b	4./	g.54	1	1- H7H3	g1HgH4	KO G1314g65	
BenFo(z)fluoranthene	ND	b	4./	g.65	1	1- H7H3	g1HgH4	KO G1314g65	*
BenFo(k)fluoranthene	ND	b	4./	g.56	1	1- H7H3	g1HgH4	KO G1314g65	
BenFo(a)pyrene	ND	b	4./	g.7-	1	1- H7H3	g1HgH4	KO G1314g65	
Indeno(1,- ,30cd)pyrene	ND	b	4./	g./ 5	1	1- H7H3	g1HgH4	KO G1314g65	
DizenF(a,h)anthracene	ND	b	4./	g.85	1	1- H7H3	g1HgH4	KO G1314g65	
BenFo(Wh,i)perylene	ND	b	4./	g./ 4	1	1- H7H3	g1HgH4	KO G1314g65	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
J luorene0d1g	65	3/ 0/ 6	g1HgH4	Acceptazle
J luoranthene0d1g	7-	4101gg	g1HgH4	Acceptazle
Terphenyl0d14	76	3/ 0111	g1HgH4	Acceptazle

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SO hdell MounL hurvey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W4Wg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	OP 20A9	**Units:**	u/ WK/
Lab Code:	K131376-0g1g	**Basis:**	H et
Extraction Method:	E2A 39S1	**Level:**	wo5
Analysis Method:	8-7gD hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Napdtdalene	ND	U	8.6	1.3	1	1-W7W3	g1WgWS	KH G131Sg69	
-0Metdylnapdtdalene	ND	U	8.6	1.1	1	1-W7W3	g1WgWS	KH G131Sg69	
Acenapdtdylene	ND	U	S.3	g.Sg	1	1-W7W3	g1WgWS	KH G131Sg69	
Acenapdtdene	ND	U	S.3	g.S1	1	1-W7W3	g1WgWS	KH G131Sg69	
DizenFofuran	**0.41**	b	S.3	g.34	1	1-W7W3	g1WgWS	KH G131Sg69	
J luorene	ND	U	S.3	g.S9	1	1-W7W3	g1WgWS	KH G131Sg69	
2denantdrene	**2.8**	b	S.3	g.97	1	1-W7W3	g1WgWS	KH G131Sg69	
Antdracene	ND	U	S.3	g.33	1	1-W7W3	g1WgWS	KH G131Sg69	
J luorantdene	**2.4**	b	S.3	g.S-	1	1-W7W3	g1WgWS	KH G131Sg69	
2yrene	**2.2**	b	S.3	g.S3	1	1-W7W3	g1WgWS	KH G131Sg69	
BenF(a)antdracene	**0.89**	b	S.3	g.33	1	1-W7W3	g1WgWS	KH G131Sg69	*
Cdrysene	**0.62**	b	S.3	g.S7	1	1-W7W3	g1WgWS	KH G131Sg69	
BenFo(z)fluorantdene	**0.57**	b	S.3	g.97	1	1-W7W3	g1WgWS	KH G131Sg69	*
BenFo(k)fluorantdene	ND	U	S.3	g.S4	1	1-W7W3	g1WgWS	KH G131Sg69	
BenFo(a)pyrene	ND	U	S.3	g.63	1	1-W7W3	g1WgWS	KH G131Sg69	
InLeno(1,-,30cL)pyrene	ND	U	S.3	g.8-	1	1-W7W3	g1WgWS	KH G131Sg69	
DizenF(a,d)antdracene	ND	U	S.3	g.7S	1	1-W7W3	g1WgWS	KH G131Sg69	
BenFo(/ ,d,i)perylene	ND	U	S.3	g.81	1	1-W7W3	g1WgWS	KH G131Sg69	

* hee Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
J luorene0L1g	7S	34046	g1WgWS	Acceptazle
J luorantdene0L1g	89	S101gg	g1WgWS	Acceptazle
Terpdenyl0L1S	86	340111	g1WgWS	Acceptazle

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	S2 hdell MounL hurvey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- W4Wg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	2 EI09 1	**Units:**	u/ WK/
Lab Code:	K131376- 0g11	**Basis:**	H et
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	D- 7gG hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p aJ dtdalene	p G	N	4.4	1.8	1	1- W7W3	g1 WgWS	KH U131Sg68	
- 0MetdylnaJ dtdalene	p G	N	4.4	1.-	1	1- W7W3	g1 WgWS	KH U131Sg68	
AcenaJ dtdylene	p G	N	8.g	g.S6	1	1- W7W3	g1 WgWS	KH U131Sg68	
AcenaJ dtdene	p G	N	8.g	g.S7	1	1- W7W3	g1 WgWS	KH U131Sg68	
Gibenzofuran	p G	N	8.g	g.S8	1	1- W7W3	g1 WgWS	KH U131Sg68	
Fluorene	p G	N	8.g	g.8-	1	1- W7W3	g1 WgWS	KH U131Sg68	
5denantdrene	**1.9**	*	8.g	g.66	1	1- W7W3	g1 WgWS	KH U131Sg68	
Antdracene	p G	N	8.g	g.3D	1	1- W7W3	g1 WgWS	KH U131Sg68	
Fluorantdene	**1.5**	*	8.g	g.S4	1	1- W7W3	g1 WgWS	KH U131Sg68	
5yrene	p G	Ni	8.g	1.D	1	1- W7W3	g1 WgWS	KH U131Sg68	
9 enz(a)antdracene	**0.78**	*	8.g	g.3D	1	1- W7W3	g1 WgWS	KH U131Sg68	B
Cdrysene	p G	N	8.g	g.88	1	1- W7W3	g1 WgWS	KH U131Sg68	
9 enzo(b)fluorantdene	p G	N	8.g	g.66	1	1- W7W3	g1 WgWS	KH U131Sg68	B
9 enzo(k)fluorantdene	p G	N	8.g	g.87	1	1- W7W3	g1 WgWS	KH U131Sg68	
9 enzo(a)J yrene	p G	N	8.g	g.73	1	1- W7W3	g1 WgWS	KH U131Sg68	
InLeno(1,- ,30cL)J yrene	p G	N	8.g	g.48	1	1- W7W3	g1 WgWS	KH U131Sg68	
Gibenz(a,d)antdracene	p G	N	8.g	g.D6	1	1- W7W3	g1 WgWS	KH U131Sg68	
9 enzo(/ ,d,i)J erylene	p G	N	8.g	g.4S	1	1- W7W3	g1 WgWS	KH U131Sg68	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene0L1g	Dg	34046	g1 WgWS	AcceJ table
Fluorantdene0L1g	D6	S101gg	g1 WgWS	AcceJ table
TerJ denyl0L1S	46	340111	g1 WgWS	AcceJ table

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	S2 hdell MounL hurvey	**Date Collected:**	1-WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1-W4Wg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	2 EI09-	**Units:**	u/ WK/
Lab Code:	K131376-0g1-	**Basis:**	H et
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	D-7gG hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p aJ dtdalene	p G	N	4.-	1.S	1	1-W7W3	g1WgWS	KH U131Sg68	
-0MetdylnaJ dtdalene	p G	N	4.-	1.-	1	1-W7W3	g1WgWS	KH U131Sg68	
AcenaJ dtdylene	p G	N	S.6	g.S3	1	1-W7W3	g1WgWS	KH U131Sg68	
AcenaJ dtdene	p G	N	S.6	g.SS	1	1-W7W3	g1WgWS	KH U131Sg68	
GizenFofuran	**0.54**	b	S.6	g.S-	1	1-W7W3	g1WgWS	KH U131Sg68	
*luorene	**0.54**	b	S.6	g.SD	1	1-W7W3	g1WgWS	KH U131Sg68	
5denantdrene	**3.6**	b	S.6	g.61	1	1-W7W3	g1WgWS	KH U131Sg68	
Antdracene	p G	N	S.6	g.38	1	1-W7W3	g1WgWS	KH U131Sg68	
*luorantdene	**2.2**	b	S.6	g.S8	1	1-W7W3	g1WgWS	KH U131Sg68	
5yrene	**4.2**	b	S.6	g.S6	1	1-W7W3	g1WgWS	KH U131Sg68	
9 enF(a)antdracene	**0.63**	b	S.6	g.38	1	1-W7W3	g1WgWS	KH U131Sg68	B
Cdrysene	p G	N	S.6	g.81	1	1-W7W3	g1WgWS	KH U131Sg68	
9 enFo(z)fluorantdene	p G	N	S.6	g.61	1	1-W7W3	g1WgWS	KH U131Sg68	B
9 enFo(k)fluorantdene	p G	N	S.6	g.83	1	1-W7W3	g1WgWS	KH U131Sg68	
9 enFo(a)J yrene	p G	N	S.6	g.6D	1	1-W7W3	g1WgWS	KH U131Sg68	
InLeno(1,-,30cL)J yrene	p G	N	S.6	g.D4	1	1-W7W3	g1WgWS	KH U131Sg68	
GizenF(a,d)antdracene	p G	N	S.6	g.74	1	1-W7W3	g1WgWS	KH U131Sg68	
9 enFo(/ ,d,i)J erylene	p G	N	S.6	g.DD	1	1-W7W3	g1WgWS	KH U131Sg68	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
*luorene0L1g	7S	34046	g1WgWS	AcceJ tazle
*luorantdene0L1g	7D	S101gg	g1WgWS	AcceJ tazle
TerJ denyl0L1S	4g	340111	g1WgWS	AcceJ tazle

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	S2 hdell MounL hurvey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- W4Wg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	2 EI09 3	**Units:**	u/ WK/
Lab Code:	K131376- 0g13	**Basis:**	H et
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	D- 7gG hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p abdtdalene	p G	N	4.4	1.8	1	1- W7W3	g1WgWS	KH U131Sg68	
- 0Metdylnabdtdalene	p G	N	4.4	1.-	1	1- W7W3	g1WgWS	KH U131Sg68	
Acenabdtdylene	p G	N	8.g	g.S6	1	1- W7W3	g1WgWS	KH U131Sg68	
Acenabdtdene	**0.54**	zJ	8.g	g.S7	1	1- W7W3	g1WgWS	KH U131Sg68	
GiXenFofuran	p G	N	8.g	g.S8	1	1- W7W3	g1WgWS	KH U131Sg68	
*luorene	**0.53**	z	8.g	g.8-	1	1- W7W3	g1WgWS	KH U131Sg68	
5denantdrene	p G	N	8.g	g.68	1	1- W7W3	g1WgWS	KH U131Sg68	
Antdracene	p G	N	8.g	g.3D	1	1- W7W3	g1WgWS	KH U131Sg68	
*luorantdene	p G	N	8.g	g.S4	1	1- W7W3	g1WgWS	KH U131Sg68	
5yrene	p G	N	8.g	g.8g	1	1- W7W3	g1WgWS	KH U131Sg68	
9 enF(a)antdracene	p G	N	8.g	g.3D	1	1- W7W3	g1WgWS	KH U131Sg68	B
Cdrysene	p G	N	8.g	g.88	1	1- W7W3	g1WgWS	KH U131Sg68	
9 enFo(X)fluorantdene	p G	N	8.g	g.68	1	1- W7W3	g1WgWS	KH U131Sg68	B
9 enFo(k)fluorantdene	p G	N	8.g	g.87	1	1- W7W3	g1WgWS	KH U131Sg68	
9 enFo(a)byrene	p G	N	8.g	g.7-	1	1- W7W3	g1WgWS	KH U131Sg68	
InLeno(1,- ,30cL)byrene	p G	N	8.g	g.48	1	1- W7W3	g1WgWS	KH U131Sg68	
GiXenF(a,d)antdracene	p G	N	8.g	g.D8	1	1- W7W3	g1WgWS	KH U131Sg68	
9 enFo(/ ,d,i)berylene	p G	N	8.g	g.4S	1	1- W7W3	g1WgWS	KH U131Sg68	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
*luorene0L1g	77	34046	g1WgWS	AccebtaXle
*luorantdene0L1g	D8	S101gg	g1WgWS	AccebtaXle
Terbdenyl0L1S	41	340111	g1WgWS	AccebtaXle

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	/9 hdell MounL hurvey	**Date Collected:**	1-HgH-g13
Sample Matrix:	Animal tissue	**Date Received:**	1-HSH-g13

Polynuclear Aromatic Hydrocarbons

Sample Name:	9EI04/	**Units:**	uWHKW
Lab Code:	K131376-0g1/	**Basis:**	2 et
Extraction Method:	E5A 38/1	**Level:**	woP
Analysis Method:	D-7gG hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
paJdtdalene	pG	N	1g	1.8	1	1-H7H3	g1HgH/	K2 U131/g68	
-0MetdylnaJdtdalene	pG	N	1g	1.-	1	1-H7H3	g1HgH/	K2 U131/g68	
AcenaJdtdylene	pG	N	8.g	g./6	1	1-H7H3	g1HgH/	K2 U131/g68	
AcenaJdtdene	pG	N	8.g	g./7	1	1-H7H3	g1HgH/	K2 U131/g68	
GizenFofuran	**0.49**	b	8.g	g./8	1	1-H7H3	g1HgH/	K2 U131/g68	
*luorene	pG	N	8.g	g.8-	1	1-H7H3	g1HgH/	K2 U131/g68	
5denantdrene	**2.4**	b	8.g	g.66	1	1-H7H3	g1HgH/	K2 U131/g68	
Antdracene	pG	N	8.g	g.3D	1	1-H7H3	g1HgH/	K2 U131/g68	
*luorantdene	**1.6**	b	8.g	g./S	1	1-H7H3	g1HgH/	K2 U131/g68	
5yrene	**3.0**	b	8.g	g.8g	1	1-H7H3	g1HgH/	K2 U131/g68	
4enF(a)antdracene	pG	N	8.g	g.3D	1	1-H7H3	g1HgH/	K2 U131/g68	B
Cdrysene	pG	N	8.g	g.88	1	1-H7H3	g1HgH/	K2 U131/g68	
4enFo(z)fluorantdene	pG	N	8.g	g.66	1	1-H7H3	g1HgH/	K2 U131/g68	B
4enFo(k)fluorantdene	pG	N	8.g	g.87	1	1-H7H3	g1HgH/	K2 U131/g68	
4enFo(a)Jyrene	pG	N	8.g	g.73	1	1-H7H3	g1HgH/	K2 U131/g68	
InLeno(1,-,30cL)Jyrene	pG	N	8.g	g.S6	1	1-H7H3	g1HgH/	K2 U131/g68	
GizenF(a,d)antdracene	pG	N	8.g	g.D6	1	1-H7H3	g1HgH/	K2 U131/g68	
4enFo(W,d,i)Jerylene	pG	N	8.g	g.S8	1	1-H7H3	g1HgH/	K2 U131/g68	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
*luorene0L1g	D1	3S0S6	g1HgH/	AcceJtazle
*luorantdene0L1g	DD	/101gg	g1HgH/	AcceJtazle
TerJdenyl0L1/	S7	3S0111	g1HgH/	AcceJtazle

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	h9 dLell Mounwdurvey	**Date Collected:**	1- HgHg13
Sample Matrix:	Animal tissue	**Date Received:**	1- HSHg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	9 EI04 /	**Units:**	uWHKW
Lab Code:	K131376- 0g1/	**Basis:**	2 et
Extraction Method:	E8A 3/ h1	**Level:**	Po5
Analysis Method:	D- 7gG dIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p aJ LtLalene	p G	N	1g	1./	1	1- H7H3	g1HgHh	K2 U131hg6/	
- 0MetLylnaJ LtLalene	p G	N	1g	1.-	1	1- H7H3	g1HgHh	K2 U131hg6/	
AcenaJ LtLylene	p G	N	/ .g	g.h6	1	1- H7H3	g1HgHh	K2 U131hg6/	
AcenaJ LtLene	p G	N	/ .g	g.h7	1	1- H7H3	g1HgHh	K2 U131hg6/	
GizenFofuran	**2.04**	b	/ .g	g.h/	1	1- H7H3	g1HgHh	K2 U131hg6/	
*luorene	p G	N	/ .g	g./ -	1	1- H7H3	g1HgHh	K2 U131hg6/	
8LenantLrene	**9.1**	b	/ .g	g.66	1	1- H7H3	g1HgHh	K2 U131hg6/	
AntLracene	p G	N	/ .g	g.3D	1	1- H7H3	g1HgHh	K2 U131hg6/	
*luorantLene	**6.4**	b	/ .g	g.hS	1	1- H7H3	g1HgHh	K2 U131hg6/	
8yrene	p G	Ni	/ .g	- ./	1	1- H7H3	g1HgHh	K2 U131hg6/	
4 enF(a)antLracene	**2.40**	b	/ .g	g.3D	1	1- H7H3	g1HgHh	K2 U131hg6/	B
CLrysene	p G	N	/ .g	g./ /	1	1- H7H3	g1HgHh	K2 U131hg6/	
4 enFo(z)fluorantLene	p G	N	/ .g	g.66	1	1- H7H3	g1HgHh	K2 U131hg6/	B
4 enFo(k)fluorantLene	p G	N	/ .g	g./ 7	1	1- H7H3	g1HgHh	K2 U131hg6/	
4 enFo(a)J yrene	p G	N	/ .g	g.73	1	1- H7H3	g1HgHh	K2 U131hg6/	
Inweno(1,- ,30cw)J yrene	p G	N	/ .g	g.S6	1	1- H7H3	g1HgHh	K2 U131hg6/	
GizenF(a,L)antLracene	p G	N	/ .g	g.D6	1	1- H7H3	g1HgHh	K2 U131hg6/	
4 enFo(W,L,i)J erylene	p G	N	/ .g	g.S/	1	1- H7H3	g1HgHh	K2 U131hg6/	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
*luorene0wl g	D-	3S0S6	g1HgHh	AcceJ tazle
*luorantLene0wl g	DD	h10l gg	g1HgHh	AcceJ tazle
TerJ Lenyl0wl h	SD	3S0l 11	g1HgHh	AcceJ tazle

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HOP-B1	**Units:**	ug/Kg
Lab Code:	K1313762-016	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	8.6	1.3	1	12/27/13	01/10/14	KWG1314065	
2-Methylnaphthalene	ND	U	8.6	1.1	1	12/27/13	01/10/14	KWG1314065	
Acenaphthylene	ND	U	4.3	0.40	1	12/27/13	01/10/14	KWG1314065	
Acenaphthene	**1.8**	JX	4.3	0.41	1	12/27/13	01/10/14	KWG1314065	
Dibenzofuran	**0.52**	J	4.3	0.39	1	12/27/13	01/10/14	KWG1314065	
Fluorene	ND	Ui	4.3	1.3	1	12/27/13	01/10/14	KWG1314065	
Phenanthrene	**3.7**	J	4.3	0.57	1	12/27/13	01/10/14	KWG1314065	
Anthracene	**0.35**	J	4.3	0.33	1	12/27/13	01/10/14	KWG1314065	
Fluoranthene	**1.8**	J	4.3	0.43	1	12/27/13	01/10/14	KWG1314065	
Pyrene	ND	Ui	4.3	3.6	1	12/27/13	01/10/14	KWG1314065	
Benz(a)anthracene	ND	U	4.3	0.33	1	12/27/13	01/10/14	KWG1314065	*
Chrysene	ND	U	4.3	0.48	1	12/27/13	01/10/14	KWG1314065	
Benzo(b)fluoranthene	ND	U	4.3	0.57	1	12/27/13	01/10/14	KWG1314065	*
Benzo(k)fluoranthene	ND	U	4.3	0.49	1	12/27/13	01/10/14	KWG1314065	
Benzo(a)pyrene	ND	U	4.3	0.63	1	12/27/13	01/10/14	KWG1314065	
Indeno(1,2,3-cd)pyrene	ND	U	4.3	0.83	1	12/27/13	01/10/14	KWG1314065	
Dibenz(a,h)anthracene	ND	U	4.3	0.74	1	12/27/13	01/10/14	KWG1314065	
Benzo(g,h,i)perylene	ND	U	4.3	0.82	1	12/27/13	01/10/14	KWG1314065	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	71	39-96	01/10/14	Acceptable
Fluoranthene-d10	76	41-100	01/10/14	Acceptable
Terphenyl-d14	86	39-111	01/10/14	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	4H Shell Mound Survey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HOP-B2	**Units:**	ug/Kg
Lab Code:	K1313762-017	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	8.9	1.4	1	12/27/13	01/10/14	KWG1314065	
2-Methylnaphthalene	ND	U	8.9	1.1	1	12/27/13	01/10/14	KWG1314065	
Acenaphthylene	ND	U	4.5	0.41	1	12/27/13	01/10/14	KWG1314065	
Acenaphthene	**0.54**	JX	4.5	0.42	1	12/27/13	01/10/14	KWG1314065	
Dibenzofuran	ND	U	4.5	0.40	1	12/27/13	01/10/14	KWG1314065	
Fluorene	ND	Ui	4.5	0.95	1	12/27/13	01/10/14	KWG1314065	
Phenanthrene	**1.4**	J	4.5	0.59	1	12/27/13	01/10/14	KWG1314065	
Anthracene	ND	U	4.5	0.34	1	12/27/13	01/10/14	KWG1314065	
Fluoranthene	**1.2**	J	4.5	0.44	1	12/27/13	01/10/14	KWG1314065	
Pyrene	ND	Ui	4.5	1.7	1	12/27/13	01/10/14	KWG1314065	
Benz(a)anthracene	ND	U	4.5	0.34	1	12/27/13	01/10/14	KWG1314065	*
Chrysene	ND	U	4.5	0.49	1	12/27/13	01/10/14	KWG1314065	
Benzo(b)fluoranthene	ND	U	4.5	0.59	1	12/27/13	01/10/14	KWG1314065	*
Benzo(k)fluoranthene	ND	U	4.5	0.51	1	12/27/13	01/10/14	KWG1314065	
Benzo(a)pyrene	ND	U	4.5	0.65	1	12/27/13	01/10/14	KWG1314065	
Indeno(1,2,3-cd)pyrene	ND	U	4.5	0.85	1	12/27/13	01/10/14	KWG1314065	
Dibenz(a,h)anthracene	ND	U	4.5	0.76	1	12/27/13	01/10/14	KWG1314065	
Benzo(g,h,i)perylene	ND	U	4.5	0.84	1	12/27/13	01/10/14	KWG1314065	

* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	80	39-96	01/10/14	Acceptable
Fluoranthene-d10	84	41-100	01/10/14	Acceptable
Terphenyl-d14	98	39-111	01/10/14	Acceptable

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313762
Project:	SO hdell MounL hurvey	**Date Collected:**	12W0W2013
Sample Matrix:	Animal tissue	**Date Received:**	12W4W2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	OP B-9 3	**Units:**	u/ WK/
Lab Code:	K1313762-01g	**Basis:**	H et
Extraction Method:	EBA 38S1	**Level:**	wo5
Analysis Method:	g270D hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Napdtdalene	ND	U	4.g	1.8	1	12W27W3	01W0WS	KH G131S068	
2-Metdylnapdtdalene	ND	U	4.g	1.2	1	12W27W3	01W0WS	KH G131S068	
Acenapdtdylene	ND	U	S.4	0.S8	1	12W27W3	01W0WS	KH G131S068	
Acenapdtdene	**1.0**	JX	S.4	0.S6	1	12W27W3	01W0WS	KH G131S068	
Dibenzofuran	ND	U	S.4	0.SS	1	12W27W3	01W0WS	KH G131S068	
Fluorene	ND	Ui	S.4	0.g1	1	12W27W3	01W0WS	KH G131S068	
Bdenantdrene	**1.8**	J	S.4	0.68	1	12W27W3	01W0WS	KH G131S068	
Antdracene	ND	U	S.4	0.37	1	12W27W3	01W0WS	KH G131S068	
Fluorantdene	**1.2**	J	S.4	0.Sg	1	12W27W3	01W0WS	KH G131S068	
Byrene	ND	Ui	S.4	2.8	1	12W27W3	01W0WS	KH G131S068	
9 enz(a)antdracene	ND	U	S.4	0.37	1	12W27W3	01W0WS	KH G131S068	*
Cdrysene	ND	U	S.4	0.8S	1	12W27W3	01W0WS	KH G131S068	
9 enzo(b)fluorantdene	ND	U	S.4	0.68	1	12W27W3	01W0WS	KH G131S068	*
9 enzo(k)fluorantdene	ND	U	S.4	0.86	1	12W27W3	01W0WS	KH G131S068	
9 enzo(a)pyrene	ND	U	S.4	0.71	1	12W27W3	01W0WS	KH G131S068	
InLeno(1,2,3-cL)pyrene	ND	U	S.4	0.4S	1	12W27W3	01W0WS	KH G131S068	
Dibenz(a,d)antdracene	ND	U	S.4	0.gS	1	12W27W3	01W0WS	KH G131S068	
9 enzo(/ ,d,i)perylene	ND	U	S.4	0.43	1	12W27W3	01W0WS	KH G131S068	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-L10	73	34-46	01W0WS	Acceptable
Fluorantdene-L10	7g	S1-100	01W0WS	Acceptable
Terpdenyl-L1S	gg	34-111	01W0WS	Acceptable

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	SP hdell MounL hurvey	**Date Collected:**	1- HgH-g13
Sample Matrix:	Animal tissue	**Date Received:**	1- H/ H-g13

Polynuclear Aromatic Hydrocarbons

Sample Name:	P 2 904 S	**Units:**	uWHKW
Lab Code:	K131376- 0g1/	**Basis:**	O et
Extraction Method:	E9A 38S1	**Level:**	wo5
Analysis Method:	D- 7gG hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p abdtdalene	p G	N	/ .7	1.8	1	1- H-7H3	g1HgHS	KO U131Sg68	
- 0Metdylnabdtdalene	p G	N	/ .7	1.-	1	1- H-7H3	g1HgHS	KO U131Sg68	
Acenabdtdylene	p G	N	S./	g.S8	1	1- H-7H3	g1HgHS	KO U131Sg68	
Acenabdtdene	p G	N	S./	g.S6	1	1- H-7H3	g1HgHS	KO U131Sg68	
GiFenJofuran	**0.55**	z	S./	g.SS	1	1- H-7H3	g1HgHS	KO U131Sg68	
*luorene	**0.54**	z	S./	g.81	1	1- H-7H3	g1HgHS	KO U131Sg68	
9denantdrene	**3.8**	z	S./	g.6S	1	1- H-7H3	g1HgHS	KO U131Sg68	
Antdracene	p G	N	S./	g.37	1	1- H-7H3	g1HgHS	KO U131Sg68	
*luorantdene	**2.3**	z	S./	g.SD	1	1- H-7H3	g1HgHS	KO U131Sg68	
9yrene	**3.5**	z	S./	g.S/	1	1- H-7H3	g1HgHS	KO U131Sg68	
4 enJ(a)antdracene	**0.75**	z	S./	g.37	1	1- H-7H3	g1HgHS	KO U131Sg68	B
Cdrysene	p G	N	S./	g.8S	1	1- H-7H3	g1HgHS	KO U131Sg68	
4 enJo(F)fluorantdene	p G	N	S./	g.6S	1	1- H-7H3	g1HgHS	KO U131Sg68	B
4 enJo(k)fluorantdene	p G	N	S./	g.88	1	1- H-7H3	g1HgHS	KO U131Sg68	
4 enJo(a)byrene	p G	Ni	S./	1.-	1	1- H-7H3	g1HgHS	KO U131Sg68	
InLeno(1,- ,30cL)byrene	**0.95**	z	S./	g./ 3	1	1- H-7H3	g1HgHS	KO U131Sg68	
GiFenJ(a,d)antdracene	**0.92**	z	S./	g.D3	1	1- H-7H3	g1HgHS	KO U131Sg68	
4 enJo(W,d,i)berylene	**1.6**	z	S./	g./ -	1	1- H-7H3	g1HgHS	KO U131Sg68	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
*luorene0L1g	71	3/ 0/ 6	g1HgHS	AccebtaFle
*luorantdene0L1g	7D	S101gg	g1HgHS	AccebtaFle
Terbdenyl0L1S	D8	3/ 0111	g1HgHS	AccebtaFle

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	hO dLell Mounwdurvey	**Date Collected:**	1- WgWg13
Sample Matrix:	Animal tissue	**Date Received:**	1- WSWg13

Polynuclear Aromatic Hydrocarbons

Sample Name:	OP 209 4	**Units:**	u/ WK/
Lab Code:	K131376- 0g- g	**Basis:**	H et
Extraction Method:	E2A 34h1	**Level:**	5 o8
Analysis Method:	D- 7gG dIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p abLtLalene	**0.5**	N	D.S	1.h	1	1- W7W3	g1 WgWh	KH U131hg64	
- 0MetLylnabLtLalene	p G	z	D.S	1.1	1	1- W7W3	g1 WgWh	KH U131hg64	
AcenabLtLylene	**4.38**	N	h.4	g.h1	1	1- W7W3	g1 WgWh	KH U131hg64	
AcenabLtLene	**0.8**	N	h.4	g.h-	1	1- W7W3	g1 WgWh	KH U131hg64	
GiFenJofuran	**0.2**	N	h.4	g.hg	1	1- W7W3	g1 WgWh	KH U131hg64	
*luorene	**7.4**	N	h.4	g.h6	1	1- W7W3	g1 WgWh	KH U131hg64	
2LenantLrene	**79**		h.4	g.4S	1	1- W7W3	g1 WgWh	KH U131hg64	
AntLracene	**8.1**	N	h.4	g.3h	1	1- W7W3	g1 WgWh	KH U131hg64	
*luorantLene	**83**		h.4	g.hh	1	1- W7W3	g1 WgWh	KH U131hg64	
2yrene	**18**		h.4	g.h4	1	1- W7W3	g1 WgWh	KH U131hg64	
9 enJ(a)antLracene	p G	z i	h.4	1.4	1	1- W7W3	g1 WgWh	KH U131hg64	B
CLrysene	**7.3**	N	h.4	g.hS	1	1- W7W3	g1 WgWh	KH U131hg64	
9 enJo(F)fluorantLene	**4.16**	N	h.4	g.4S	1	1- W7W3	g1 WgWh	KH U131hg64	B
9 enJo(k)fluorantLene	p G	z	h.4	g.41	1	1- W7W3	g1 WgWh	KH U131hg64	
9 enJo(a)byrene	**0.0**	N	h.4	g.64	1	1- W7W3	g1 WgWh	KH U131hg64	
Inweno(1,- ,30cw)byrene	**0.7**	N	h.4	g.D4	1	1- W7W3	g1 WgWh	KH U131hg64	
GiFenJ(a,L)antLracene	p G	z	h.4	g.76	1	1- W7W3	g1 WgWh	KH U131hg64	
9 enJo(/ ,L,i)berylene	**2.6**		h.4	g.Dh	1	1- W7W3	g1 WgWh	KH U131hg64	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
*luorene0wl g	76	3S0S6	g1 WgWh	AccebtaFle
*luorantLene0wl g	D-	h10l gg	g1 WgWh	AccebtaFle
TerbLenyl0wl h	SD	3S0l 11	g1 WgWh	AccebtaFle

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K131376-
Project:	/ 5 8hell Mound 8urvey	**Date Collected:**	P A
Sample Matrix:	Animal tissue	**Date Received:**	P A

Polynuclear Aromatic Hydrocarbons

Sample Name:	Method Llanw	**Units:**	u4SK4
Lab Code:	K0 g 131/ W6H29	**Basis:**	0 et
Extraction Method:	EUA 3H/ 1	**Level:**	DoG
Analysis Method:	9- 7WN 8IM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
P aJ hthalene	P N	p	9.6	1.3	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
- 2MethylnaJ hthalene	P N	p	9.6	1.1	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
AcenaJ hthylene	P N	p	/ .3	W/ W	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
AcenaJ hthene	P N	p	/ .3	W/ 1	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
NizenFofuran	P N	p	/ .3	W3b	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
*luorene	P N	p	/ .3	W/ H	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
Uhenanthrene	P N	p	/ .3	WH7	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
Anthracene	P N	p	/ .3	W33	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
*luoranthene	P N	p	/ .3	W/ -	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
Uyrene	P N	p	/ .3	W/ 3	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
LenF)akanthracene	**0.45**	B	/ .3	W33	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	(
Chrysene	P N	p	/ .3	W/ 7	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
LenFo)zkfluoranthene	P N	p	/ .3	WH7	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	(
LenFo)wkfluoranthene	P N	p	/ .3	W/ b	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
LenFo)akJ yrene	P N	p	/ .3	W63	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
Indeno)1,- ,32cdkJ yrene	P N	p	/ .3	W9-	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
NizenF)a,hkanthracene	P N	p	/ .3	W7/	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	
LenFo)4,h,ikJ erylene	**1.0**	B	/ .3	W91	1	1- S 7S13	WlSlWSl/	K0 g 131/ W6H	

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Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
*luorene2d1W	7H	3b2b6	WlSlWSl/	AcceJ tazle
*luoranthene2d1W	97	/ 121WW	WlSlWSl/	AcceJ tazle
TerJ henyl2d1/	b/	3b2111	WlSlWSl/	AcceJ tazle

Comments:

Client: AMEC Environment & Infrastructure, Inc.
Service Request: K131376L
Project: HS hde44Mouny hurveP
Sample Matrix: Anima4tissue

Surrogate Recovery Summary
Polynuclear Aromatic Hydrocarbons

Extraction Method: E5A 38H1
Analysis Method: 2L70D hIM
Units: 5ercent
Level: wol

Sample Name	Lab Code	Sur1	Sur2	Sur3
S EI-A1	K131376L-001	77	26	9L
S EI-AL	K131376L-00L	78	28	90
S EI-A3	K131376L-003	20	26	96
S EI-AH	K131376L-00H	7H	23	27
S EI-A8	K131376L-008	68	7L	76
S O5-A1	K131376L-006	76	2L	22
S O5-AL	K131376L-007	68	76	79
S O5-A3	K131376L-002	66	73	72
S O5-AH	K131376L-009	68	7L	76
S O5-A8	K131376L-010	7H	28	26
S EI-F1	K131376L-011	20	26	96
S EI-FL	K131376L-01L	7H	72	90
S EI-F3	K131376L-013	77	28	91
S EI-FH	K131376L-01H	21	22	97
S EI-F8	K131376L-018	2L	22	92
S O5-F1	K131376L-016	71	76	26
S O5-FL	K131376L-017	20	2H	92
S O5-F3	K131376L-012	73	72	22
S O5-FH	K131376L-019	71	72	28
S O5-F8	K131376L-0L0	76	2L	92
Metdoy F4anG	KB Wl31H068-2	78	27	9H
S O5-FHMh	KB Wl31H068-1	79	22	99
S O5-FHDMh	KB Wl31H068-L	77	27	99
wak Contro4hamp4e	KB Wl31H068-6	7L	93	97
Dup4icate wak Contro4hamp4e	KB Wl31H068-7	7L	9L	98

Surrogate Recovery Control Limits (%)

hur1	=	b4uorene-y10	39-96
hurL	=	b4uorantdene-y10	H1-100
hur3	=	TerpdenP4-y1H	39-111

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	3 7676082
Project:	1F l de44Mouny l urve9	**Date Extracted:**	72/20/2D76
Sample Matrix:	Anima4tissue	**Date Analyzed:**	D7/7D/2D71

Matrix Spike/Duplicate Matrix Spike Summary
Polynuclear Aromatic Hydrocarbons

Sample Name:	F - B5K1	**Units:**	uL/3 L
Lab Code:	3 76760825D7S	**Basis:**	w et
Extraction Method:	EBA 6P17	**Level:**	Hoh
Analysis Method:	g20DW1 IM	**Extraction Lot:**	3 w G7671D8P

		F - B5K1Ml 3 w G7671D8P57 **Matrix Spike**			F - B5K1WMl 3 w G7671D8P52 **Duplicate Matrix Spike**					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Napdtda4ene	NW	606	1g8	00	687	1gS	01	1657D2	6	1D
25Metd94napdtda4ene	NW	607	1g8	08	68P	1gS	0P	165771	2	1D
Acenapdtd94ene	NW	162	1g8	gS	17P	1gS	gP	P657DD	1	1D
Acenapdtdene	NW	1P2	1g8	S6	16D	1gS	gg	P257D7	P	1D
Wibenzofuran	D.PP	1P6	1g8	S6	166	1gS	gg	PP57D6	1	1D
*4uorene	D.P1	182	1g8	SP	11D	1gS	SD	P857D1	P	1D
Bdenantdrene	6.g	1S6	1g8	7D7 (	188	1gS	S1	P157DD	8	1D
Antdracene	NW	P7D	1g8	7DP (	1g2	1gS	Sg	P057D6	8	1D
*4uorantdene	2.6	10g	1g8	Sg	110	1gS	S7	PP57Dg	0	1D
B9rene	6.P	P72	1g8	7D1	1g6	1gS	Sg	1g5770	8	1D
Kenz)akantdracene	D.0P	1S1	1g8	7D7	100	1gS	S0	PP57DP	6	1D
Cdr9sene	NW	P1D	1g8	777	P26	1gS	7D0	Pg5772	6	1D
Kenzo)bkf4uorantdene	NW	10g	1g8	Sg	18P	1gS	SP	8D57D0	6	1D
Kenzo)Ckf4uorantdene	NW	1g6	1g8	SS	187	1gS	S1	Pg577P	P	1D
Kenzo)akp9rene	NW	P27	1g8	7D0	1Sg	1gS	7D2	P8577D	1	1D
Inyeno)7,2,65cykp9rene	D.SP	8DS	1g8	72P (	P06	1gS	770	PD5770	8	1D
Wibenz)a,dkantdracene	D.S2	87g	1g8	720 (	P01	1gS	770 (	P25772	0	1D
Kenzo)L,d,ikper94ene	7.8	87S	1g8	720 (	P06	1gS	770	P85770	g	1D

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Bercent recoveries any re4ative percent yifferences)RBWkare yeterminey b9 tde softh are usinL va4ues in tde ca4cu4ation h dicd dave not been rounyey.

Client:	A7 6C 6f0vrofs eft 8 2fDmStrEitEreg2fi W	**Service Request:**	u . F. F35l
Project:	-H ahem7 oEfd aEr0ey	**Date Extracted:**	. l /l 3/l B. F
Sample Matrix:	Af vs mtvSSEe	**Date Analyzed:**	B. /. B/l B. -

Lab Control Spike/Duplicate Lab Control Spike Summary
Polynuclear Aromatic Hydrocarbons

Extraction Method:	69A FK- .	**Units:**	Ew/u w
Analysis Method:	Ll 3BMa 27	**Basis:**	c et
		Level:	&o4
		Extraction Lot:	u c , . F. - B5K

	&ml Cof trona ms pre u c , . F. - B5Kl5 Lab Control Spike			MEpmi mte &ml Cof trona ms pre u c , . F. - B5Kl3 Duplicate Lab Control Spike					
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
P mphthmef e	- . .	KBB	Ll	FL5	KBB	33	- Fl. Bl	5	- B
l 17 ethyrf mphthmef e	- l 3	KBB	LK	F55	KBB	3F	- Fl. . -	. 5	- B
Ai ef mphthyref e	- F3	KBB	L3	- . l	KBB	Ll	KFl. BB	5	- B
Ai ef mphthef e	- Kl	KBB	GB	- l 3	KBB	LK	Kl l. B.	5	- B
MvI ef NoDErmf	- Kl	KBB	GB	- l G	KBB	L5	KKl. BF	K	- B
brEoref e	- KL	KBB	Gl	- FK	KBB	L3	K5l. B-	K	- B
9hef mf thref e	- L5	KBB	G3	- 5.	KBB	Gl	K- l. BB	K	- B
Af thrmi ef e	KB-	KBB	. B.	- 3l	KBB	G-	K3l. BF	3	- B
brEormf thef e	Kl L	KBB	. B5	- GK	KBB	GG	KKl. BL	5	- B
9yref e	KF3	KBB	. B3	- G5	KBB	GG	- Ll. . 3	L	- B
* ef N(m)mf thrmi ef e	KFl	KBB	. B5 z	- GK	KBB	GG	KKl. BK	3	- B
ChrySef e	KK	KBB	. . B	Kl l	KBB	. B-	KLl. . l	K	- B
* ef No(I)DEormf thef e	K- l	KBB	. BL z	Kl F	KBB	. BK	5Bl. B3	-	- B
* ef No(k)DEormf thef e	Kl l	KBB	. B-	KB-	KBB	. B.	KLl. . K	F	- B
* ef No(m)pyref e	KFF	KBB	. B3	K l	KBB	. Bl	K5l. . B	-	- B
2f def o(. gl gFl i d)pyref e	KF3	KBB	. B3	Kl -	KBB	. BK	KBl. . 3	l	- B
MvI ef N(mgh)mf thrmi ef e	KFB	KBB	. B5	Kl B	KBB	. B-	Kl l. . l	l	- B
* ef No(wghgy)perynef e	Kl K	KBB	. BK	K 3	KBB	. BF	K5l. . 3	l	- B

Results flagged with an asterisk (*) indicate values outside control criteria.

9eri ef t rei o0erveS mf d remtv0e peri ef t dvDDeref i eS (R9M) mre deters vf ed I y the SoD4 mre ESvf w0mEeS vf the i mi Emtvof 4 hvi h hm0e f ot I eef roEf dedW

January 27, 2014 Analytical Report for Service Request No: K1313763

Michael Henry
AMEC Environment & Infrastructure, Inc.
10670 White Rock Road, Suite 100
Rancho Cordova, CA 95670-6032

RE: 4H Shell Mound Survey

Dear Michael:

Enclosed are the results of the samples submitted to our laboratory on December 19, 2013. For your reference, these analyses have been assigned our service request number K1313763.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3293. You may also contact me via Email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA Corp. dba ALS Environmental

Shar Samy, Ph.D.
Project Manager

SS/kd

ADDRESS 1317 S. 13th Avenue, Kelso, WA 98626 USA | PHONE +1 360 577 7222 | FAX +1 360 636 1068
ALS Group USA, Corp. Part of the ALS Group An ALS Limited Company

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

* The result is an outlier. See case narrative.
# The control limit criteria is not applicable. See case narrative.
B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E The result is an estimate amount because the value exceeded the instrument calibration range.
J The result is an estimated value.
U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X See case narrative.
Q See case narrative. One or more quality control criteria was outside the limits.
H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

The control limit criteria is not applicable. See case narrative.
J The result is an estimated value.
E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M The duplicate injection precision was not met.
N The Matrix Spike sample recovery is not within control limits. See case narrative.
S The reported value was determined by the Method of Standard Additions (MSA).
U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X See case narrative.
+ The correlation coefficient for the MSA is less than 0.995.
Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

* The result is an outlier. See case narrative.
# The control limit criteria is not applicable. See case narrative.
A A tentatively identified compound, a suspected aldol-condensation product.
B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D The reported result is from a dilution.
E The result is an estimated value.
J The result is an estimated value.
N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X See case narrative.
Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2286
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L12-28
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Georgia DNR	http://www.gaepd.org/Documents/techguide_pcb.html#cel	881
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
Indiana DOH	http://www.in.gov/isdh/24859.htm	C-WA-01
ISO 17025	http://www.pjlabs.com/	L12-27
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	3016
Maine DHS	Not available	WA0035
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-368
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA35
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA200001
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427-08-TX
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C1203
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.caslab.com or at the accreditation bodies web site

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

ALS ENVIRONMENTAL

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request No.:**	K1313763
Project:	4H Shell Mound Survey	**Date Received:**	12/19/13
Sample Matrix:	Animal Tissue		

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), Matrix/Duplicate Matrix Spike (MS/DMS), Laboratory Control Sample (LCS), and Laboratory/Duplicate Laboratory Control Sample (LCS/DLCS).

Sample Receipt

Seventeen animal tissue samples were received for analysis at ALS Environmental on 12/19/13. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at –20ºC upon receipt at the laboratory.

Total Metals

Matrix Spike Recovery Exceptions:
The control criteria for matrix spike recovery of Arsenic and Zinc for sample HAZ-C1 were not applicable. The analyzed concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

No other anomalies associated with the analysis of these samples were observed.

Organochlorine Pesticides by EPA Method 8081

Relative Percent Difference Exceptions:
The Relative Percent Difference (RPD) for Endrin Aldehyde in the replicate matrix spike analyses of sample HAZ-B1 was outside control criteria. In general, the RPD was relatively high for all spiked compounds, which was attributed to an apparent low bias in the Duplicate Matrix Spike (DMS). All spike recoveries in the Matrix Spike (MS), Duplicate Matrix Spike (DMS), and associated Laboratory Control Sample (LCS) were within acceptance limits, which indicated the analytical batch was in control. No further corrective action was appropriate.

Elevated Detection Limits:
The detection limit was elevated for one or more target analytes in several field samples. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compounds at the normal limit. The results were flagged to indicate the matrix interference.

Sample Notes and Discussion:
Insufficient sample mass was available to perform a Matrix Spike/Matrix Spike Duplicate (MS/MSD) for Toxaphene. A Laboratory Control Sample/Duplicate Laboratory Control Sample (LCS/DLCS) was analyzed and reported in lieu of the MS/MSD for this analyte.

No other anomalies associated with the analysis of these samples were observed.

Approved by______________________________

PCB Aroclors by EPA Method 8082

Sample Notes and Discussion:
Two Aroclors were identified in samples HAZ-L1, HAZ-L2, and HAZ-L3: Aroclor 1254 and Aroclor 1260. When mixtures of PCB Aroclors are present in a sample, correct identification and quantitative analysis of the individual Aroclors can be subjective. Care is taken to minimize the possibility of double-counting PCBs. Analytical peaks are selected based on the best resolution possible for that particular sample. However, when a mixture of Aroclors 1254 and 1260 is present in a sample, the potential exists for a high bias from contribution of one Aroclor to another due to common peaks or peaks that cannot be completely resolved.

No other anomalies associated with the analysis of these samples were observed.

Polynuclear Aromatic Hydrocarbons by EPA Method 8270

Matrix Spike Recovery Exceptions:
The upper control criterion was exceeded for Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, and Benzo(g,h,i)perylene in the Matrix Spike (MS) of sample REF-L1. The analytes in question were not detected at levels greater than the MRL in the associated field samples. The error associated with elevated recovery indicated a high bias. The sample data was not significantly affected. No further corrective action was appropriate.

The upper control criterion was exceeded for Benzo(g,h,i)perylene in the Matrix Spike Duplicate (MSD) of sample REF-L1. The analyte in question was not detected at levels greater than the MRL in the associated field samples. The error associated with elevated recovery indicated a high bias. The sample data was not significantly affected. No further corrective action was appropriate.

Elevated Detection Limits:
The detection limit was elevated for Benzo(a)pyrene in samples HAZ-C1, HAZ-C4, HAZ-L2, REF-L1, REF-L2, and HAZ-L3. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compound at the normal limit. The result was flagged to indicate the matrix interference.

No other anomalies associated with the analysis of these samples were observed.

Approved by______________________________

ALS Environmental
1317 South 13th Ave
Kelso, WA 98626
(Tel) 360.577.7222
(Fax) 360.636.1068

Chain of Custody Form

Page 3 of 4

K1313763

ALS Project Manager:		ALS Work Order #:	

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	4H Shell Mound Survey	A	CAM-17 Metals - 6010C, 6020A, 7471B
Work Order		Project Number		B	PAHs by CC/MS SIM - 8270D
Company Name	AMEC	Bill To Company		C	PCBs by GC - 8082A
Send Report To	Michael Henry	Invoice Attn.		D	Organochlorine Pesticides- 8081B
Address	10670 White Rock Rd. Suite 100	Address		E	lipids
				F	freeze dry
City/State/Zip	Rancho Cordova/CA/95670-6032	City/State/Zip		G	de-shell (back and claw) and homogenize composited tissue (crabs)
Phone	916-853-8947	Phone		H	whole body homogenization (sea cucumbers and bat stars)
Fax	916-636-3208	Fax		I	fillet (skin on) and homogenize tissue (fish)
e-Mail Address	michael.henry@amec.com			J	

No.	Sample Description	Date	Time	Matrix	Pres. Key Numbers	# Bags	A	B	C	D	E	F	G	H	I	J	Hold
1	HAZ-C1 (1 crab)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
2	HAZ-C2 (1 crab)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
3	HAZ-C3 (1 crab)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
4	HAZ-C4 (1 crab)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
5	HIL-C1 (1 crab)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
6	HIL-C2 (1 crab)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
7	HIL-C3 (1 crab)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
8	HIL-C4 (1 crab)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X	X				
9																	
10																	

Sampler(s): Please Print & Sign: Bonnie Luke (Marine Research Specialists) [signature]

Shipment Method: Fed Ex overnight

Required Turnaround Time: (Check Box) ☐ 10 Wk Days ☐ 5 Wk Days ☐ 3 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☑ Other

Results Due Date:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Notes:
Bonnie Luke (Marine Research Specialists) [signature]	12/19/13	15:00	[signature]	12/19/13	1200	
Relinquished by:	Date:	Time:	Received by (Laboratory):	Date:	Time:	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):			

ALS Cooler ID	Cooler Temp	QC Package: (Check Box Below)	
		☑ Level II: Standard QC	☐ Level III: Raw Data
		☐ TRRP LRC	☐ TRRP Level IV
		☐ Level IV: SW846 Methods/CLP like	
		☐ Other:	

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other (circled) 8-4°C

Note: Any changes must be made in writing once samples and COC Form have been submitted to ALS.

ALS Environmental
1317 South 13th Ave
Kelso, WA 98626
(Tel) 360.577.7222
(Fax) 360.636.1068

Chain of Custody Form

Page 4 of 4

K1313763

ALS Project Manager:		ALS Work Order #:	

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	4H Shell Mound Survey	A	CAM-17 Metals - 6010C, 6020A, 7471B
Work Order		Project Number		B	PAHs by CC/MS SIM - 8270D
Company Name	AMEC	Bill To Company		C	PCBs by GC - 8082A
Send Report To	Michael Henry	Invoice Attn.		D	Organochlorine Pesticides- 8081B
Address	10670 White Rock Rd. Suite 100	Address		E	lipids
				F	freeze dry
City/State/Zip	Rancho Cordova/CA/95670-6032	City/State/Zip		G	de-shell (back and claw) and homogenize composited tissue (crabs)
Phone	916-853-8947	Phone		H	whole body homogenization (sea cucumbers and bat stars)
Fax	916-636-3208	Fax		I	fillet (skin on) and homogenize tissue (fish)
e-Mail Address	michael.henry@amec.com			J	

No.	Sample Description	Date	Time	Matrix	Pres. Key Numbers	# Bags	A	B	C	D	E	F	G	H	I	J	Hold
1	HAZ-B1 (bat stars)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
2	HAZ-B2 (bat stars)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
3	HAZ-B3 (bat stars)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
4	HIL-B1 (bat stars)	12/9/2013	12:00 PM	tissue		1	X	X	X	X	X	X		X			
5	HAZ-L1 (fish)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X			X		
6	HAZ-L2 (fish)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X			X		
7	REF-L1 (fish)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X			X		
8	REF-L2 (fish)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X			X		
9	REF-L3 (fish)	12/10/2013	12:00 PM	tissue		1	X	X	X	X	X	X			X		
10																	

Sampler(s): Please Print & Sign [signature]
Bonnie Luke (Marine Research Specialists)

Shipment Method: Fed Ex overnight

Required Turnaround Time: (Check Box) ☑ Other ______ ☐ 10 Wk Days ☐ 5 Wk Days ☐ 3 Wk Days ☐ 2 Wk Days ☐ 24 Hour

Results Due Date:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Notes:
[signature] Bonnie Luke (Marine Research Specialists)	12/19/13	15:00:00				
Relinquished by:	Date:	Time:	Received by (Laboratory):	Date:	Time:	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):			

ALS Cooler ID	Cooler Temp	QC Package: (Check Box Below)
		☑ Level II: Standard QC ☐ Level III: Raw Data
		☐ TRRP LRC ☐ TRRP Level IV
		☐ Level IV: SW846 Methods/CLP like
		☐ Other:

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C

Note: Any changes must be made in writing once samples and COC Form have been submitted to ALS.

PC Shaw

Cooler Receipt and Preservation Form

Client / Project: HTS   Service Request K13 13763

Received: 12/13/13   Opened: 12/13/13   By: rk   Unloaded: 12/13/13   By: rk

1. Samples were received via? *Mail* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* ________ *NA*
3. Were custody seals on coolers? NA Y N   If yes, how many and where? ________

   If present, were custody seals intact? Y N   If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected. Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA	Tracking Number NA	Filed
-26	-26	—	—	0.0	316		7994 5155 8826	
-30	-29.9	—	—	+0.1	305		" 5720 2050	

4. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* DRY ICE
5. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
12. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:
HA2-L3	REF-L3	

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: ________

Page ____ *of* ____

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09-10/13
Sample Matrix:	Tissue	**Date Received:**	12/19/13

Solids, Total

Prep Method:	NONE	Units:	PERCENT
Analysis Method:	Freeze Dry	Basis:	Wet
Test Notes:			

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
HAZ-C1	K1313763-001	12/31/13	23.0	
HAZ-C2	K1313763-002	12/31/13	22.7	
HAZ-C3	K1313763-003	12/31/13	20.1	
HAZ-C4	K1313763-004	12/31/13	24.2	
HIL-C1	K1313763-005	12/31/13	20.2	
HIL-C2	K1313763-006	12/31/13	21.9	
HIL-C3	K1313763-007	12/31/13	18.5	
HIL-C4	K1313763-008	12/31/13	16.3	
HAZ-B1	K1313763-009	12/31/13	41.0	
HAZ-B2	K1313763-010	12/31/13	44.7	
HAZ-B3	K1313763-011	12/31/13	45.3	
HIL-B1	K1313763-012	12/31/13	43.4	
HAZ-L1	K1313763-013	12/31/13	22.1	
HAZ-L2	K1313763-014	12/31/13	21.5	
REF-L1	K1313763-015	12/31/13	22.7	
REF-L2	K1313763-016	12/31/13	21.8	
HAZ-L3	K1313763-017	12/31/13	23.0	

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/13
Sample Matrix:	Tissue	**Date Received:**	12/19/13
		Date Extracted:	NA
		Date Analyzed:	12/31/13

Duplicate Summary

Sample Name:	HAZ-C1	Units:	PERCENT
Lab Code:	K1313763-001D	Basis:	Wet
Test Notes:			

Analyte	**Prep Method**	**Analysis Method**	**Sample Result**	**Duplicate Sample Result**	**Average**	**Relative Percent Difference**	**Result Notes**
Solids, Total	NA	Freeze Dry	23.0	23.0	23.0	<1	

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INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project Name:	4H Shell Mound Survey		
Project No.:			

Sample Name:	Lab Code:
HAZ-C1	K1313763-001
HAZ-C1D	K1313763-001D
HAZ-C1S	K1313763-001S
HAZ-C2	K1313763-002
HAZ-C3	K1313763-003
HAZ-C4	K1313763-004
HIL-C1	K1313763-005
HIL-C2	K1313763-006
HIL-C3	K1313763-007
HIL-C4	K1313763-008
HAZ-B1	K1313763-009
HAZ-B2	K1313763-010
HAZ-B3	K1313763-011
HIL-B1	K1313763-012
HAZ-L1	K1313763-013
HAZ-L2	K1313763-014
REF-L1	K1313763-015
REF-L2	K1313763-016
HAZ-L3	K1313763-017
Method Blank	K1313763-MB

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HAZ-C1** **Lab Code:** **K1313763-001**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.007	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	112		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	4.620		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.300		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.24		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.557		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	42.0		
Lead	6020A	0.0197	0.0005	5.0	01/06/14	01/09/14	0.0831		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.669		
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.028	J	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.16	J	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	3.0		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.324		
Thallium	6020A	0.0197	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.197	0.007	5.0	01/06/14	01/09/14	0.145	J	
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	329		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HAZ-C2
Lab Code: K1313763-002

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.011	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	36.2		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	0.891		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.075		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.07	J	
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.035		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	28.6		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.0497		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.362		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.025	J	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.22		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	6.7		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.639		
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.054	J	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	373		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HAZ-C3** **Lab Code:** **K1313763-003**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.012	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	34.9		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	14.6		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.004	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	1.150		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.20		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.082		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	22.7		
Lead	6020A	0.0197	0.0005	5.0	01/06/14	01/09/14	0.148		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.343		
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.064		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.20	J	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	2.9		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.600		
Thallium	6020A	0.0197	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.197	0.007	5.0	01/06/14	01/09/14	0.397		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	201		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HAZ-C4 **Lab Code:** K1313763-004

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.009	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	27.3		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	87.5		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	3.920		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.21		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.113		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	48.3		
Lead	6020A	0.0197	0.0005	5.0	01/06/14	01/09/14	0.232		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.789		
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.104		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.74		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	7.1		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	1.250		
Thallium	6020A	0.0197	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.197	0.007	5.0	01/06/14	01/09/14	0.489		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	265		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HIL-C1 **Lab Code:** K1313763-005

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.012	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	39.3		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	0.934		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.411		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.18	J	
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.049		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	23.2		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.195		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.294		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.059		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.25		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	3.6		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.421		
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.223		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	302		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HIL-C2
Lab Code: K1313763-006

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.010	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	32.4		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	1.090		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.225		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.26		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.054		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	40.2		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.270		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.518		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.050	J	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.19	J	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	3.8		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.532		
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.210		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	314		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HIL-C3
Lab Code: K1313763-007

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.009	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	45.9		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	3.990		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	8.360		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.28		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.366		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	88.7		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.306		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	2.38		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.113		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.43		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	4.8		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	1.340		
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.392		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	353		

Comments:

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HIL-C4** **Lab Code:** **K1313763-008**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.017	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	101		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	0.908		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	1.900		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.11	J	
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.094		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	32.5		
Lead	6020A	0.0198	0.0005	5.0	01/06/14	01/09/14	0.0678		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	1.47		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.080		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.21		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	4.0		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.245		
Thallium	6020A	0.0198	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.198	0.007	5.0	01/06/14	01/09/14	0.191	J	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	373		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313763
Project No.:	NA	**Date Collected:**	12/09/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HAZ-B1** **Lab Code:** **K1313763-009**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.013	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	2.76		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	16.9		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.005	J	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	14.7		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.88		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.090		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	14.7		
Lead	6020A	0.0198	0.0005	5.0	01/06/14	01/09/14	0.624		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.020	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.305		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.10		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	1.0		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.302		
Thallium	6020A	0.0198	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.198	0.007	5.0	01/06/14	01/09/14	0.572		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	16.8		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HAZ-B2** **Lab Code:** **K1313763-010**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.011	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	3.38		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	9.090		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	11.9		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	9.91		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.147		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	10.2		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.445		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.020	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.306		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	4.38		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	1.1		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.228		
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.365		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	14.1		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/09/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HAZ-B3** **Lab Code:** **K1313763-011**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.016	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	2.17		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	10.2		
Beryllium	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.019	0.002	5.0	01/06/14	01/09/14	15.8		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.87		
Cobalt	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.099		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	12.9		
Lead	6020A	0.0195	0.0005	5.0	01/06/14	01/09/14	0.481		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.023	J	
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.261		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.04		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	1.2		
Silver	6020A	0.019	0.006	5.0	01/06/14	01/09/14	0.307		
Thallium	6020A	0.0195	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.195	0.007	5.0	01/06/14	01/09/14	0.389		
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	14.9		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313763
Project No.:	NA	**Date Collected:**	12/09/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HIL-B1** **Lab Code:** **K1313763-012**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.011	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	2.30		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	5.470		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	20.5		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	2.16		
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.075		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	12.2		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.410		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.028	J	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.277		
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	1.25		
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	0.9	J	
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.376		
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.304		
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	12.9		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: HAZ-L1
Lab Code: K1313763-013

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.003	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	1.52		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	0.837		
Beryllium	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.019	0.002	5.0	01/06/14	01/09/14	0.564		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.23		
Cobalt	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.023		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	1.43		
Lead	6020A	0.0195	0.0005	5.0	01/06/14	01/09/14	0.0234		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	1.56		
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.017	J	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.07	J	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	1.4		
Silver	6020A	0.019	0.006	5.0	01/06/14	01/09/14	0.006	U	
Thallium	6020A	0.0195	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.195	0.007	5.0	01/06/14	01/09/14	0.041	J	
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	29.3		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **HAZ-L2** **Lab Code:** **K1313763-014**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.002	J	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	2.09		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	0.262		
Beryllium	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.019	0.002	5.0	01/06/14	01/09/14	0.493		
Chromium	6020A	0.19	0.02	5.0	01/06/14	01/09/14	0.15	J	
Cobalt	6020A	0.019	0.003	5.0	01/06/14	01/09/14	0.018	J	
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	1.03		
Lead	6020A	0.0194	0.0005	5.0	01/06/14	01/09/14	0.0246		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.583		
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.009	J	
Nickel	6020A	0.19	0.02	5.0	01/06/14	01/09/14	0.08	J	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	1.4		
Silver	6020A	0.019	0.006	5.0	01/06/14	01/09/14	0.006	U	
Thallium	6020A	0.0194	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.194	0.007	5.0	01/06/14	01/09/14	0.059	J	
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	31.0		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **REF-L1** **Lab Code:** **K1313763-015**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.049	0.002	5.0	01/06/14	01/09/14	0.002	U	
Arsenic	6020A	0.49	0.02	5.0	01/06/14	01/09/14	10.1		
Barium	6020A	0.049	0.005	5.0	01/06/14	01/09/14	0.376		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.048		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.09	J	
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	0.81		
Lead	6020A	0.0197	0.0005	5.0	01/06/14	01/09/14	0.0461		
Mercury	7470A	0.039	0.008	4.0	01/06/14	01/13/14	0.339		
Molybdenum	6020A	0.049	0.008	5.0	01/06/14	01/09/14	0.008	J	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.05	J	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	1.6		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.006	U	
Thallium	6020A	0.0197	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.197	0.007	5.0	01/06/14	01/09/14	0.038	J	
Zinc	6020A	0.49	0.06	5.0	01/06/14	01/09/14	20.8		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected: 12/10/13
Project Name: 4H Shell Mound Survey
Date Received: 12/19/13
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **REF-L2** **Lab Code:** **K1313763-016**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.003	J	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	8.78		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	0.260		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.337		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.12	J	
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.014	J	
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	1.13		
Lead	6020A	0.0199	0.0005	5.0	01/06/14	01/09/14	0.0570		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.917		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.011	J	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.07	J	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	1.6		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.006	U	
Thallium	6020A	0.0199	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.199	0.007	5.0	01/06/14	01/09/14	0.034	J	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	28.6		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	AMEC Environment & Infrastructur	**Service Request:**	K1313763
Project No.:	NA	**Date Collected:**	12/10/13
Project Name:	4H Shell Mound Survey	**Date Received:**	12/19/13
Matrix:	TISSUE	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: **HAZ-L3** **Lab Code:** **K1313763-017**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.002	U	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	3.98		
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	0.150		
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.250		
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.10	J	
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.035		
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	1.21		
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.0543		
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	1.12		
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.008	U	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.05	J	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	1.7		
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.014	J	
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.044	J	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	25.2		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: AMEC Environment & Infrastructur
Service Request: K1313763
Project No.: NA
Date Collected:
Project Name: 4H Shell Mound Survey
Date Received:
Matrix: TISSUE
Units: mg/Kg
Basis: DRY

Sample Name: **Method Blank** **Lab Code:** **K1313763-MB**

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Antimony	6020A	0.050	0.002	5.0	01/06/14	01/09/14	0.002	U	
Arsenic	6020A	0.50	0.02	5.0	01/06/14	01/09/14	0.02	U	
Barium	6020A	0.050	0.005	5.0	01/06/14	01/09/14	0.005	U	
Beryllium	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Cadmium	6020A	0.020	0.002	5.0	01/06/14	01/09/14	0.002	U	
Chromium	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.02	U	
Cobalt	6020A	0.020	0.003	5.0	01/06/14	01/09/14	0.003	U	
Copper	6020A	0.10	0.02	5.0	01/06/14	01/09/14	0.02	U	
Lead	6020A	0.0200	0.0005	5.0	01/06/14	01/09/14	0.0005	U	
Mercury	7470A	0.040	0.008	4.0	01/06/14	01/13/14	0.008	U	
Molybdenum	6020A	0.050	0.008	5.0	01/06/14	01/09/14	0.008	U	
Nickel	6020A	0.20	0.02	5.0	01/06/14	01/09/14	0.02	U	
Selenium	6020A	1.0	0.2	5.0	01/06/14	01/13/14	0.2	U	
Silver	6020A	0.020	0.006	5.0	01/06/14	01/09/14	0.006	U	
Thallium	6020A	0.0200	0.0009	5.0	01/06/14	01/09/14	0.0009	U	
Vanadium	6020A	0.200	0.007	5.0	01/06/14	01/09/14	0.007	U	
Zinc	6020A	0.50	0.06	5.0	01/06/14	01/09/14	0.06	U	

Comments:

Metals
- 5A -
SPIKE SAMPLE RECOVERY

Client: AMEC Environment & Infrastructur **Service Request:** K1313763

Project No.: NA **Units:** MG/KG

Project Name: 4H Shell Mound Survey **Basis:** DRY

Matrix: TISSUE

Sample Name: HAZ-C1S **Lab Code:** K1313763-001S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Antimony	75 - 125	51.083		0.007	J	49.834	102.5		6020A
Arsenic		130.47		112.49		16.64	108.1		6020A
Barium	75 - 125	214.707		4.623		199.336	105.4		6020A
Beryllium	75 - 125	5.075		0.003	U	4.983	101.8		6020A
Cadmium	75 - 125	5.562		0.300		4.983	105.6		6020A
Chromium	75 - 125	20.03		0.24		19.93	99.3		6020A
Cobalt	75 - 125	50.280		0.557		49.834	99.8		6020A
Copper	75 - 125	67.65		41.99		24.92	103.0		6020A
Lead	75 - 125	47.9300		0.0831		49.8339	96.0		6020A
Mercury	80 - 120	2.75		0.669		1.99	104.6		7470A
Molybdenum	75 - 125	17.492		0.028	J	16.645	104.9		6020A
Nickel	75 - 125	50.15		0.16	J	49.83	100.3		6020A
Selenium	75 - 125	21.1		3.0		16.6	109.0		6020A
Silver	75 - 125	4.932		0.324		4.983	92.5		6020A
Thallium	75 - 125	15.7776		0.0009	U	16.6445	94.8		6020A
Vanadium	75 - 125	51.469		0.145	J	49.834	103.0		6020A
Zinc		380.71		329.22		49.83	103.3		6020A

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

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DUPLICATES

Client: AMEC Environment & Infrastructur **Service Request:** K1313763

Project No.: NA **Units:** MG/KG

Project Name: 4H Shell Mound Survey **Basis:** DRY

Matrix: TISSUE

Sample Name: HAZ-C1D **Lab Code:** K1313763-001D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Antimony		0.007	J	0.007	J	0.0		6020A
Arsenic	20	112.49		106.29		5.7		6020A
Barium	20	4.623		3.909		16.7		6020A
Beryllium		0.003	U	0.003	U			6020A
Cadmium	20	0.300		0.286		4.8		6020A
Chromium		0.24		0.20		18.2		6020A
Cobalt	20	0.557		0.565		1.4		6020A
Copper	20	41.99		41.72		0.6		6020A
Lead		0.0831		0.0843		1.4		6020A
Mercury	20	0.669		0.680		1.6		7470A
Molybdenum		0.028	J	0.028	J	0.0		6020A
Nickel		0.16	J	0.15	J	6.5		6020A
Selenium		3.0		2.8		6.9		6020A
Silver	20	0.324		0.315		2.8		6020A
Thallium		0.0009	U	0.0009	U			6020A
Vanadium		0.145	J	0.135	J	7.1		6020A
Zinc	20	329.22		321.39		2.4		6020A

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals
-7-
LABORATORY CONTROL SAMPLE

Client: AMEC Environment & Infrastructur **Service Request:** K1313763

Project No.: NA

Project Name: 4H Shell Mound Survey

Aqueous LCS Source: CAS MIXED **Solid LCS Source:**

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Antimony	500.0	494.8	99.0						
Arsenic	167.0	178.2	106.7						
Barium	2000.0	2059.1	103.0						
Beryllium	50.0	48.8	97.6						
Cadmium	50.0	50.7	101.4						
Chromium	200.0	198.9	99.4						
Cobalt	500.0	498.0	99.6						
Copper	250.0	251.1	100.4						
Lead	500.0	521.8	104.4						
Mercury	20	20.0	100.0						
Molybdenum	167.0	170.4	102.0						
Nickel	500.0	506.7	101.3						
Selenium	167.0	171.4	102.6						
Silver	50.0	46.0	92.0						
Thallium	167.0	165.6	99.2						
Vanadium	500.0	500.6	100.1						
Zinc	500.0	506.2	101.2						

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client: AMEC Environment & Infrastructure, Inc.
Project: 4H Shell Mound Survey
LCS Matrix: Tissue

Service Request: K1313763
Date Collected: NA
Date Received: NA
Date Extracted: 01/06/14
Date Analyzed: 01/09,13/14

Standard Reference Material Summary
Total Metals

Sample Name: Standard Reference Material
Lab Code: K1313763-SRM1
Test Notes:

Units: mg/Kg (ppm)
Basis: Dry

Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	6020A	6.80	7.95	117	4.93 - 8.93	
Cadmium	PSEP Tissue	6020A	0.306	0.327	107	0.233 - 0.385	
Chromium	PSEP Tissue	6020A	1.87	1.67	89	1.37 - 2.44	
Copper	PSEP Tissue	6020A	15.9	15.1	95	12.0 - 20.2	
Lead	PSEP Tissue	6020A	0.416	0.363	87	0.290 - 0.563	
Nickel	PSEP Tissue	6020A	1.36	1.33	98	0.912 - 1.90	
Selenium	PSEP Tissue	6020A	3.56	3.87	109	2.58-4.68	
Zinc	PSEP Tissue	6020A	52.2	54.3	104	39.2 - 66.5	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	01/06/14
		Date Analyzed:	01/09,13/14

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K1313763-SRM2	Basis:	Dry
Test Notes:			

Source: N.R.C.C. Tort-2

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	6020A	21.6	24.9	115	15.8-28.1	
Cadmium	PSEP Tissue	6020A	26.7	29.4	110	20.9-32.8	
Chromium	PSEP Tissue	6020A	0.77	0.59	77	0.5-1.1	
Cobalt	PSEP Tissue	6020A	0.51	0.51	100	0.34-0.72	
Copper	PSEP Tissue	6020A	106	101	95	77-139	
Lead	PSEP Tissue	6020A	0.35	0.36	103	0.18-0.58	
Mercury	PSEP Tissue	7470A	0.27	0.28	104	0.17-0.40	
Molybdenum	PSEP Tissue	6020A	0.95	1.07	113	0.68-1.26	
Nickel	PSEP Tissue	6020A	2.5	2.2	88	1.85-3.23	
Selenium	PSEP Tissue	6020A	5.63	5.91	105	3.97-7.56	
Vanadium	PSEP Tissue	6020A	1.64	1.80	110	1.46-2.2	
Zinc	PSEP Tissue	6020A	180	194	108	139-223	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/9-10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Lipids, Total

Prep Method:	EPA 3541	Units:	PERCENT
Analysis Method:	NOAA	Basis:	Wet Weight
Test Notes:			

Sample Name	Lab Code	MRL	Date Extracted	Date Analyzed	Result	Result Notes
HAZ-C1	K1313763-001	0.05	12/28/2013	12/30/2013	0.29	
HAZ-C2	K1313763-002	0.04	12/28/2013	12/30/2013	0.24	
HAZ-C3	K1313763-003	0.05	12/28/2013	12/30/2013	0.22	
HAZ-C4	K1313763-004	0.05	12/28/2013	12/30/2013	0.65	
HIL-C1	K1313763-005	0.05	12/28/2013	12/30/2013	0.41	
HIL-C2	K1313763-006	0.09	12/28/2013	12/30/2013	0.36	
HIL-C3	K1313763-007	0.05	12/28/2013	12/30/2013	0.41	
HIL-C4	K1313763-008	0.05	12/28/2013	12/30/2013	0.06	
HAZ-B1	K1313763-009	0.05	12/28/2013	12/30/2013	0.34	
HAZ-B2	K1313763-010	0.05	12/28/2013	12/30/2013	0.29	
HAZ-B3	K1313763-011	0.05	12/28/2013	12/30/2013	0.28	
HIL-B1	K1313763-012	0.05	12/28/2013	12/30/2013	0.29	
HAZ-L1	K1313763-013	0.05	12/28/2013	12/30/2013	0.28	
HAZ-L2	K1313763-014	0.05	12/28/2013	12/30/2013	0.56	
REF-L1	K1313763-015	0.05	12/28/2013	12/30/2013	0.83	
REF-L2	K1313763-016	0.05	12/28/2013	12/30/2013	0.39	
HAZ-L3	K1313763-017	0.05	12/28/2013	12/30/2013	0.64	
Method Blank	K1313763-MB	0.04	12/28/2013	12/30/2013	0.04	U

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: AMEC Environment & Infrastructure, Inc.
Project: 4H Shell Mound Survey
Sample Matrix: Animal tissue

Service Request: K1313763
Date Collected: 12/10/2013
Date Received: 12/19/2013
Date Extracted: 12/28/2013
Date Analyzed: 12/30/2013

Triplicate Summary
Lipids, Total

Sample Name: REF-L1
Lab Code: K1313763-015 TRP
Test Notes:

Units: PERCENT
Basis: Wet Weight

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Triplicate Sample Result	Average	Percent Relative Standard Deviation	Result Notes
Lipids, Total	EPA 3541	NOAA	0.05	0.83	1.0	0.82	0.88	11	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	NA
Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	12/28/2013
		Date Analyzed:	12/30/2013

Laboratory Control Sample
Lipids, Total

Sample Name: K1313763-LCS

Units: % (percent)
Basis: Wet Weight

Test Notes:

Analyte	**Prep Method**	**Analysis Method**	**Spike Level Percent**	**Result**	**CAS Advisory Limits**	**Result Notes**
Lipids, Total	EPA 3541	NOAA	100	93	70-130	

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Organochlorine Pesticides

Sample Name:	HAZ-C1	**Units:**	ug/Kg
Lab Code:	K1313763-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.98	0.16	1	01/02/14	01/14/14	KWG1400338	
beta-BHC	ND	U	0.98	0.41	1	01/02/14	01/14/14	KWG1400338	
gamma-BHC (Lindane)	ND	U	0.98	0.21	1	01/02/14	01/14/14	KWG1400338	
delta-BHC	ND	U	0.98	0.20	1	01/02/14	01/14/14	KWG1400338	
Heptachlor	ND	U	0.98	0.27	1	01/02/14	01/14/14	KWG1400338	
Aldrin	ND	U	0.98	0.74	1	01/02/14	01/14/14	KWG1400338	
Heptachlor Epoxide	ND	U	0.98	0.18	1	01/02/14	01/14/14	KWG1400338	
gamma-Chlordane†	ND	U	0.98	0.26	1	01/02/14	01/14/14	KWG1400338	
Endosulfan I	ND	U	0.98	0.22	1	01/02/14	01/14/14	KWG1400338	
alpha-Chlordane	ND	U	0.98	0.25	1	01/02/14	01/14/14	KWG1400338	
Dieldrin	ND	U	0.98	0.20	1	01/02/14	01/14/14	KWG1400338	
4,4'-DDE	**9.0**		0.98	0.45	1	01/02/14	01/14/14	KWG1400338	
Endrin	ND	U	0.98	0.28	1	01/02/14	01/14/14	KWG1400338	
Endosulfan II	ND	U	0.98	0.24	1	01/02/14	01/14/14	KWG1400338	
4,4'-DDD	ND	U	0.98	0.55	1	01/02/14	01/14/14	KWG1400338	
Endrin Aldehyde	ND	U	0.98	0.62	1	01/02/14	01/14/14	KWG1400338	
Endosulfan Sulfate	ND	U	0.98	0.53	1	01/02/14	01/14/14	KWG1400338	
4,4'-DDT	ND	Ui	0.98	0.63	1	01/02/14	01/14/14	KWG1400338	
Endrin Ketone	ND	U	0.98	0.39	1	01/02/14	01/14/14	KWG1400338	
Methoxychlor	ND	U	0.98	0.48	1	01/02/14	01/14/14	KWG1400338	
Toxaphene	ND	U	49	13	1	01/02/14	01/14/14	KWG1400338	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	70	29-117	01/14/14	Acceptable
Decachlorobiphenyl	79	22-121	01/14/14	Acceptable

† Analyte Comments

gamma-Chlordane	For this analyte (CAS Registry No. 5103-74-2), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Organochlorine Pesticides

Sample Name:	HAZ-C2	**Units:**	ug/Kg
Lab Code:	K1313763-002	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	1.0	0.16	1	01/02/14	01/14/14	KWG1400338	
beta-BHC	ND	U	1.0	0.41	1	01/02/14	01/14/14	KWG1400338	
gamma-BHC (Lindane)	ND	U	1.0	0.21	1	01/02/14	01/14/14	KWG1400338	
delta-BHC	ND	U	1.0	0.20	1	01/02/14	01/14/14	KWG1400338	
Heptachlor	ND	U	1.0	0.27	1	01/02/14	01/14/14	KWG1400338	
Aldrin	ND	U	1.0	0.74	1	01/02/14	01/14/14	KWG1400338	
Heptachlor Epoxide	ND	U	1.0	0.18	1	01/02/14	01/14/14	KWG1400338	
gamma-Chlordane†	**0.29**	J	1.0	0.26	1	01/02/14	01/14/14	KWG1400338	
Endosulfan I	ND	U	1.0	0.22	1	01/02/14	01/14/14	KWG1400338	
alpha-Chlordane	ND	U	1.0	0.25	1	01/02/14	01/14/14	KWG1400338	
Dieldrin	ND	U	1.0	0.20	1	01/02/14	01/14/14	KWG1400338	
4,4'-DDE	**1.5**		1.0	0.45	1	01/02/14	01/14/14	KWG1400338	
Endrin	ND	U	1.0	0.28	1	01/02/14	01/14/14	KWG1400338	
Endosulfan II	ND	U	1.0	0.24	1	01/02/14	01/14/14	KWG1400338	
4,4'-DDD	ND	U	1.0	0.55	1	01/02/14	01/14/14	KWG1400338	
Endrin Aldehyde	ND	U	1.0	0.62	1	01/02/14	01/14/14	KWG1400338	
Endosulfan Sulfate	ND	U	1.0	0.53	1	01/02/14	01/14/14	KWG1400338	
4,4'-DDT	ND	Ui	1.0	0.71	1	01/02/14	01/14/14	KWG1400338	
Endrin Ketone	ND	U	1.0	0.39	1	01/02/14	01/14/14	KWG1400338	
Methoxychlor	ND	U	1.0	0.48	1	01/02/14	01/14/14	KWG1400338	
Toxaphene	ND	U	50	13	1	01/02/14	01/14/14	KWG1400338	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	72	29-117	01/14/14	Acceptable
Decachlorobiphenyl	79	22-121	01/14/14	Acceptable

† **Analyte Comments**

gamma-Chlordane	For this analyte (CAS Registry No. 5103-74-2), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Organochlorine Pesticides

Sample Name:	HAZ-C3	**Units:**	ug/Kg
Lab Code:	K1313763-003	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.95	0.16	1	01/02/14	01/14/14	KWG1400338	
beta-BHC	ND	U	0.95	0.41	1	01/02/14	01/14/14	KWG1400338	
gamma-BHC (Lindane)	ND	U	0.95	0.21	1	01/02/14	01/14/14	KWG1400338	
delta-BHC	ND	Ui	0.95	0.25	1	01/02/14	01/14/14	KWG1400338	
Heptachlor	ND	U	0.95	0.27	1	01/02/14	01/14/14	KWG1400338	
Aldrin	ND	U	0.95	0.74	1	01/02/14	01/14/14	KWG1400338	
Heptachlor Epoxide	ND	U	0.95	0.18	1	01/02/14	01/14/14	KWG1400338	
gamma-Chlordane†	ND	U	0.95	0.26	1	01/02/14	01/14/14	KWG1400338	
Endosulfan I	ND	U	0.95	0.22	1	01/02/14	01/14/14	KWG1400338	
alpha-Chlordane	ND	U	0.95	0.25	1	01/02/14	01/14/14	KWG1400338	
Dieldrin	ND	U	0.95	0.20	1	01/02/14	01/14/14	KWG1400338	
4,4'-DDE	**1.2**		0.95	0.45	1	01/02/14	01/14/14	KWG1400338	
Endrin	ND	U	0.95	0.28	1	01/02/14	01/14/14	KWG1400338	
Endosulfan II	ND	U	0.95	0.24	1	01/02/14	01/14/14	KWG1400338	
4,4'-DDD	ND	U	0.95	0.55	1	01/02/14	01/14/14	KWG1400338	
Endrin Aldehyde	ND	U	0.95	0.62	1	01/02/14	01/14/14	KWG1400338	
Endosulfan Sulfate	ND	U	0.95	0.53	1	01/02/14	01/14/14	KWG1400338	
4,4'-DDT	ND	U	0.95	0.49	1	01/02/14	01/14/14	KWG1400338	
Endrin Ketone	ND	U	0.95	0.39	1	01/02/14	01/14/14	KWG1400338	
Methoxychlor	ND	U	0.95	0.48	1	01/02/14	01/14/14	KWG1400338	
Toxaphene	ND	U	48	13	1	01/02/14	01/14/14	KWG1400338	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	66	29-117	01/14/14	Acceptable
Decachlorobiphenyl	73	22-121	01/14/14	Acceptable

† Analyte Comments

gamma-Chlordane	For this analyte (CAS Registry No. 5103-74-2), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	gZ Shell Mound Survey	**Date Collected:**	19W04W9013
Sample Matrix:	Animal tissue	**Date Received:**	19W14W9013

Organochlorine Pesticides

Sample Name:	ZA2-Cg	**Units:**	u/ Wk/
Lab Code:	K1313763-00g	**Basis:**	H et
Extraction Method:	EPA 35g1	**Level:**	Low
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BZC	ND	U	0.67	0.16	1	01W09Wg	01WgWg	KH G1g00338	
beta-BZC	ND	U	0.67	0.g1	1	01W09Wg	01WgWg	KH G1g00338	
/ amma-BZC (Lindane)	ND	U	0.67	0.91	1	01W09Wg	01WgWg	KH G1g00338	
delta-BZC	ND	U	0.67	0.90	1	01W09Wg	01WgWg	KH G1g00338	
Zeptachlor	ND	U	0.67	0.97	1	01W09Wg	01WgWg	KH G1g00338	
Aldrin	ND	U	0.7g	0.7g	1	01W09Wg	01WgWg	KH G1g00338	
Zeptachlor Epoxide	ND	U	0.67	0.18	1	01W09Wg	01WgWg	KH G1g00338	
/ amma-Chlordane†	ND	U	0.67	0.96	1	01W09Wg	01WgWg	KH G1g00338	
Endosulfan I	ND	U	0.67	0.99	1	01W09Wg	01WgWg	KH G1g00338	
alpha-Chlordane	ND	U	0.67	0.95	1	01W09Wg	01WgWg	KH G1g00338	
Dieldrin	ND	U	0.67	0.90	1	01W09Wg	01WgWg	KH G1g00338	
g,g'-DDE	**4.4**		0.67	0.g5	1	01W09Wg	01WgWg	KH G1g00338	
Endrin	ND	U	0.67	0.98	1	01W09Wg	01WgWg	KH G1g00338	
Endosulfan II	ND	U	0.67	0.9g	1	01W09Wg	01WgWg	KH G1g00338	
g,g'-DDD	ND	U	0.67	0.55	1	01W09Wg	01WgWg	KH G1g00338	
Endrin Aldehyde	ND	U	0.67	0.69	1	01W09Wg	01WgWg	KH G1g00338	
Endosulfan Sulfate	ND	U	0.67	0.53	1	01W09Wg	01WgWg	KH G1g00338	
g,g'-DDT	ND	U	0.67	0.g4	1	01W09Wg	01WgWg	KH G1g00338	
Endrin Ketone	ND	U	0.67	0.34	1	01W09Wg	01WgWg	KH G1g00338	
Methoxychlor	ND	U	0.67	0.g8	1	01W09Wg	01WgWg	KH G1g00338	
Toxaphene	ND	U	3g	13	1	01W09Wg	01WgWg	KH G1g00338	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	70	94-117	01WgWg	Acceptable
Decachlorobiphenyl	74	99-191	01WgWg	Acceptable

† **Analyte Comments**

/ amma-Chlordane	For this analyte (CAS Re/ istry No. 5103-7g-9), USEPA has corrected the name to be beta-Chlordane, also known as trans-Chlordane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	h2 dLell Mounwdurvey	**Date Collected:**	14W0SW4013
Sample Matrix:	Animal tissue	**Date Received:**	14W1SW4013

Organochlorine Pesticides

Sample Name:	2 I9-C1	**Units:**	u/ WK/
Lab Code:	K1313763-00g	**Basis:**	H et
Extraction Method:	E5A 3gh1	**Level:**	9oP
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpLa-B2 C	ND	U	1.1	0.17	1	01W04Wh	01WhWh	KH G1h00338	
beta-B2 C	ND	U	1.1	0.h4	1	01W04Wh	01WhWh	KH G1h00338	
/ amma-B2 C (9inwane)	ND	U	1.1	0.44	1	01W04Wh	01WhWh	KH G1h00338	
welta-B2 C	ND	U	1.1	0.41	1	01W04Wh	01WhWh	KH G1h00338	
2 eptacLlor	ND	U	1.1	0.48	1	01W04Wh	01WhWh	KH G1h00338	
Alwrin	ND	U	1.1	0.7g	1	01W04Wh	01WhWh	KH G1h00338	
2 eptacLlor Epoxiwe	ND	U	1.1	0.1S	1	01W04Wh	01WhWh	KH G1h00338	
/ amma-CLlorwane†	ND	U	1.1	0.47	1	01W04Wh	01WhWh	KH G1h00338	
Enwosulfan I	ND	U	1.1	0.43	1	01W04Wh	01WhWh	KH G1h00338	
alpLa-CLlorwane	ND	U	1.1	0.46	1	01W04Wh	01WhWh	KH G1h00338	
Dielwrin	ND	U	1.1	0.41	1	01W04Wh	01WhWh	KH G1h00338	
h,h'-DDE	**1.6**		1.1	0.h6	1	01W04Wh	01WhWh	KH G1h00338	
Enwrin	ND	U	1.1	0.4S	1	01W04Wh	01WhWh	KH G1h00338	
Enwosulfan II	ND	U	1.1	0.4g	1	01W04Wh	01WhWh	KH G1h00338	
h,h'-DDD	ND	U	1.1	0.g6	1	01W04Wh	01WhWh	KH G1h00338	
Enwrin AlweLywe	ND	U	1.1	0.63	1	01W04Wh	01WhWh	KH G1h00338	
Enwosulfan dulfate	ND	U	1.1	0.gh	1	01W04Wh	01WhWh	KH G1h00338	
h,h'-DDT	ND	U	1.1	0.g0	1	01W04Wh	01WhWh	KH G1h00338	
Enwrin Ketone	ND	U	1.1	0.h0	1	01W04Wh	01WhWh	KH G1h00338	
MetLoxycLlor	ND	U	1.1	0.hS	1	01W04Wh	01WhWh	KH G1h00338	
ToxapLene	ND	U	g1	1h	1	01W04Wh	01WhWh	KH G1h00338	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracLloro-m-xylene	68	4S-117	01WhWh	Acceptable
DecacLlorobipLenyl	74	44-141	01WhWh	Acceptable

† Analyte Comments

/ amma-CLlorwane	For tLis analyte (CAd Re/ istry No. g103-7h-4), UdE5A Las correctewtLe name to be beta-CLlorwane, also knoP n as trans-CLlorwane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SH hdell MounL hurvey	**Date Collected:**	19/04/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Organochlorine Pesticides

Sample Name:	HI2-C9	**Units:**	ug/Kg
Lab Code:	K1313763-006	**Basis:**	Wet
Extraction Method:	EPA 35S1	**Level:**	2ow
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda-BHC	ND	U	1.3	0.90	1	01/09/1S	01/1S/1S	KWG1S00338	
beta-BHC	ND	U	1.3	0.51	1	01/09/1S	01/1S/1S	KWG1S00338	
gamma-BHC (2inLane)	ND	U	1.3	0.96	1	01/09/1S	01/1S/1S	KWG1S00338	
Lelta-BHC	ND	U	1.3	0.95	1	01/09/1S	01/1S/1S	KWG1S00338	
Heptacdlor	ND	U	1.3	0.3S	1	01/09/1S	01/1S/1S	KWG1S00338	
AlLrin	ND	U	1.3	0.49	1	01/09/1S	01/1S/1S	KWG1S00338	
Heptacdlor EpoxiLe	ND	U	1.3	0.93	1	01/09/1S	01/1S/1S	KWG1S00338	
gamma-CdlorLane†	ND	U	1.3	0.33	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLosulfan I	ND	U	1.3	0.98	1	01/09/1S	01/1S/1S	KWG1S00338	
alpda-CdlorLane	ND	U	1.3	0.31	1	01/09/1S	01/1S/1S	KWG1S00338	
DielLrin	ND	U	1.3	0.95	1	01/09/1S	01/1S/1S	KWG1S00338	
S,S'-DDE	**1.8**		1.3	0.56	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLrin	ND	U	1.3	0.35	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLosulfan II	ND	U	1.3	0.30	1	01/09/1S	01/1S/1S	KWG1S00338	
S,S'-DDD	ND	U	1.3	0.68	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLrin AlLedyLe	ND	U	1.3	0.77	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLosulfan hulfate	ND	U	1.3	0.66	1	01/09/1S	01/1S/1S	KWG1S00338	
S,S'-DDT	ND	U	1.3	0.61	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLrin Ketone	ND	U	1.3	0.S4	1	01/09/1S	01/1S/1S	KWG1S00338	
Metdoxycdlor	ND	U	1.3	0.60	1	01/09/1S	01/1S/1S	KWG1S00338	
Toxapdene	ND	U	69	17	1	01/09/1S	01/1S/1S	KWG1S00338	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro-m-xylene	64	94-117	01/1S/1S	Acceptable
Decacdlorobipdenyl	7S	99-191	01/1S/1S	Acceptable

† **Analyte Comments**

gamma-CdlorLane	For tdis analyte (CAh Registry No. 5103-7S-9), UhEPA das correcteL tde name to be beta-CdlorLane, also known as trans-CdlorLane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SH hdell MounL hurvey	**Date Collected:**	19/04/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Organochlorine Pesticides

Sample Name:	HI2-C3	**Units:**	ug/Kg
Lab Code:	K1313763-007	**Basis:**	Wet
Extraction Method:	EPA 35S1	**Level:**	2ow
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda-BHC	ND	U	0.47	0.16	1	01/09/1S	01/1S/1S	KWG1S00338	
beta-BHC	ND	U	0.47	0.S1	1	01/09/1S	01/1S/1S	KWG1S00338	
gamma-BHC (2inLane)	ND	U	0.47	0.91	1	01/09/1S	01/1S/1S	KWG1S00338	
Lelta-BHC	ND	U	0.47	0.90	1	01/09/1S	01/1S/1S	KWG1S00338	
Heptacdlor	ND	U	0.47	0.97	1	01/09/1S	01/1S/1S	KWG1S00338	
AlLrin	ND	U	0.47	0.7S	1	01/09/1S	01/1S/1S	KWG1S00338	
Heptacdlor EpoxiLe	ND	U	0.47	0.18	1	01/09/1S	01/1S/1S	KWG1S00338	
gamma-CdlorLane†	ND	U	0.47	0.96	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLosulfan I	ND	U	0.47	0.99	1	01/09/1S	01/1S/1S	KWG1S00338	
alpda-CdlorLane	ND	U	0.47	0.95	1	01/09/1S	01/1S/1S	KWG1S00338	
DielLrin	ND	U	0.47	0.90	1	01/09/1S	01/1S/1S	KWG1S00338	
S,S'-DDE	**7.1**		0.47	0.S5	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLrin	ND	U	0.47	0.98	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLosulfan II	ND	U	0.47	0.9S	1	01/09/1S	01/1S/1S	KWG1S00338	
S,S'-DDD	ND	U	0.47	0.55	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLrin AlLedyLe	ND	U	0.47	0.69	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLosulfan hulfate	ND	U	0.47	0.53	1	01/09/1S	01/1S/1S	KWG1S00338	
S,S'-DDT	ND	U	0.47	0.S4	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLrin Ketone	ND	U	0.47	0.34	1	01/09/1S	01/1S/1S	KWG1S00338	
Metdoxycdlor	ND	U	0.47	0.S8	1	01/09/1S	01/1S/1S	KWG1S00338	
Toxapdene	ND	U	S4	13	1	01/09/1S	01/1S/1S	KWG1S00338	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro-m-xylene	88	94-117	01/1S/1S	Acceptable
Decacdlorobipdenyl	49	99-191	01/1S/1S	Acceptable

† Analyte Comments

gamma-CdlorLane	For tdis analyte (CAh Registry No. 5103-7S-9), UhEPA das correcteL tde name to be beta-CdlorLane, also known as trans-CdlorLane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	9H dLell Mounwdurvey	**Date Collected:**	1S/0h/S013
Sample Matrix:	Animal tissue	**Date Received:**	1S/1h/S013

Organochlorine Pesticides

Sample Name:	HI2-C9	**Units:**	ug/Kg
Lab Code:	K1313763-004	**Basis:**	Wet
Extraction Method:	E5A 3891	**Level:**	2oP
Analysis Method:	4041B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpLa-BHC	ND	U	1.0	0.16	1	01/0S/19	01/19/19	KWG1900334	
beta-BHC	ND	U	1.0	0.91	1	01/0S/19	01/19/19	KWG1900334	
gamma-BHC (2inwane)	ND	U	1.0	0.S1	1	01/0S/19	01/19/19	KWG1900334	
welta-BHC	ND	U	1.0	0.S0	1	01/0S/19	01/19/19	KWG1900334	
HeptacLlor	ND	U	1.0	0.S7	1	01/0S/19	01/19/19	KWG1900334	
Alwrin	ND	U	1.0	0.79	1	01/0S/19	01/19/19	KWG1900334	
HeptacLlor Epoxiwe	ND	U	1.0	0.14	1	01/0S/19	01/19/19	KWG1900334	
gamma-CLlorwane†	ND	U	1.0	0.S6	1	01/0S/19	01/19/19	KWG1900334	
Enwosulfan I	ND	U	1.0	0.SS	1	01/0S/19	01/19/19	KWG1900334	
alpLa-CLlorwane	ND	U	1.0	0.S8	1	01/0S/19	01/19/19	KWG1900334	
Dielwrin	ND	U	1.0	0.S0	1	01/0S/19	01/19/19	KWG1900334	
9,9'-DDE	**0.53**	J	1.0	0.98	1	01/0S/19	01/19/19	KWG1900334	
Enwrin	ND	U	1.0	0.S4	1	01/0S/19	01/19/19	KWG1900334	
Enwosulfan II	ND	U	1.0	0.S9	1	01/0S/19	01/19/19	KWG1900334	
9,9'-DDD	ND	U	1.0	0.88	1	01/0S/19	01/19/19	KWG1900334	
Enwrin AlweLywe	ND	U	1.0	0.6S	1	01/0S/19	01/19/19	KWG1900334	
Enwosulfan dulfate	ND	U	1.0	0.83	1	01/0S/19	01/19/19	KWG1900334	
9,9'-DDT	ND	U	1.0	0.9h	1	01/0S/19	01/19/19	KWG1900334	
Enwrin Ketone	ND	U	1.0	0.3h	1	01/0S/19	01/19/19	KWG1900334	
MetLoxycLlor	ND	U	1.0	0.94	1	01/0S/19	01/19/19	KWG1900334	
ToxapLene	ND	U	80	13	1	01/0S/19	01/19/19	KWG1900334	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracLloro-m-xylene	6h	Sh-117	01/19/19	Acceptable
DecacLlorobipLenyl	76	SS-1S1	01/19/19	Acceptable

† Analyte Comments

gamma-CLlorwane	For tLis analyte (CAd Registry No. 8103-79-S), UdE5A Las correctewtLe name to be beta-CLlorwane, also knoP n as trans-CLlorwane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SH hdell MounL hurvey	**Date Collected:**	14/02/4013
Sample Matrix:	Animal tissue	**Date Received:**	14/12/4013

y rHanochlorine Pesticides

Sample Name:	HAZ-9 1	**Units:**	ug/Kg
Lab Code:	K1313763-002	**Basis:**	Wet
Extraction Method:	E5A 38S1	**Level:**	woP
AnalQsis Method:	B0B19		

AnalQte Name	Result	z	MRL	MDL	Dilution 0actor	Date Extracted	Date AnalQFed	Extraction Lot	Note
alpda-9 HC	ND	U	0.27	0.16	1	01/04/1S	01/1S/1S	KWG1S0033B	
beta-9 HC	ND	U	0.27	0.S1	1	01/04/1S	01/1S/1S	KWG1S0033B	
gamma-9 HC (winLane)	ND	U	0.27	0.41	1	01/04/1S	01/1S/1S	KWG1S0033B	
Lelta-9 HC	ND	Ui	0.27	0.41	1	01/04/1S	01/1S/1S	KWG1S0033B	
Heptacdlor	ND	U	0.27	0.47	1	01/04/1S	01/1S/1S	KWG1S0033B	
AlLrin	ND	U	0.27	0.7S	1	01/04/1S	01/1S/1S	KWG1S0033B	
Heptacdlor EpoxiLe	ND	U	0.27	0.1B	1	01/04/1S	01/1S/1S	KWG1S0033B	
gamma-CdlorLaneJ	ND	U	0.27	0.46	1	01/04/1S	01/1S/1S	KWG1S0033B	
EnLosulfan I	ND	U	0.27	0.44	1	01/04/1S	01/1S/1S	KWG1S0033B	
alpda-CdlorLane	ND	U	0.27	0.48	1	01/04/1S	01/1S/1S	KWG1S0033B	
DielLrin	ND	Ui	0.27	0.41	1	01/04/1S	01/1S/1S	KWG1S0033B	
S,S'-DDE	**4.51**	†	0.27	0.S8	1	01/04/1S	01/1S/1S	KWG1S0033B	
EnLrin	ND	U	0.27	0.4B	1	01/04/1S	01/1S/1S	KWG1S0033B	
EnLosulfan II	ND	U	0.27	0.4S	1	01/04/1S	01/1S/1S	KWG1S0033B	
S,S'-DDD	ND	U	0.27	0.88	1	01/04/1S	01/1S/1S	KWG1S0033B	
EnLrin AlLedyLe	ND	U	0.27	0.64	1	01/04/1S	01/1S/1S	KWG1S0033B	
EnLosulfan hulfate	ND	U	0.27	0.83	1	01/04/1S	01/1S/1S	KWG1S0033B	
S,S'-DDT	ND	U	0.27	0.S2	1	01/04/1S	01/1S/1S	KWG1S0033B	
EnLrin Ketone	ND	U	0.27	0.32	1	01/04/1S	01/1S/1S	KWG1S0033B	
Metdoxycdlor	ND	U	0.27	0.SB	1	01/04/1S	01/1S/1S	KWG1S0033B	
Toxapdene	ND	U	S2	13	1	01/04/1S	01/1S/1S	KWG1S0033B	

SurroHate Name	g Rec	Control Limits	Date AnalQFed	Note
Tetracdloro-m-xylene	76	42-117	01/1S/1S	Acceptable
Decacdlorobipdenyl	7B	44-141	01/1S/1S	Acceptable

%AnalQte Comments

gamma-CdlorLane	For tdis analyte (CAh Registry No. 8103-7S-4), UhE5A das correcteL tde name to be beta-CdlorLane, also knoP n as trans-CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SWhdell MounL hurvey	**Date Collected:**	19g04g9013
Sample Matrix:	Animal tissue	**Date Received:**	19g14g9013

Organochlorine Pesticides

Sample Name:	WAH-Z9	**Units:**	u2gK2
Lab Code:	K1313763-010	**Basis:**	/ et
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	B0B1Z		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda-ZWC	ND	U	0.47	0.16	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
beta-ZWC	ND	Ui	0.47	0.SS	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
2amma-ZWC (winLane)	ND	U	0.47	0.91	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Lelta-ZWC	ND	Ui	0.47	0.97	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Weptacdlor	ND	U	0.47	0.97	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
AlLrin	ND	U	0.47	0.7S	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Weptacdlor EpoxiLe	ND	U	0.47	0.1B	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
2amma-CdlorLaneJ	ND	U	0.47	0.96	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLosulfan I	ND	U	0.47	0.99	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
alpda-CdlorLane	ND	U	0.47	0.98	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
DielLrin	ND	U	0.47	0.90	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
S,S'-DDE	**0.67**	†	0.47	0.S8	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLrin	ND	U	0.47	0.9B	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLosulfan II	ND	U	0.47	0.9S	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
S,S'-DDD	ND	U	0.47	0.88	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLrin AlLedyLe	ND	U	0.47	0.69	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLosulfan hulfate	ND	U	0.47	0.83	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
S,S'-DDT	ND	U	0.47	0.S4	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLrin Ketone	ND	U	0.47	0.34	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Metdoxycdlor	ND	U	0.47	0.SB	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Toxapdene	ND	U	S4	13	1	01g09g1S	01g1Sg1S	K/ G1S0033B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro-m-xylene	70	94-117	01g1Sg1S	Acceptable
Decacdlorobipdenyl	7S	99-191	01g1Sg1S	Acceptable

† Analyte Comments

2amma-CdlorLane	For tdis analyte (CAh Re2istry No. 8103-7S-9), UhE5A das correcteL tde name to be beta-CdlorLane, also knoP n as trans-CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SWhdell MounL hurvey	**Date Collected:**	19g04g9013
Sample Matrix:	Animal tissue	**Date Received:**	19g14g9013

Organochlorine Pesticides

Sample Name:	WAH-Z3	**Units:**	u2gK2
Lab Code:	K1313763-011	**Basis:**	/ et
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	B0B1Z		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda-ZWC	ND	U	0.46	0.16	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
beta-ZWC	ND	U	0.46	0.S1	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
2amma-ZWC (winLane)	ND	U	0.46	0.91	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Lelta-ZWC	ND	Ui	0.46	0.80	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Weptacdlor	ND	U	0.46	0.97	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
AlLrin	ND	U	0.46	0.7S	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Weptacdlor EpoxiLe	ND	U	0.46	0.1B	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
2amma-CdlorLaneJ	ND	U	0.46	0.96	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLosulfan I	ND	U	0.46	0.99	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
alpda-CdlorLane	ND	U	0.46	0.98	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
DielLrin	ND	U	0.46	0.90	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
S,S'-DDE	**0.83**	†	0.46	0.S8	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLrin	ND	U	0.46	0.9B	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLosulfan II	ND	Ui	0.46	0.S4	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
S,S'-DDD	ND	U	0.46	0.88	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLrin AlLedyLe	ND	U	0.46	0.69	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLosulfan hulfate	ND	U	0.46	0.83	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
S,S'-DDT	ND	U	0.46	0.S4	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
EnLrin Ketone	ND	U	0.46	0.34	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Metdoxycdlor	ND	U	0.46	0.SB	1	01g09g1S	01g1Sg1S	K/ G1S0033B	
Toxapdene	ND	U	SB	13	1	01g09g1S	01g1Sg1S	K/ G1S0033B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro-m-xylene	79	94-117	01g1Sg1S	Acceptable
Decacdlorobipdenyl	7B	99-191	01g1Sg1S	Acceptable

† Analyte Comments	
2amma-CdlorLane	For tdis analyte (CAh Re2istry No. 8103-7S-9), UhE5A das correcteL tde name to be beta-CdlorLane, also knoP n as trans-CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	h2 dLell Mounwdurvey	**Date Collected:**	1gW0SWg013
Sample Matrix:	Animal tissue	**Date Received:**	1gW1SWg013

Organochlorine Pesticides

Sample Name:	2 I9-4 1	**Units:**	u/ WK/
Lab Code:	K1313763-01g	**Basis:**	H et
Extraction Method:	E5A 38h1	**Level:**	9 oP
Analysis Method:	B0B14		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpLa-4 2 C	ND	U	1.0	0.16	1	01W0gW1h	01W1hW1h	KH G1h0033B	
beta-4 2 C	ND	Ui	1.0	0.hg	1	01W0gW1h	01W1hW1h	KH G1h0033B	
/ amma-4 2 C (9 inwane)	ND	U	1.0	0.g1	1	01W0gW1h	01W1hW1h	KH G1h0033B	
welta-4 2 C	ND	Ui	1.0	0.gS	1	01W0gW1h	01W1hW1h	KH G1h0033B	
2 eptacLlor	ND	U	1.0	0.g7	1	01W0gW1h	01W1hW1h	KH G1h0033B	
Alwrin	ND	U	1.0	0.7h	1	01W0gW1h	01W1hW1h	KH G1h0033B	
2 eptacLlor Epoxiwe	ND	U	1.0	0.1B	1	01W0gW1h	01W1hW1h	KH G1h0033B	
/ amma-CLlorwane†	ND	U	1.0	0.g6	1	01W0gW1h	01W1hW1h	KH G1h0033B	
Enwosulfan I	ND	U	1.0	0.gg	1	01W0gW1h	01W1hW1h	KH G1h0033B	
alpLa-CLlorwane	ND	U	1.0	0.g8	1	01W0gW1h	01W1hW1h	KH G1h0033B	
Dielwrin	ND	U	1.0	0.g0	1	01W0gW1h	01W1hW1h	KH G1h0033B	
h,h'-DDE	**1.1**		1.0	0.h8	1	01W0gW1h	01W1hW1h	KH G1h0033B	
Enwrin	ND	U	1.0	0.gB	1	01W0gW1h	01W1hW1h	KH G1h0033B	
Enwosulfan II	ND	U	1.0	0.gh	1	01W0gW1h	01W1hW1h	KH G1h0033B	
h,h'-DDD	ND	U	1.0	0.88	1	01W0gW1h	01W1hW1h	KH G1h0033B	
Enwrin AlweLywe	ND	U	1.0	0.6g	1	01W0gW1h	01W1hW1h	KH G1h0033B	
Enwosulfan dulfate	ND	U	1.0	0.83	1	01W0gW1h	01W1hW1h	KH G1h0033B	
h,h'-DDT	ND	U	1.0	0.hS	1	01W0gW1h	01W1hW1h	KH G1h0033B	
Enwrin Ketone	ND	U	1.0	0.3S	1	01W0gW1h	01W1hW1h	KH G1h0033B	
MetLoxycLlor	ND	U	1.0	0.hB	1	01W0gW1h	01W1hW1h	KH G1h0033B	
ToxapLene	ND	U	80	13	1	01W0gW1h	01W1hW1h	KH G1h0033B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
TetracLloro-m-xylene	71	gS-117	01W1hW1h	Acceptable
DecacLlorobipLenyl	76	gg-1g1	01W1hW1h	Acceptable

† Analyte Comments

/ amma-CLlorwane	For tLis analyte (CAd Re/ istry No. 8103-7h-g), UdE5A Las correctewtLe name to be beta-CLlorwane, also knoP n as trans-CLlorwane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SH hdell MounL hurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Organochlorine Pesticides

Sample Name:	HAZ-21	**Units:**	ug/Kg
Lab Code:	K1313763-013	**Basis:**	Wet
Extraction Method:	EPA 35S1	**Level:**	2ow
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda-BHC	ND	U	1.0	0.16	1	01/09/1S	01/1S/1S	KWG1S00338	
beta-BHC	ND	U	1.0	0.S1	1	01/09/1S	01/1S/1S	KWG1S00338	
gamma-BHC (2inLane)	ND	U	1.0	0.91	1	01/09/1S	01/1S/1S	KWG1S00338	
Lelta-BHC	ND	U	1.0	0.90	1	01/09/1S	01/1S/1S	KWG1S00338	
Heptacdlor	ND	U	1.0	0.97	1	01/09/1S	01/1S/1S	KWG1S00338	
AlLrin	ND	U	1.0	0.7S	1	01/09/1S	01/1S/1S	KWG1S00338	
Heptacdlor EpoxiLe	ND	U	1.0	0.18	1	01/09/1S	01/1S/1S	KWG1S00338	
gamma-CdlorLane†	ND	Ui	1.0	0.37	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLosulfan I	ND	U	1.0	0.99	1	01/09/1S	01/1S/1S	KWG1S00338	
alpda-CdlorLane	ND	U	1.0	0.95	1	01/09/1S	01/1S/1S	KWG1S00338	
DielLrin	ND	U	1.0	0.90	1	01/09/1S	01/1S/1S	KWG1S00338	
S,S'-DDE	**18**		1.0	0.S5	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLrin	ND	U	1.0	0.98	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLosulfan II	ND	U	1.0	0.9S	1	01/09/1S	01/1S/1S	KWG1S00338	
S,S'-DDD	ND	U	1.0	0.55	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLrin AlLedyLe	ND	U	1.0	0.69	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLosulfan hulfate	ND	U	1.0	0.53	1	01/09/1S	01/1S/1S	KWG1S00338	
S,S'-DDT	ND	Ui	1.0	0.58	1	01/09/1S	01/1S/1S	KWG1S00338	
EnLrin Ketone	ND	U	1.0	0.34	1	01/09/1S	01/1S/1S	KWG1S00338	
Metdoxycdlor	ND	U	1.0	0.S8	1	01/09/1S	01/1S/1S	KWG1S00338	
Toxapdene	ND	U	50	13	1	01/09/1S	01/1S/1S	KWG1S00338	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro-m-xylene	58	94-117	01/1S/1S	Acceptable
Decacdlorobipdenyl	66	99-191	01/1S/1S	Acceptable

† Analyte Comments

gamma-CdlorLane	For tdis analyte (CAh Registry No. 5103-7S-9), UhEPA das correcteL tde name to be beta-CdlorLane, also known as trans-CdlorLane.

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	2H hdell MounL hurvey	**Date Collected:**	14/10/4013
Sample Matrix:	Animal tissue	**Date Received:**	14/1S/4013

Organochlorine Pesticides

Sample Name:	HAZ-94	**Units:**	ug/Kg
Lab Code:	K1313763-012	**Basis:**	Wet
Extraction Method:	EPA 3521	**Level:**	9ow
Analysis Method:	8081B		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpda-BHC	ND	U	0.SS	0.16	1	01/04/12	01/12/12	KWG1200338	
beta-BHC	ND	U	0.SS	0.21	1	01/04/12	01/12/12	KWG1200338	
gamma-BHC (9inLane)	ND	U	0.SS	0.41	1	01/04/12	01/12/12	KWG1200338	
Lelta-BHC	ND	U	0.SS	0.40	1	01/04/12	01/12/12	KWG1200338	
Heptacdlor	ND	U	0.SS	0.47	1	01/04/12	01/12/12	KWG1200338	
AlLrin	ND	U	0.SS	0.72	1	01/04/12	01/12/12	KWG1200338	
Heptacdlor EpoxiLe	ND	U	0.SS	0.18	1	01/04/12	01/12/12	KWG1200338	
gamma-CdlorLane†	**0.38**	JP	0.SS	0.46	1	01/04/12	01/12/12	KWG1200338	
EnLosulfan I	ND	U	0.SS	0.44	1	01/04/12	01/12/12	KWG1200338	
alpda-CdlorLane	ND	U	0.SS	0.45	1	01/04/12	01/12/12	KWG1200338	
DielLrin	ND	U	0.SS	0.40	1	01/04/12	01/12/12	KWG1200338	
2,2'-DDE	**14**		0.SS	0.25	1	01/04/12	01/12/12	KWG1200338	
EnLrin	ND	U	0.SS	0.48	1	01/04/12	01/12/12	KWG1200338	
EnLosulfan II	ND	U	0.SS	0.42	1	01/04/12	01/12/12	KWG1200338	
2,2'-DDD	ND	U	0.SS	0.55	1	01/04/12	01/12/12	KWG1200338	
EnLrin AlLedyLe	ND	U	0.SS	0.64	1	01/04/12	01/12/12	KWG1200338	
EnLosulfan hulfate	ND	U	0.SS	0.53	1	01/04/12	01/12/12	KWG1200338	
2,2'-DDT	ND	Ui	1.4	1.4	1	01/04/12	01/12/12	KWG1200338	
EnLrin Ketone	ND	U	0.SS	0.3S	1	01/04/12	01/12/12	KWG1200338	
Metdoxycdlor	ND	U	0.SS	0.28	1	01/04/12	01/12/12	KWG1200338	
Toxapdene	ND	U	50	13	1	01/04/12	01/12/12	KWG1200338	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetracdloro-m-xylene	71	4S-117	01/12/12	Acceptable
Decacdlorobipdenyl	7S	44-141	01/12/12	Acceptable

† **Analyte Comments**

gamma-CdlorLane	For tdis analyte (CAh Registry No. 5103-72-4), UhEPA das correcteL tde name to be beta-CdlorLane, also known as trans-CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	hd Lwell MounP Lurvey	**Date Collected:**	14W0W4013
Sample Matrix:	Animal tissue	**Date Received:**	14WSW4013

Organochlorine Pesticides

Sample Name:	RE2-91	**Units:**	u/ WK/
Lab Code:	K1313763-01g	**Basis:**	H et
Extraction Method:	E8A 3gh1	**Level:**	9o5
Analysis Method:	B0B1G		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albwa-Gd C	Dp	N	0.SS	0.16	1	01W04Wh	01WhWh	KH U1h0033B	
(eta-Gd C	Dp	N	0.SS	0.h1	1	01W04Wh	01WhWh	KH U1h0033B	
/ amma-Gd C)9 inPanex	Dp	N	0.SS	0.41	1	01W04Wh	01WhWh	KH U1h0033B	
Pelta-Gd C	Dp	N	0.SS	0.40	1	01W04Wh	01WhWh	KH U1h0033B	
d ebtacwlor	Dp	N	0.SS	0.47	1	01W04Wh	01WhWh	KH U1h0033B	
AlPrin	Dp	N	0.SS	0.7h	1	01W04Wh	01WhWh	KH U1h0033B	
d ebtacwlor Ebo†iPe	Dp	N	0.SS	0.1B	1	01W04Wh	01WhWh	KH U1h0033B	
/ amma-CwlorPane'	Dp	N	0.SS	0.46	1	01W04Wh	01WhWh	KH U1h0033B	
EnPosulfan I	Dp	N	0.SS	0.44	1	01W04Wh	01WhWh	KH U1h0033B	
albwa-CwlorPane	Dp	N	0.SS	0.4g	1	01W04Wh	01WhWh	KH U1h0033B	
p ielPrin	Dp	N	0.SS	0.40	1	01W04Wh	01WhWh	KH U1h0033B	
h,hTp p E	**8.5**		0.SS	0.hg	1	01W04Wh	01WhWh	KH U1h0033B	
EnPrin	Dp	N	0.SS	0.4B	1	01W04Wh	01WhWh	KH U1h0033B	
EnPosulfan II	Dp	N	0.SS	0.4h	1	01W04Wh	01WhWh	KH U1h0033B	
h,hTp p p	Dp	N	0.SS	0.gg	1	01W04Wh	01WhWh	KH U1h0033B	
EnPrin AlPewyPe	Dp	N	0.SS	0.64	1	01W04Wh	01WhWh	KH U1h0033B	
EnPosulfan Lulfate	Dp	N	0.SS	0.g3	1	01W04Wh	01WhWh	KH U1h0033B	
h,hTp p F	Dp	N	0.SS	0.hS	1	01W04Wh	01WhWh	KH U1h0033B	
EnPrin Ketone	Dp	N	0.SS	0.3S	1	01W04Wh	01WhWh	KH U1h0033B	
Metwo†ycwlor	Dp	N	0.SS	0.hB	1	01W04Wh	01WhWh	KH U1h0033B	
Fo†abwene	Dp	N	g0	13	1	01W04Wh	01WhWh	KH U1h0033B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fetracwloro-m-†ylene	7S	4S-117	01WhWh	Accebta(le
p ecacwloro(ibwenyl	B6	44-141	01WhWh	Accebta(le

† **Analyte Comments**

/ amma-CwlorPane	2or twis analyte)CAL Re/ istry Do. g103-7h-4x, NLE8A was correcteP twe name to (e (eta-CwlorPane, also kno5 n as trans-CwlorPane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	Sh dLell Mounwdurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Organochlorine Pesticides

Sample Name:	REH-29	**Units:**	ug/Kg
Lab Code:	K1313763-016	**Basis:**	Wet
Extraction Method:	E5A 38S1	**Level:**	2oP
Analysis Method:	B0B1G		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
albLa-Gh C	Dp	N	0.47	0.16	1	01/09/1S	01/1S/1S	KWU1S0033B	
(eta-Gh C	Dp	N	0.47	0.S1	1	01/09/1S	01/1S/1S	KWU1S0033B	
gamma-Gh C)2inwanex	Dp	N	0.47	0.91	1	01/09/1S	01/1S/1S	KWU1S0033B	
welta-Gh C	Dp	N	0.47	0.90	1	01/09/1S	01/1S/1S	KWU1S0033B	
h ebtacLlor	Dp	N	0.47	0.97	1	01/09/1S	01/1S/1S	KWU1S0033B	
Alwrin	Dp	N	0.47	0.7S	1	01/09/1S	01/1S/1S	KWU1S0033B	
h ebtacLlor Ebo†iwe	Dp	N	0.47	0.1B	1	01/09/1S	01/1S/1S	KWU1S0033B	
gamma-CLlorwane'	Dp	N	0.47	0.96	1	01/09/1S	01/1S/1S	KWU1S0033B	
Enwosulfan I	Dp	N	0.47	0.99	1	01/09/1S	01/1S/1S	KWU1S0033B	
albLa-CLlorwane	Dp	N	0.47	0.98	1	01/09/1S	01/1S/1S	KWU1S0033B	
p ielwrin	Dp	N	0.47	0.90	1	01/09/1S	01/1S/1S	KWU1S0033B	
S,ST-p p E	**9.5**		0.47	0.S8	1	01/09/1S	01/1S/1S	KWU1S0033B	
Enwrin	Dp	N	0.47	0.9B	1	01/09/1S	01/1S/1S	KWU1S0033B	
Enwosulfan II	Dp	N	0.47	0.9S	1	01/09/1S	01/1S/1S	KWU1S0033B	
S,ST-p p p	Dp	N	0.47	0.88	1	01/09/1S	01/1S/1S	KWU1S0033B	
Enwrin AlweLywe	Dp	N	0.47	0.69	1	01/09/1S	01/1S/1S	KWU1S0033B	
Enwosulfan dulfate	Dp	N	0.47	0.83	1	01/09/1S	01/1S/1S	KWU1S0033B	
S,ST-p p F	Dp	N	0.47	0.S4	1	01/09/1S	01/1S/1S	KWU1S0033B	
Enwrin Ketone	Dp	N	0.47	0.34	1	01/09/1S	01/1S/1S	KWU1S0033B	
MetLo†ycLlor	Dp	N	0.47	0.SB	1	01/09/1S	01/1S/1S	KWU1S0033B	
Fo†abLene	Dp	N	S4	13	1	01/09/1S	01/1S/1S	KWU1S0033B	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
FetracLloro-m-†ylene	70	94-117	01/1S/1S	Accebta(le
p ecacLloro(ibLenyl	78	99-191	01/1S/1S	Accebta(le

† **Analyte Comments**

gamma-CLlorwane	Hor tLis analyte)CAd Registry Do. 8103-7S-9x, NdE5A Las correctewtLe name to (e (eta-CLlorwane, also knoP n as trans-CLlorwane.

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SWhdell MounL hurvey	**Date Collected:**	19g10g9013
Sample Matrix:	Animal tissue	**Date Received:**	19g14g9013

y rHanochlorine Pesticides

Sample Name:	WAH-Z3	**Units:**	u2gK2
Lab Code:	K1313763-017	**Basis:**	/ et
Extraction Method:	EPA 35S1	**Level:**	Zow
AnalQsis Method:	8081B		

AnalQte Name	Result	z	MRL	MDL	Dilution 2actor	Date Extracted	Date AnalQFed	Extraction Lot	Note
alpda-BWC	ND	U	0.46	0.16	1	01g09g1S	01g1Sg1S	K/ G1S00338	
beta-BWC	ND	U	0.46	0.S1	1	01g09g1S	01g1Sg1S	K/ G1S00338	
2amma-BWC (ZinLane)	ND	U	0.46	0.91	1	01g09g1S	01g1Sg1S	K/ G1S00338	
Lelta-BWC	ND	U	0.46	0.90	1	01g09g1S	01g1Sg1S	K/ G1S00338	
Weptacdlor	ND	U	0.46	0.97	1	01g09g1S	01g1Sg1S	K/ G1S00338	
AlLrin	ND	U	0.46	0.7S	1	01g09g1S	01g1Sg1S	K/ G1S00338	
Weptacdlor EpoxiLe	ND	U	0.46	0.18	1	01g09g1S	01g1Sg1S	K/ G1S00338	
2amma-CdlorLaneJ	ND	Ui	0.46	0.S7	1	01g09g1S	01g1Sg1S	K/ G1S00338	
EnLosulfan I	ND	U	0.46	0.99	1	01g09g1S	01g1Sg1S	K/ G1S00338	
alpda-CdlorLane	ND	U	0.46	0.95	1	01g09g1S	01g1Sg1S	K/ G1S00338	
DielLrin	ND	U	0.46	0.90	1	01g09g1S	01g1Sg1S	K/ G1S00338	
S,S‡DDE	**04**		0.46	0.S5	1	01g09g1S	01g1Sg1S	K/ G1S00338	
EnLrin	ND	U	0.46	0.98	1	01g09g1S	01g1Sg1S	K/ G1S00338	
EnLosulfan II	ND	U	0.46	0.9S	1	01g09g1S	01g1Sg1S	K/ G1S00338	
S,S‡DDD	**9.16**	'	0.46	0.55	1	01g09g1S	01g1Sg1S	K/ G1S00338	
EnLrin AlLedyLe	ND	U	0.46	0.69	1	01g09g1S	01g1Sg1S	K/ G1S00338	
EnLosulfan hulfate	ND	U	0.46	0.53	1	01g09g1S	01g1Sg1S	K/ G1S00338	
S,S‡DDT	ND	Ui	1.5	1.5	1	01g09g1S	01g1Sg1S	K/ G1S00338	
EnLrin Ketone	ND	U	0.46	0.34	1	01g09g1S	01g1Sg1S	K/ G1S00338	
Metdoxycdlor	ND	U	0.46	0.S8	1	01g09g1S	01g1Sg1S	K/ G1S00338	
Toxapdene	ND	U	S8	13	1	01g09g1S	01g1Sg1S	K/ G1S00338	

SurroHate Name	g Rec	Control Limits	Date AnalQFed	Note
Tetracdloro-m-xylene	64	94-117	01g1Sg1S	Acceptable
Decacdlorobipdenyl	77	99-191	01g1Sg1S	Acceptable

%AnalQte Comments

2amma-CdlorLane	For tdis analyte (CAh Re2istry No. 5103-7S-9), UhEPA das correcteL tde name to be beta-CdlorLane, also known as trans-CdlorLane.

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	gw P4ell MounS Purvey	**Date Collected:**	LA
Sample Matrix:	Animal tissue	**Date Received:**	LA

Organochlorine Pesticides

Sample Name:	Met4oS h land	**Units:**	u29K2
Lab Code:	K- 0 1g/ / 33W6	**Basis:**	- et
Extraction Method:	EBA 3Gg1	**Level:**	5o8
Analysis Method:	W'W'h		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alp4aHh wC	LD	N	/ .67	/ .16	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
betaHh wC	LD	N	/ .67	/ .g1	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
2ammaHh wC (5inSane)	LD	N	/ .67	/ .Ul	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
SeltaHh wC	LD	N	/ .67	/ .U/	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
weptac4lor	LD	N	/ .67	/ .U7	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
AlSrin	LD	N	/ .7g	/ .7g	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
weptac4lor EpoxiSe	LD	N	/ .67	/ .1W	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
2ammaHC4lorSane†	LD	N	/ .67	/ .U6	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
EnSosulfan I	LD	N	/ .67	/ .UU	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
alp4aHC4lorSane	LD	N	/ .67	/ .UG	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
DielSrin	LD	N	/ .67	/ .U/	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
g,g'HDDE	LD	N	/ .67	/ .gG	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
EnSrin	LD	N	/ .67	/ .UW	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
EnSosulfan II	LD	N	/ .67	/ .Ug	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
g,g'HDDD	LD	N	/ .67	/ .GG	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
EnSrin AlSe4ySe	LD	N	/ .67	/ .6U	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
EnSosulfan Pulfate	LD	N	/ .67	/ .G3	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
g,g'HDDF	LD	N	/ .67	/ .gT	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
EnSrin Ketone	LD	N	/ .67	/ .3T	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
Met4oxyc4lor	LD	N	/ .67	/ .gW	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	
Foxap4ene	LD	N	3g	13	1	/ 19/ U9l g	/ 19l g9l g	K- 0 1g/ / 33W	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fetrac4loroHmHxylene	6g	UTH17	/ 19l g9l g	Acceptable
Decac4lorobip4enyl	7T	UUHUl	/ 19l g9l g	Acceptable

† Analyte Comments

2ammaHC4lorSane	kor t4is analyte (CAP Re2istry Lo. Gl/ 3H7gHU), NPEBA 4as correcteS t4e name to be betaHC4lorSane, also dno8 n as transHC4lorSane.

Comments:

Client: AMEC Environment & Infrastructure, Inc.
Service Request: K1313763
Project: 4H Shell Mound Survey
Sample Matrix: Animal tissue

Surrogate Recovery Summary
Organochlorine Pesticides

Extraction Method: EPA 3541
Units: Percent
Analysis Method: 8081B
Level: Low

Sample Name	Lab Code	Sur1	Sur2
HAZ-C1	K1313763-001	70	79
HAZ-C2	K1313763-002	72	79
HAZ-C3	K1313763-003	66	73
HAZ-C4	K1313763-004	70	79
HIL-C1	K1313763-005	68	72
HIL-C2	K1313763-006	69	74
HIL-C3	K1313763-007	88	92
HIL-C4	K1313763-008	69	76
HAZ-B1	K1313763-009	76	78
HAZ-B2	K1313763-010	70	74
HAZ-B3	K1313763-011	72	78
HIL-B1	K1313763-012	71	76
HAZ-L1	K1313763-013	58	66
HAZ-L2	K1313763-014	71	79
REF-L1	K1313763-015	79	86
REF-L2	K1313763-016	70	75
HAZ-L3	K1313763-017	69	77
Method Blank	KWG1400338-6	64	79
HAZ-B1MS	KWG1400338-1	77	82
HAZ-B1DMS	KWG1400338-2	72	74
Lab Control Sample	KWG1400338-3	75	74
Lab Control Sample	KWG1400338-4	70	70
Duplicate Lab Control Sample	KWG1400338-5	64	65

Surrogate Recovery Control Limits (%)

Sur1	=	Tetrachloro-m-xylene	29-117
Sur2	=	Decachlorobiphenyl	22-121

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Extracted:**	01/02/2014
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/14/2014

Matrix Spike/Duplicate Matrix Spike Summary
Organochlorine Pesticides

Sample Name:	HAZ-B1	**Units:**	ug/Kg
Lab Code:	K1313763-009	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8081B	**Extraction Lot:**	KWG1400338

		HAZ-B1MS KWG1400338-1 **Matrix Spike**			HAZ-B1DMS KWG1400338-2 **Duplicate Matrix Spike**					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
alpha-BHC	ND	12.0	19.7	61	9.77	19.3	51	31-118	21	40
beta-BHC	ND	13.6	19.7	69	11.5	19.3	59	22-123	17	40
gamma-BHC (Lindane)	ND	12.3	19.7	62	9.83	19.3	51	34-123	22	40
delta-BHC	ND	15.0	19.7	76	12.5	19.3	65	38-133	18	40
Heptachlor	ND	11.2	19.7	57	8.98	19.3	47	37-122	22	40
Aldrin	ND	9.81	19.7	50	7.77	19.3	40	38-116	23	40
Heptachlor Epoxide	ND	13.1	19.7	67	10.8	19.3	56	39-113	19	40
gamma-Chlordane	ND	12.4	19.7	63	10.1	19.3	52	34-123	20	40
Endosulfan I	ND	12.1	19.7	61	9.73	19.3	50	22-113	22	40
alpha-Chlordane	ND	12.5	19.7	63	9.93	19.3	52	39-113	23	40
Dieldrin	ND	14.2	19.7	72	11.7	19.3	61	33-120	19	40
4,4'-DDE	0.72	15.2	19.7	74	11.9	19.3	58	33-134	25	40
Endrin	ND	15.8	19.7	80	12.9	19.3	67	43-124	20	40
Endosulfan II	ND	13.9	19.7	71	11.0	19.3	57	28-120	23	40
4,4'-DDD	ND	14.6	19.7	74	11.9	19.3	62	35-126	20	40
Endrin Aldehyde	ND	10.8	19.7	55	6.66	19.3	35	10-118	48 *	40
Endosulfan Sulfate	ND	14.4	19.7	73	11.9	19.3	62	23-128	19	40
4,4'-DDT	ND	13.8	19.7	70	11.5	19.3	59	26-133	19	40
Endrin Ketone	ND	13.2	19.7	67	11.0	19.3	57	27-128	19	40
Methoxychlor	ND	14.9	19.7	76	12.6	19.3	65	27-148	17	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4w SHell Mounh Surved	**Date Extracted:**	01/0y/y014
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/14/y014

Lab Control Spike Summary
Organochlorine Pesticides

Extraction Method:	EPA 3541	**Units:**	ug/Kg
Analysis Method:	8081B	**Basis:**	Wet
		Level:	Lo-
		Extraction Lot:	KWG1400338

	Lab Control Sample KWG140033823 **Lab Control Spike**			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
alpHa2BwC	11.5	19.5	59	4y21y4
beta2BwC	11.5	19.5	59	3921yy
gamma2BwC (Linhane)	11.5	19.5	59	4421y3
helta2BwC	1y.3	19.5	63	442141
weptacHlor	10.5	19.5	54	3921y6
Alhrin	11.1	19.5	57	462116
weptacHlor Epoxihe	1y.0	19.5	6y	432119
gamma2CHlorhane	11.6	19.5	59	3821y1
Enhosulfan I	11.6	19.5	59	y32116
alpHa2CHlorhane	11.6	19.5	60	4021y1
Dielhrin	1y.1	19.5	6y	4021y0
4,4'2DDE	1y.5	19.5	64	362139
Enhrin	13.3	19.5	68	442130
Enhosulfan II	11.y	19.5	58	352111
4,4'2DDD	1y.y	19.5	6y	332138
Enhrin AlheHdhe	10.6	19.5	54	112110
Enhosulfan Sulfate	13.8	19.5	71	3621y7
4,4'2DDT	1y.0	19.5	61	492136
Enhrin Ketone	11.3	19.5	58	y92133
MetHoxdcHlor	1y.4	19.5	64	372144

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries anh relative percent hifferences (RPD) are hetermineh bd tHe soft- are using values in tHe calculation - HicHHave not been rounheh.

Client:	A5 MC MhEironment v &Iraftructures &c,	**Service Request:**	K1212. 32
Project:	4w SHell 5 ounh SurEed	**Date Extracted:**	01/0y/y014
Sample Matrix:	Animal tiffue	**Date Analyzed:**	01/14/y014

Lab Control Spike/Duplicate Lab Control Spike Summary
Organochlorine Pesticides

Extraction Method:	MPA 2- 41	**Units:**	uB/KB
Analysis Method:	80816	**Basis:**	Wet
		Level:	Log
		Extraction Lot:	KWG1400228

	Lab Control Sample KWG14002287 4 **Lab Control Spike**			Duplicate Lab Control Sample KWG14002287- **Duplicate Lab Control Spike**					
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
ToxapHene	3. ,0	99,0	38	. y,4	98,0	. 4	y17l- y	8	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoEerief anh relatiEe percent hiIIerencef (RPD) are hetermineh bd tHe foItg are ufinB Ealuef in tHe calculation g HcHHaEe not been rounheh,

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	HAZ-C1	**Units:**	ug/Kg
Lab Code:	K1313763-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.8	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1221	ND	U	20	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1232	ND	U	9.8	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1242	ND	U	9.8	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1248	ND	U	9.8	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1254	ND	U	9.8	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1260	ND	U	9.8	2.8	1	01/02/14	01/13/14	KWG1400337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	76	37-139	01/13/14	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	HAZ-C2	**Units:**	ug/Kg
Lab Code:	K1313763-002	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1221	ND	U	20	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1232	ND	U	10	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1242	ND	U	10	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1248	ND	U	10	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1254	**5.0**	J	10	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1260	ND	U	10	2.8	1	01/02/14	01/13/14	KWG1400337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	78	37-139	01/13/14	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	HAZ-C3	**Units:**	ug/Kg
Lab Code:	K1313763-003	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.5	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1221	ND	U	19	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1232	ND	U	9.5	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1242	ND	U	9.5	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1248	ND	U	9.5	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1254	ND	U	9.5	2.8	1	01/02/14	01/13/14	KWG1400337	
Aroclor 1260	ND	U	9.5	2.8	1	01/02/14	01/13/14	KWG1400337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	86	37-139	01/13/14	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	gZ Shell Mound Survey	**Date Collected:**	19W04W9013
Sample Matrix:	Animal tissue	**Date Received:**	19W14W9013

Polychlorinated Biphenyls (PCBs)

Sample Name:	ZA2-Cg	**Units:**	u/ WK/
Lab Code:	K1313763-00g	**Basis:**	H et
Extraction Method:	EPA 35g1	**Level:**	Low
Analysis Method:	8089A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	6.7	9.8	1	01W09Wg	01W3Wg	KH G1g00337	
Aroclor 1991	ND	U	1g	9.8	1	01W09Wg	01W3Wg	KH G1g00337	
Aroclor 1939	ND	U	6.7	9.8	1	01W09Wg	01W3Wg	KH G1g00337	
Aroclor 19g9	ND	U	6.7	9.8	1	01W09Wg	01W3Wg	KH G1g00337	
Aroclor 19g8	ND	U	6.7	9.8	1	01W09Wg	01W3Wg	KH G1g00337	
Aroclor 195g	ND	U	6.7	9.8	1	01W09Wg	01W3Wg	KH G1g00337	
Aroclor 1960	ND	U	6.7	9.8	1	01W09Wg	01W3Wg	KH G1g00337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	83	37-134	01W3Wg	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	h2 dLell Mounwdurvey	**Date Collected:**	14W0SW4013
Sample Matrix:	Animal tissue	**Date Received:**	14W1SW4013

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 I9-C1	**Units:**	u/ WK/
Lab Code:	K1313763-00g	**Basis:**	H et
Extraction Method:	E5A 3gh1	**Level:**	9oP
Analysis Method:	8084A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	11	4.S	1	01W04W1h	01W13W1h	KH G1h00337	
Aroclor 1441	ND	U	41	4.S	1	01W04W1h	01W13W1h	KH G1h00337	
Aroclor 1434	ND	U	11	4.S	1	01W04W1h	01W13W1h	KH G1h00337	
Aroclor 14h4	ND	U	11	4.S	1	01W04W1h	01W13W1h	KH G1h00337	
Aroclor 14h8	ND	U	11	4.S	1	01W04W1h	01W13W1h	KH G1h00337	
Aroclor 14gh	ND	U	11	4.S	1	01W04W1h	01W13W1h	KH G1h00337	
Aroclor 1460	ND	U	11	4.S	1	01W04W1h	01W13W1h	KH G1h00337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
DecacLlorobipLenyl	81	37-13S	01W13W1h	Acceptable

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SH hdell MounL hurvey	**Date Collected:**	19/04/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Polychlorinated Biphenyls (PCBs)

Sample Name:	HI2-C9	**Units:**	ug/Kg
Lab Code:	K1313763-006	**Basis:**	Wet
Extraction Method:	EPA 35S1	**Level:**	2ow
Analysis Method:	8089A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	13	3.5	1	01/09/1S	01/13/1S	KWG1S00337	
Aroclor 1991	ND	U	95	3.5	1	01/09/1S	01/13/1S	KWG1S00337	
Aroclor 1939	ND	U	13	3.5	1	01/09/1S	01/13/1S	KWG1S00337	
Aroclor 19S9	ND	U	13	3.5	1	01/09/1S	01/13/1S	KWG1S00337	
Aroclor 19S8	ND	U	13	3.5	1	01/09/1S	01/13/1S	KWG1S00337	
Aroclor 195S	ND	U	13	3.5	1	01/09/1S	01/13/1S	KWG1S00337	
Aroclor 1960	ND	U	13	3.5	1	01/09/1S	01/13/1S	KWG1S00337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	89	37-134	01/13/1S	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	HIL-C3	**Units:**	ug/Kg
Lab Code:	K1313763-007	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1221	ND	U	20	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1232	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1242	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1248	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1254	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1260	**3.7**	J	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	108	37-139	01/14/14	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	42 dLell Mounwdurvey	**Date Collected:**	1SW0hWS013
Sample Matrix:	Animal tissue	**Date Received:**	1SW1hWS013

Polychlorinated Biphenyls (PCBs)

Sample Name:	2 I9-C4	**Units:**	u/ WK/
Lab Code:	K1313763-00g	**Basis:**	H et
Extraction Method:	E5A 3841	**Level:**	9 oP
Analysis Method:	g0gSA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	S.g	1	01W0SW14	01W4W14	KH G1400337	
Aroclor 1SS1	ND	U	S0	S.g	1	01W0SW14	01W4W14	KH G1400337	
Aroclor 1S3S	ND	U	10	S.g	1	01W0SW14	01W4W14	KH G1400337	
Aroclor 1S4S	ND	U	10	S.g	1	01W0SW14	01W4W14	KH G1400337	
Aroclor 1S4g	ND	U	10	S.g	1	01W0SW14	01W4W14	KH G1400337	
Aroclor 1S84	ND	U	10	S.g	1	01W0SW14	01W4W14	KH G1400337	
Aroclor 1S60	ND	U	10	S.g	1	01W0SW14	01W4W14	KH G1400337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
DecacLlorobipLenyl	gg	37-13h	01W4W14	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polychlorinated Biphenyls (PCBs)

Sample Name:	HAZ-B1	**Units:**	ug/Kg
Lab Code:	K1313763-009	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8082A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1221	ND	U	20	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1232	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1242	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1248	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1254	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	
Aroclor 1260	ND	U	9.7	2.8	1	01/02/14	01/14/14	KWG1400337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	89	37-139	01/14/14	Acceptable

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4WShell Mound Survey	**Date Collected:**	1Bg02gB013
Sample Matrix:	Animal tissue	**Date Received:**	1Bg12gB013

Polychlorinated Biphenyls (PCBs)

Sample Name:	WAH-ZB	**Units:**	u9gK9
Lab Code:	K1313763-010	**Basis:**	/ et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	808BA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	2.7	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1BB1	ND	U	B0	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B3B	ND	U	2.7	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B4B	ND	U	2.7	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B48	ND	U	2.7	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B54	ND	U	2.7	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B60	ND	U	2.7	B.8	1	01g0Bg14	01g14g14	K/ G1400337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	20	37-132	01g14g14	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4WShell Mound Survey	**Date Collected:**	1Bg02gB013
Sample Matrix:	Animal tissue	**Date Received:**	1Bg12gB013

Polychlorinated Biphenyls (PCBs)

Sample Name:	WAH-Z3	**Units:**	u9gK9
Lab Code:	K1313763-011	**Basis:**	/ et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	808BA		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	2.6	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1BB1	ND	U	B0	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B3B	ND	U	2.6	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B4B	ND	U	2.6	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B48	ND	U	2.6	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B54	ND	U	2.6	B.8	1	01g0Bg14	01g14g14	K/ G1400337	
Aroclor 1B60	ND	U	2.6	B.8	1	01g0Bg14	01g14g14	K/ G1400337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	86	37-132	01g14g14	Acceptable

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	HF Shell Mound Survey	**Date Collected:**	14/09/4013
Sample Matrix:	Animal tissue	**Date Received:**	14/19/4013

Polychlorinated Biphenyls (PCBs)

Sample Name:	F IB-2 1	**Units:**	ug/Kg
Lab Code:	K1313763-014	**Basis:**	Wet
Extraction Method:	EwA 3PH1	**Level:**	BoL
Analysis Method:	5054A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	UN	G	10	4.5	1	01/04/1H	01/1H/1H	KW8 1H00337	
Aroclor 1441	UN	G	40	4.5	1	01/04/1H	01/1H/1H	KW8 1H00337	
Aroclor 1434	UN	G	10	4.5	1	01/04/1H	01/1H/1H	KW8 1H00337	
Aroclor 14H4	UN	G	10	4.5	1	01/04/1H	01/1H/1H	KW8 1H00337	
Aroclor 14H5	UN	G	10	4.5	1	01/04/1H	01/1H/1H	KW8 1H00337	
Aroclor 14PH	UN	G	10	4.5	1	01/04/1H	01/1H/1H	KW8 1H00337	
Aroclor 1460	UN	G	10	4.5	1	01/04/1H	01/1H/1H	KW8 1H00337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
NecachloropiDhenyl	75	37-139	01/1H/1H	AcceDtaple

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SWhdell MounL hurvey	**Date Collected:**	19gl0g9013
Sample Matrix:	Animal tissue	**Date Received:**	19gl4g9013

Polychlorinated Biphenyls (PCBs)

Sample Name:	WAH-Z1	**Units:**	u2gK2
Lab Code:	K1313763-013	**Basis:**	/ et
Extraction Method:	EPA 35S1	**Level:**	Zow
Analysis Method:	8089A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	9.8	1	01g09gl S	01gl Sgl S	K/ G1S00337	
Aroclor 1991	ND	U	90	9.8	1	01g09gl S	01gl Sgl S	K/ G1S00337	
Aroclor 1939	ND	U	10	9.8	1	01g09gl S	01gl Sgl S	K/ G1S00337	
Aroclor 19S9	ND	U	10	9.8	1	01g09gl S	01gl Sgl S	K/ G1S00337	
Aroclor 19S8	ND	U	10	9.8	1	01g09gl S	01gl Sgl S	K/ G1S00337	
Aroclor 195S	**7.8**	J	10	9.8	1	01g09gl S	01gl Sgl S	K/ G1S00337	
Aroclor 1960	**6.4**	J	10	9.8	1	01g09gl S	01gl Sgl S	K/ G1S00337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	7S	37-134	01gl Sgl S	Acceptable

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	2H hdell MounL hurvey	**Date Collected:**	14/10/4013
Sample Matrix:	Animal tissue	**Date Received:**	14/1S/4013

Polychlorinated Biphenyls (PCBs)

Sample Name:	HAZ-94	**Units:**	ug/Kg
Lab Code:	K1313763-012	**Basis:**	Wet
Extraction Method:	EPA 3521	**Level:**	9ow
Analysis Method:	8084A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	S.S	4.8	1	01/04/12	01/12/12	KWG1200337	
Aroclor 1441	ND	U	40	4.8	1	01/04/12	01/12/12	KWG1200337	
Aroclor 1434	ND	U	S.S	4.8	1	01/04/12	01/12/12	KWG1200337	
Aroclor 1424	ND	U	S.S	4.8	1	01/04/12	01/12/12	KWG1200337	
Aroclor 1428	ND	U	S.S	4.8	1	01/04/12	01/12/12	KWG1200337	
Aroclor 1452	**7.6**	J	S.S	4.8	1	01/04/12	01/12/12	KWG1200337	
Aroclor 1460	**4.2**	J	S.S	4.8	1	01/04/12	01/12/12	KWG1200337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	77	37-13S	01/12/12	Acceptable

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	hd Lwell MounP Lurvey	**Date Collected:**	14W0W4013
Sample Matrix:	Animal tissue	**Date Received:**	14WSW4013

Polychlorinated Biphenyls (PCBs)

Sample Name:	RE2-91	**Units:**	u/ WK/
Lab Code:	K1313763-01g	**Basis:**	H et
Extraction Method:	E8A 3gh1	**Level:**	9o5
Analysis Method:	G0G4A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	S.S	4.G	1	01W04Wh	01WhWh	KH U1h00337	
Aroclor 1441	Dp	N	40	4.G	1	01W04Wh	01WhWh	KH U1h00337	
Aroclor 1434	Dp	N	S.S	4.G	1	01W04Wh	01WhWh	KH U1h00337	
Aroclor 14h4	Dp	N	S.S	4.G	1	01W04Wh	01WhWh	KH U1h00337	
Aroclor 14hG	Dp	N	S.S	4.G	1	01W04Wh	01WhWh	KH U1h00337	
Aroclor 14gh	Dp	N	S.S	4.G	1	01W04Wh	01WhWh	KH U1h00337	
Aroclor 1460	Dp	N	S.S	4.G	1	01W04Wh	01WhWh	KH U1h00337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacwloro: ibwenyl	GG	37-13S	01WhWh	Accebta: le

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	Sh dLell Mounwdurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Polychlorinated Biphenyls (PCBs)

Sample Name:	REH-29	**Units:**	ug/Kg
Lab Code:	K1313763-016	**Basis:**	Wet
Extraction Method:	E5A 38S1	**Level:**	2oP
Analysis Method:	G0G9A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	Dp	N	4.7	9.G	1	01/09/1S	01/1S/1S	KWU1S00337	
Aroclor 1991	Dp	N	90	9.G	1	01/09/1S	01/1S/1S	KWU1S00337	
Aroclor 1939	Dp	N	4.7	9.G	1	01/09/1S	01/1S/1S	KWU1S00337	
Aroclor 19S9	Dp	N	4.7	9.G	1	01/09/1S	01/1S/1S	KWU1S00337	
Aroclor 19SG	Dp	N	4.7	9.G	1	01/09/1S	01/1S/1S	KWU1S00337	
Aroclor 198S	Dp	N	4.7	9.G	1	01/09/1S	01/1S/1S	KWU1S00337	
Aroclor 1960	Dp	N	4.7	9.G	1	01/09/1S	01/1S/1S	KWU1S00337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
p ecacLloro: ibLenyl	GS	37-134	01/1S/1S	Accebta: le

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SWhdell MounL hurvey	**Date Collected:**	19gl0g9013
Sample Matrix:	Animal tissue	**Date Received:**	19gl4g9013

Polychlorinated Biphenyls (PCBs)

Sample Name:	WAH-Z3	**Units:**	u2gK2
Lab Code:	K1313763-017	**Basis:**	/ et
Extraction Method:	EPA 35S1	**Level:**	Zow
Analysis Method:	8089A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	4.6	9.8	1	01g09glS	01glSglS	K/ G1S00337	
Aroclor 1991	ND	U	90	9.8	1	01g09glS	01glSglS	K/ G1S00337	
Aroclor 1939	ND	U	4.6	9.8	1	01g09glS	01glSglS	K/ G1S00337	
Aroclor 19S9	ND	U	4.6	9.8	1	01g09glS	01glSglS	K/ G1S00337	
Aroclor 19S8	ND	U	4.6	9.8	1	01g09glS	01glSglS	K/ G1S00337	
Aroclor 195S	**8.9**	J	4.6	9.8	1	01g09glS	01glSglS	K/ G1S00337	
Aroclor 1960	**5.7**	J	4.6	9.8	1	01g09glS	01glSglS	K/ G1S00337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacdlorobipdenyl	8S	37-134	01glSglS	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4k Ngell Moun/ Nurvey	**Date Collected:**	BA
Sample Matrix:	Animal tissue	**Date Received:**	BA

Polychlorinated Biphenyls (PCBs)

Sample Name:	Metgo/ h land	**Units:**	u8-K8
Lab Code:	KWG140033724	**Basis:**	Wet
Extraction Method:	ELA 3w41	**Level:**	HoS
Analysis Method:	P0P5A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	BD	U	6.7	5.P	1	01-05-14	01-13-14	KWG1400337	
Aroclor 1551	BD	U	14	5.P	1	01-05-14	01-13-14	KWG1400337	
Aroclor 1535	BD	U	6.7	5.P	1	01-05-14	01-13-14	KWG1400337	
Aroclor 1545	BD	U	6.7	5.P	1	01-05-14	01-13-14	KWG1400337	
Aroclor 154P	BD	U	6.7	5.P	1	01-05-14	01-13-14	KWG1400337	
Aroclor 15w4	BD	U	6.7	5.P	1	01-05-14	01-13-14	KWG1400337	
Aroclor 1560	BD	U	6.7	5.P	1	01-05-14	01-13-14	KWG1400337	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decacglorobipgenyl	P7	372139	01-13-14	Acceptable

Comments:

QA/QC Report

Client: AMEC Environment & Infrastructure, Inc.
Service Request: K1313763
Project: 4H Shell Mound Survey
Sample Matrix: Animal tissue

Surrogate Recovery Summary
Polychlorinated Biphenyls (PCBs)

Extraction Method: EPA 3541
Units: Percent
Analysis Method: 8082A
Level: Low

Sample Name	Lab Code	Sur1
HAZ-C1	K1313763-001	76
HAZ-C2	K1313763-002	78
HAZ-C3	K1313763-003	86
HAZ-C4	K1313763-004	83
HIL-C1	K1313763-005	81
HIL-C2	K1313763-006	82
HIL-C3	K1313763-007	108
HIL-C4	K1313763-008	88
HAZ-B1	K1313763-009	89
HAZ-B2	K1313763-010	90
HAZ-B3	K1313763-011	86
HIL-B1	K1313763-012	78
HAZ-L1	K1313763-013	74
HAZ-L2	K1313763-014	77
REF-L1	K1313763-015	88
REF-L2	K1313763-016	84
HAZ-L3	K1313763-017	84
Method Blank	KWG1400337-4	87
HAZ-B3MS	KWG1400337-1	71
HAZ-B3DMS	KWG1400337-2	61
Lab Control Sample	KWG1400337-3	75

Surrogate Recovery Control Limits (%)

Sur1 = Decachlorobiphenyl 37-139

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

QA/QC Report

Client: AMEC Environment & Infrastructure, Inc.
Project: 4H Shell Mound Survey
Sample Matrix: Animal tissue

Service Request: K1313763
Date Extracted: 01/02/2014
Date Analyzed: 01/14/2014

Matrix Spike/Duplicate Matrix Spike Summary
Polychlorinated Biphenyls (PCBs)

Sample Name: HAZ-B3
Lab Code: K1313763-011

Units: ug/Kg
Basis: Wet

Extraction Method: EPA 3541
Analysis Method: 8082A

Level: Low
Extraction Lot: KWG1400337

		HAZ-B3MS KWG1400337-1 Matrix Spike			HAZ-B3DMS KWG1400337-2 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Aroclor 1016	ND	155	196	79	148	200	74	46-128	4	40
Aroclor 1260	ND	133	196	68	125	200	63	46-128	6	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Extracted:**	01/02/2014
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/13/2014

Lab Control Spike Summary
Polychlorinated Biphenyls (PCBs)

Extraction Method:	EPA 3541	**Units:**	ug/Kg
Analysis Method:	8082A	**Basis:**	Wet
		Level:	Low
		Extraction Lot:	KWG1400337

	Lab Control Sample KWG1400337-3 **Lab Control Spike**			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
Aroclor 1016	188	199	95	46-128
Aroclor 1260	153	199	77	46-128

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HAZ-C1	**Units:**	ug/Kg
Lab Code:	K1313763-001	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	9.9	1.5	1	12/28/13	01/14/14	KWG1314063	
2-Methylnaphthalene	ND	U	9.9	1.2	1	12/28/13	01/14/14	KWG1314063	
Acenaphthylene	**1.62**	J	5.0	0.46	1	12/28/13	01/14/14	KWG1314063	
Acenaphthene	ND	U	5.0	0.47	1	12/28/13	01/14/14	KWG1314063	
Dibenzofuran	ND	U	5.0	0.45	1	12/28/13	01/14/14	KWG1314063	
Fluorene	**0.8**	J	5.0	0.52	1	12/28/13	01/14/14	KWG1314063	
Phenanthrene	**0.0**	J	5.0	0.66	1	12/28/13	01/14/14	KWG1314063	
Anthracene	ND	U	5.0	0.38	1	12/28/13	01/14/14	KWG1314063	
Fluoranthene	**1.89**	J	5.0	0.49	1	12/28/13	01/14/14	KWG1314063	
Pyrene	ND	U	5.0	0.50	1	12/28/13	01/14/14	KWG1314063	
Benz(a)anthracene	**1.54**	J	5.0	0.38	1	12/28/13	01/14/14	KWG1314063	
Chrysene	ND	U	5.0	0.55	1	12/28/13	01/14/14	KWG1314063	
Benzo(b)fluoranthene	ND	U	5.0	0.66	1	12/28/13	01/14/14	KWG1314063	
Benzo(k)fluoranthene	ND	U	5.0	0.57	1	12/28/13	01/14/14	KWG1314063	
Benzo(a)pyrene	ND	Ui	5.0	0.98	1	12/28/13	01/14/14	KWG1314063	
Indeno(1,2,3-cd)pyrene	ND	U	5.0	0.95	1	12/28/13	01/14/14	KWG1314063	
Dibenz(a,h)anthracene	ND	U	5.0	0.85	1	12/28/13	01/14/14	KWG1314063	
Benzo(g,h,i)perylene	ND	U	5.0	0.94	1	12/28/13	01/14/14	KWG1314063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	70	39-96	01/14/14	Acceptable
Fluoranthene-d10	76	41-100	01/14/14	Acceptable
Terphenyl-d14	78	39-111	01/14/14	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4Z Shell Mound Survey	**Date Collected:**	1gW09Wg013
Sample Matrix:	Animal tissue	**Date Received:**	1gW19Wg013

Polynuclear Aromatic Hydrocarbons

Sample Name:	ZA2-Cg	**Units:**	u/ Wk/
Lab Code:	K1313763-00g	**Basis:**	H et
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8g70D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	8.6	1.3	1	1gWg8W13	01W4W4	KH G1314063	
g-Methylnaphthalene	ND	U	8.6	1.1	1	1gWg8W13	01W4W4	KH G1314063	
Acenaphthylene	ND	U	4.3	0.40	1	1gWg8W13	01W4W4	KH G1314063	
Acenaphthene	ND	U	4.3	0.41	1	1gWg8W13	01W4W4	KH G1314063	
DiJenbofuran	ND	U	4.3	0.39	1	1gWg8W13	01W4W4	KH G1314063	
Fluorene	**0.86**	z	4.3	0.45	1	1gWg8W13	01W4W4	KH G1314063	
Phenanthrene	**0.80**	z	4.3	0.57	1	1gWg8W13	01W4W4	KH G1314063	
Anthracene	ND	U	4.3	0.33	1	1gWg8W13	01W4W4	KH G1314063	
Fluoranthene	ND	U	4.3	0.4g	1	1gWg8W13	01W4W4	KH G1314063	
Pyrene	ND	U	4.3	0.43	1	1gWg8W13	01W4W4	KH G1314063	
Benb(a)anthracene	**0.58**	z	4.3	0.33	1	1gWg8W13	01W4W4	KH G1314063	
Chrysene	ND	U	4.3	0.48	1	1gWg8W13	01W4W4	KH G1314063	
Benbo(J)fluoranthene	ND	U	4.3	0.57	1	1gWg8W13	01W4W4	KH G1314063	
Benbo(k)fluoranthene	ND	U	4.3	0.49	1	1gWg8W13	01W4W4	KH G1314063	
Benbo(a)pyrene	ND	U	4.3	0.63	1	1gWg8W13	01W4W4	KH G1314063	
Indeno(1,g,3-cd)pyrene	ND	U	4.3	0.83	1	1gWg8W13	01W4W4	KH G1314063	
DiJenb(a,h)anthracene	ND	U	4.3	0.74	1	1gWg8W13	01W4W4	KH G1314063	
Benbo(/,h,i)perylene	ND	U	4.3	0.8g	1	1gWg8W13	01W4W4	KH G1314063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	68	39-96	01W4W4	AcceptaJle
Fluoranthene-d10	75	41-100	01W4W4	AcceptaJle
Terphenyl-d14	79	39-111	01W4W4	AcceptaJle

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HAZ-C3	**Units:**	ug/Kg
Lab Code:	K1313763-003	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	**1.6**	U	10	1.5	1	12/28/13	01/14/14	KWG1314063	
2-Methylnaphthalene	ND	J	10	1.2	1	12/28/13	01/14/14	KWG1314063	
Acenaphthylene	ND	J	5.0	0.46	1	12/28/13	01/14/14	KWG1314063	
Acenaphthene	ND	J	5.0	0.47	1	12/28/13	01/14/14	KWG1314063	
Dibenzofuran	ND	J	5.0	0.45	1	12/28/13	01/14/14	KWG1314063	
Fluorene	**0.81**	U	5.0	0.52	1	12/28/13	01/14/14	KWG1314063	
Phenanthrene	**0.76**	U	5.0	0.66	1	12/28/13	01/14/14	KWG1314063	
Anthracene	ND	J	5.0	0.38	1	12/28/13	01/14/14	KWG1314063	
Fluoranthene	ND	J	5.0	0.49	1	12/28/13	01/14/14	KWG1314063	
Pyrene	ND	J	5.0	0.50	1	12/28/13	01/14/14	KWG1314063	
Benz(a)anthracene	ND	J	5.0	0.38	1	12/28/13	01/14/14	KWG1314063	
Chrysene	ND	J	5.0	0.55	1	12/28/13	01/14/14	KWG1314063	
Benzo(b)fluoranthene	ND	J	5.0	0.66	1	12/28/13	01/14/14	KWG1314063	
Benzo(k)fluoranthene	ND	J	5.0	0.57	1	12/28/13	01/14/14	KWG1314063	
Benzo(a)pyrene	ND	J	5.0	0.73	1	12/28/13	01/14/14	KWG1314063	
Indeno(1,2,3-cd)pyrene	ND	J	5.0	0.96	1	12/28/13	01/14/14	KWG1314063	
Dibenz(a,h)anthracene	ND	J	5.0	0.86	1	12/28/13	01/14/14	KWG1314063	
Benzo(g,h,i)perylene	ND	J	5.0	0.95	1	12/28/13	01/14/14	KWG1314063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	70	39-96	01/14/14	Acceptable
Fluoranthene-d10	73	41-100	01/14/14	Acceptable
Terphenyl-d14	84	39-111	01/14/14	Acceptable

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	gZ Shell Mound Survey	**Date Collected:**	19W04W9013
Sample Matrix:	Animal tissue	**Date Received:**	19W14W9013

Polynuclear Aromatic Hydrocarbons

Sample Name:	ZA2-Cg	**Units:**	u/ WK/
Lab Code:	K1313763-00g	**Basis:**	H et
Extraction Method:	EPA 35g1	**Level:**	Low
Analysis Method:	8970D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	4.6	1.5	1	19W8W3	01WgWg	KH G131g063	
9-Methylnaphthalene	ND	U	4.6	1.9	1	19W8W3	01WgWg	KH G131g063	
Acenaphthylene	**0.49**	J	g.8	0.gg	1	19W8W3	01WgWg	KH G131g063	
Acenaphthene	ND	U	g.8	0.g5	1	19W8W3	01WgWg	KH G131g063	
Dibenzofuran	ND	U	g.8	0.gg	1	19W8W3	01WgWg	KH G131g063	
Fluorene	**1.3**	J	g.8	0.50	1	19W8W3	01WgWg	KH G131g063	
Phenanthrene	**1.2**	J	g.8	0.6g	1	19W8W3	01WgWg	KH G131g063	
Anthracene	ND	U	g.8	0.37	1	19W8W3	01WgWg	KH G131g063	
Fluoranthene	ND	U	g.8	0.g7	1	19W8W3	01WgWg	KH G131g063	
Pyrene	ND	U	g.8	0.g8	1	19W8W3	01WgWg	KH G131g063	
Benz(a)anthracene	**0.54**	J	g.8	0.37	1	19W8W3	01WgWg	KH G131g063	
Chrysene	ND	U	g.8	0.53	1	19W8W3	01WgWg	KH G131g063	
Benzo(b)fluoranthene	ND	U	g.8	0.6g	1	19W8W3	01WgWg	KH G131g063	
Benzo(k)fluoranthene	ND	U	g.8	0.55	1	19W8W3	01WgWg	KH G131g063	
Benzo(a)pyrene	ND	Ui	g.8	1.1	1	19W8W3	01WgWg	KH G131g063	
Indeno(1,9,3-cd)pyrene	ND	U	g.8	0.49	1	19W8W3	01WgWg	KH G131g063	
Dibenz(a,h)anthracene	ND	U	g.8	0.83	1	19W8W3	01WgWg	KH G131g063	
Benzo(/ ,h,i)perylene	ND	U	g.8	0.41	1	19W8W3	01WgWg	KH G131g063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	68	34-46	01WgWg	Acceptable
Fluoranthene-d10	75	g1-100	01WgWg	Acceptable
Terphenyl-d1g	77	34-111	01WgWg	Acceptable

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HIL-C1	**Units:**	ug/Kg
Lab Code:	K1313763-005	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	9.8	1.5	1	12/28/13	01/14/14	KWG1314063	
2-Methylnaphthalene	ND	U	9.8	1.2	1	12/28/13	01/14/14	KWG1314063	
Acenaphthylene	ND	U	4.9	0.46	1	12/28/13	01/14/14	KWG1314063	
Acenaphthene	ND	U	4.9	0.47	1	12/28/13	01/14/14	KWG1314063	
Dibenzofuran	ND	U	4.9	0.45	1	12/28/13	01/14/14	KWG1314063	
Fluorene	**0.86**	J	4.9	0.51	1	12/28/13	01/14/14	KWG1314063	
Phenanthrene	**0.72**	J	4.9	0.65	1	12/28/13	01/14/14	KWG1314063	
Anthracene	ND	U	4.9	0.38	1	12/28/13	01/14/14	KWG1314063	
Fluoranthene	ND	U	4.9	0.49	1	12/28/13	01/14/14	KWG1314063	
Pyrene	ND	U	4.9	0.49	1	12/28/13	01/14/14	KWG1314063	
Benz(a)anthracene	ND	U	4.9	0.38	1	12/28/13	01/14/14	KWG1314063	
Chrysene	ND	U	4.9	0.54	1	12/28/13	01/14/14	KWG1314063	
Benzo(b)fluoranthene	ND	U	4.9	0.65	1	12/28/13	01/14/14	KWG1314063	
Benzo(k)fluoranthene	ND	U	4.9	0.56	1	12/28/13	01/14/14	KWG1314063	
Benzo(a)pyrene	ND	U	4.9	0.72	1	12/28/13	01/14/14	KWG1314063	
Indeno(1,2,3-cd)pyrene	ND	U	4.9	0.95	1	12/28/13	01/14/14	KWG1314063	
Dibenz(a,h)anthracene	ND	U	4.9	0.85	1	12/28/13	01/14/14	KWG1314063	
Benzo(g,h,i)perylene	ND	U	4.9	0.94	1	12/28/13	01/14/14	KWG1314063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	71	39-96	01/14/14	Acceptable
Fluoranthene-d10	80	41-100	01/14/14	Acceptable
Terphenyl-d14	84	39-111	01/14/14	Acceptable

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	9W4Sell Mounh 4urvey	**Date Collected:**	1Lg02gL013
Sample Matrix:	Animal tissue	**Date Received:**	1Lg12gL013

Polynuclear Aromatic Hydrocarbons

Sample Name:	WH-CL	**Units:**	u5gK5
Lab Code:	K1313763-006	**Basis:**	/ et
Extraction Method:	EwA 3P91	**Level:**	Hod
Analysis Method:	8L70D 4IM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
NapStSalene	**1.4**	U	8.6	1.3	1	1LgL8gl3	01gl9gl9	K/ G1319063	
L-MetSylnapStSalene	ND	b	8.6	1.1	1	1LgL8gl3	01gl9gl9	K/ G1319063	
AcenapStSylene	ND	b	9.3	0.90	1	1LgL8gl3	01gl9gl9	K/ G1319063	
AcenapStSene	ND	b	9.3	0.91	1	1LgL8gl3	01gl9gl9	K/ G1319063	
DizenJofuran	**0.41**	U	9.3	0.32	1	1LgL8gl3	01gl9gl9	K/ G1319063	
Fluorene	**0.58**	U	9.3	0.9P	1	1LgL8gl3	01gl9gl9	K/ G1319063	
wSenantSrene	**1.1**	U	9.3	0.P7	1	1LgL8gl3	01gl9gl9	K/ G1319063	
AntSracene	ND	b	9.3	0.33	1	1LgL8gl3	01gl9gl9	K/ G1319063	
FluorantSene	**0.51**	U	9.3	0.9L	1	1LgL8gl3	01gl9gl9	K/ G1319063	
wyrene	**0.92**	U	9.3	0.93	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJ(a)antSracene	ND	b	9.3	0.33	1	1LgL8gl3	01gl9gl9	K/ G1319063	
CSrysene	ND	b	9.3	0.98	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJo(z)fluorantSene	ND	b	9.3	0.P7	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJo(k)fluorantSene	ND	b	9.3	0.92	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJo(a)pyrene	ND	b	9.3	0.63	1	1LgL8gl3	01gl9gl9	K/ G1319063	
Inheno(1,L,3-ch)pyrene	ND	b	9.3	0.83	1	1LgL8gl3	01gl9gl9	K/ G1319063	
DizenJ(a,S)antSracene	ND	b	9.3	0.79	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJo(5,S,i)perylene	ND	b	9.3	0.8L	1	1LgL8gl3	01gl9gl9	K/ G1319063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-h10	67	32-26	01gl9gl9	Acceptazle
FluorantSene-h10	79	91-100	01gl9gl9	Acceptazle
TerpSenyl-h19	7P	32-111	01gl9gl9	Acceptazle

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	9W4Sell Mounh 4urvey	**Date Collected:**	1Lg02gL013
Sample Matrix:	Animal tissue	**Date Received:**	1Lg12gL013

Polynuclear Aromatic Hydrocarbons

Sample Name:	WH-C3	**Units:**	u5gK5
Lab Code:	K1313763-007	**Basis:**	/ et
Extraction Method:	EwA 3P91	**Level:**	Hod
Analysis Method:	8L70D 4IM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
NapStSalene	**0.5**	U	10	1.P	1	1LgL8gl3	01gl9gl9	K/ G1319063	
L-MetSylnapStSalene	ND	b	10	1.L	1	1LgL8gl3	01gl9gl9	K/ G1319063	
AcenapStSylene	**4.51**	U	P.0	0.96	1	1LgL8gl3	01gl9gl9	K/ G1319063	
AcenapStSene	ND	b	P.0	0.97	1	1LgL8gl3	01gl9gl9	K/ G1319063	
DizenJofuran	ND	b	P.0	0.9P	1	1LgL8gl3	01gl9gl9	K/ G1319063	
Fluorene	**0.8**	U	P.0	0.PL	1	1LgL8gl3	01gl9gl9	K/ G1319063	
wSenantSrene	**0.6**	U	P.0	0.66	1	1LgL8gl3	01gl9gl9	K/ G1319063	
AntSracene	ND	b	P.0	0.38	1	1LgL8gl3	01gl9gl9	K/ G1319063	
FluorantSene	**4.50**	U	P.0	0.92	1	1LgL8gl3	01gl9gl9	K/ G1319063	
wyrene	ND	b	P.0	0.P0	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJ(a)antSracene	ND	b	P.0	0.38	1	1LgL8gl3	01gl9gl9	K/ G1319063	
CSrysene	ND	b	P.0	0.PP	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJo(z)fluorantSene	ND	b	P.0	0.66	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJo(k)fluorantSene	ND	b	P.0	0.P7	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJo(a)pyrene	ND	b	P.0	0.73	1	1LgL8gl3	01gl9gl9	K/ G1319063	
Inheno(1,L,3-ch)pyrene	ND	b	P.0	0.26	1	1LgL8gl3	01gl9gl9	K/ G1319063	
DizenJ(a,S)antSracene	ND	b	P.0	0.86	1	1LgL8gl3	01gl9gl9	K/ G1319063	
BenJo(5,S,i)perylene	ND	b	P.0	0.2P	1	1LgL8gl3	01gl9gl9	K/ G1319063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-h10	71	32-26	01gl9gl9	Acceptazle
FluorantSene-h10	72	91-100	01gl9gl9	Acceptazle
TerpSenyl-h19	81	32-111	01gl9gl9	Acceptazle

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	2H Shell Mound Survey	**Date Collected:**	19/04/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HIL-C2	**Units:**	ug/Kg
Lab Code:	K1313763-005	**Basis:**	Wet
Extraction Method:	EPA 3821	**Level:**	Low
Analysis Method:	5970D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	**1.7**	U	4.3	1.2	1	19/95/13	01/12/12	KWG1312063	
9-Methylnaphthalene	ND	b	4.3	1.9	1	19/95/13	01/12/12	KWG1312063	
Acenaphthylene	ND	b	2.7	0.23	1	19/95/13	01/12/12	KWG1312063	
Acenaphthene	ND	b	2.7	0.22	1	19/95/13	01/12/12	KWG1312063	
DizenJofuran	ND	b	2.7	0.29	1	19/95/13	01/12/12	KWG1312063	
Fluorene	ND	b	2.7	0.24	1	19/95/13	01/12/12	KWG1312063	
Phenanthrene	**0.79**	U	2.7	0.61	1	19/95/13	01/12/12	KWG1312063	
Anthracene	ND	b	2.7	0.36	1	19/95/13	01/12/12	KWG1312063	
Fluoranthene	ND	b	2.7	0.26	1	19/95/13	01/12/12	KWG1312063	
Pyrene	ND	b	2.7	0.27	1	19/95/13	01/12/12	KWG1312063	
BenJ(a)anthracene	ND	b	2.7	0.36	1	19/95/13	01/12/12	KWG1312063	
Chrysene	ND	b	2.7	0.81	1	19/95/13	01/12/12	KWG1312063	
BenJo(z)fluoranthene	ND	b	2.7	0.61	1	19/95/13	01/12/12	KWG1312063	
BenJo(k)fluoranthene	ND	b	2.7	0.83	1	19/95/13	01/12/12	KWG1312063	
BenJo(a)pyrene	ND	b	2.7	0.65	1	19/95/13	01/12/12	KWG1312063	
Indeno(1,9,3-cd)pyrene	ND	b	2.7	0.54	1	19/95/13	01/12/12	KWG1312063	
DizenJ(a,h)anthracene	ND	b	2.7	0.50	1	19/95/13	01/12/12	KWG1312063	
BenJo(g,h,i)perylene	ND	b	2.7	0.55	1	19/95/13	01/12/12	KWG1312063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	66	34-46	01/12/12	Acceptazle
Fluoranthene-d10	65	21-100	01/12/12	Acceptazle
Terphenyl-d12	51	34-111	01/12/12	Acceptazle

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SZ hdell MounL hurvey	**Date Collected:**	14W0gW013
Sample Matrix:	Animal tissue	**Date Received:**	14W1gW013

Polynuclear Aromatic Hydrocarbons

Sample Name:	ZA2-91	**Units:**	u/ WK/
Lab Code:	K1313763-00g	**Basis:**	H et
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	D470G hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p aJ dtdalene	p G	N	g.3	1.S	1	14WDW3	01WSWS	KH U131S063	
4-MetdylnaJ dtdalene	p G	N	g.3	1.4	1	14WDW3	01WSWS	KH U131S063	
AcenaJ dtdylene	p G	N	S.7	0.S3	1	14WDW3	01WSWS	KH U131S063	
AcenaJ dtdene	p G	N	S.7	0.SS	1	14WDW3	01WSWS	KH U131S063	
Gibenzofuran	p G	N	S.7	0.S4	1	14WDW3	01WSWS	KH U131S063	
Fluorene	p G	N	S.7	0.SD	1	14WDW3	01WSWS	KH U131S063	
5denantdrene	**0.66**	B	S.7	0.61	1	14WDW3	01WSWS	KH U131S063	
Antdracene	p G	N	S.7	0.38	1	14WDW3	01WSWS	KH U131S063	
Fluorantdene	p G	N	S.7	0.S6	1	14WDW3	01WSWS	KH U131S063	
5yrene	p G	N	S.7	0.S7	1	14WDW3	01WSWS	KH U131S063	
9enz(a)antdracene	p G	N	S.7	0.38	1	14WDW3	01WSWS	KH U131S063	
Cdrysene	p G	N	S.7	0.81	1	14WDW3	01WSWS	KH U131S063	
9enzo(b)fluorantdene	p G	N	S.7	0.61	1	14WDW3	01WSWS	KH U131S063	
9enzo(k)fluorantdene	p G	N	S.7	0.83	1	14WDW3	01WSWS	KH U131S063	
9enzo(a)Jyrene	p G	N	S.7	0.6D	1	14WDW3	01WSWS	KH U131S063	
InLeno(1,4,3-cL)Jyrene	p G	N	S.7	0.Dg	1	14WDW3	01WSWS	KH U131S063	
Gibenz(a,d)antdracene	p G	N	S.7	0.D0	1	14WDW3	01WSWS	KH U131S063	
9enzo(/ ,d,i)Jerylene	p G	N	S.7	0.DD	1	14WDW3	01WSWS	KH U131S063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-L10	6g	3g-g6	01WSWS	AcceJ table
Fluorantdene-L10	7g	S1-100	01WSWS	AcceJ table
TerJ denyl-L1S	DS	3g-111	01WSWS	AcceJ table

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SH hdell MounL hurvey	**Date Collected:**	19/04/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HAZ-2 9	**Units:**	ug/Kg
Lab Code:	K1313763-010	**Basis:**	Wet
Extraction Method:	E5A 38S1	**Level:**	woP
Analysis Method:	D970G hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p aJ dtdalene	**1.6**	N	4.D	1.8	1	19/9D'13	01/1S/1S	KWU131S063	
9-MetdylnaJ dtdalene	p G	b	4.D	1.9	1	19/9D'13	01/1S/1S	KWU131S063	
AcenaJ dtdylene	p G	b	S.4	0.S8	1	19/9D'13	01/1S/1S	KWU131S063	
AcenaJ dtdene	p G	b	S.4	0.S6	1	19/9D'13	01/1S/1S	KWU131S063	
GizenFofuran	p G	b	S.4	0.SS	1	19/9D'13	01/1S/1S	KWU131S063	
Bluorene	p G	b	S.4	0.81	1	19/9D'13	01/1S/1S	KWU131S063	
5denantdrene	**0.74**	N	S.4	0.68	1	19/9D'13	01/1S/1S	KWU131S063	
Antdracene	p G	b	S.4	0.37	1	19/9D'13	01/1S/1S	KWU131S063	
Bluorantdene	p G	b	S.4	0.SD	1	19/9D'13	01/1S/1S	KWU131S063	
5yrene	p G	b	S.4	0.S4	1	19/9D'13	01/1S/1S	KWU131S063	
2 enF(a)antdracene	p G	b	S.4	0.37	1	19/9D'13	01/1S/1S	KWU131S063	
Cdrysene	p G	b	S.4	0.8S	1	19/9D'13	01/1S/1S	KWU131S063	
2 enFo(z)fluorantdene	p G	b	S.4	0.68	1	19/9D'13	01/1S/1S	KWU131S063	
2 enFo(k)fluorantdene	p G	b	S.4	0.86	1	19/9D'13	01/1S/1S	KWU131S063	
2 enFo(a)J yrene	p G	b	S.4	0.71	1	19/9D'13	01/1S/1S	KWU131S063	
InLeno(1,9,3-cL)J yrene	p G	b	S.4	0.4S	1	19/9D'13	01/1S/1S	KWU131S063	
GizenF(a,d)antdracene	p G	b	S.4	0.DS	1	19/9D'13	01/1S/1S	KWU131S063	
2 enFo(g,d,i)J erylene	p G	b	S.4	0.43	1	19/9D'13	01/1S/1S	KWU131S063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Bluorene-L10	79	34-46	01/1S/1S	AcceJ tazle
Bluorantdene-L10	7D	S1-100	01/1S/1S	AcceJ tazle
TerJ denyl-L1S	DS	34-111	01/1S/1S	AcceJ tazle

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HAZ-B3	**Units:**	ug/Kg
Lab Code:	K1313763-011	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	9.4	1.5	1	12/28/13	01/14/14	KWG1314063	
2-Methylnaphthalene	ND	U	9.4	1.2	1	12/28/13	01/14/14	KWG1314063	
Acenaphthylene	ND	U	4.7	0.43	1	12/28/13	01/14/14	KWG1314063	
Acenaphthene	ND	U	4.7	0.44	1	12/28/13	01/14/14	KWG1314063	
Dibenzofuran	ND	U	4.7	0.43	1	12/28/13	01/14/14	KWG1314063	
Fluorene	ND	U	4.7	0.49	1	12/28/13	01/14/14	KWG1314063	
Phenanthrene	ND	U	4.7	0.62	1	12/28/13	01/14/14	KWG1314063	
Anthracene	ND	U	4.7	0.36	1	12/28/13	01/14/14	KWG1314063	
Fluoranthene	ND	U	4.7	0.46	1	12/28/13	01/14/14	KWG1314063	
Pyrene	ND	U	4.7	0.47	1	12/28/13	01/14/14	KWG1314063	
Benz(a)anthracene	ND	U	4.7	0.36	1	12/28/13	01/14/14	KWG1314063	
Chrysene	ND	U	4.7	0.52	1	12/28/13	01/14/14	KWG1314063	
Benzo(b)fluoranthene	ND	U	4.7	0.62	1	12/28/13	01/14/14	KWG1314063	
Benzo(k)fluoranthene	ND	U	4.7	0.54	1	12/28/13	01/14/14	KWG1314063	
Benzo(a)pyrene	ND	U	4.7	0.69	1	12/28/13	01/14/14	KWG1314063	
Indeno(1,2,3-cd)pyrene	ND	U	4.7	0.90	1	12/28/13	01/14/14	KWG1314063	
Dibenz(a,h)anthracene	ND	U	4.7	0.81	1	12/28/13	01/14/14	KWG1314063	
Benzo(g,h,i)perylene	ND	U	4.7	0.89	1	12/28/13	01/14/14	KWG1314063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	67	39-96	01/14/14	Acceptable
Fluoranthene-d10	71	41-100	01/14/14	Acceptable
Terphenyl-d14	77	39-111	01/14/14	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Collected:**	12/09/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HIL-B1	**Units:**	ug/Kg
Lab Code:	K1313763-012	**Basis:**	Wet
Extraction Method:	EPA 3541	**Level:**	Low
Analysis Method:	8270D SIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	9.5	1.5	1	12/28/13	01/14/14	KWG1314063	
2-Methylnaphthalene	ND	U	9.5	1.2	1	12/28/13	01/14/14	KWG1314063	
Acenaphthylene	ND	U	4.8	0.44	1	12/28/13	01/14/14	KWG1314063	
Acenaphthene	ND	U	4.8	0.45	1	12/28/13	01/14/14	KWG1314063	
Dibenzofuran	ND	U	4.8	0.43	1	12/28/13	01/14/14	KWG1314063	
Fluorene	ND	U	4.8	0.50	1	12/28/13	01/14/14	KWG1314063	
Phenanthrene	ND	U	4.8	0.63	1	12/28/13	01/14/14	KWG1314063	
Anthracene	ND	U	4.8	0.36	1	12/28/13	01/14/14	KWG1314063	
Fluoranthene	ND	U	4.8	0.47	1	12/28/13	01/14/14	KWG1314063	
Pyrene	ND	U	4.8	0.48	1	12/28/13	01/14/14	KWG1314063	
Benz(a)anthracene	ND	U	4.8	0.36	1	12/28/13	01/14/14	KWG1314063	
Chrysene	ND	U	4.8	0.53	1	12/28/13	01/14/14	KWG1314063	
Benzo(b)fluoranthene	ND	U	4.8	0.63	1	12/28/13	01/14/14	KWG1314063	
Benzo(k)fluoranthene	ND	U	4.8	0.54	1	12/28/13	01/14/14	KWG1314063	
Benzo(a)pyrene	ND	U	4.8	0.70	1	12/28/13	01/14/14	KWG1314063	
Indeno(1,2,3-cd)pyrene	ND	U	4.8	0.91	1	12/28/13	01/14/14	KWG1314063	
Dibenz(a,h)anthracene	ND	U	4.8	0.82	1	12/28/13	01/14/14	KWG1314063	
Benzo(g,h,i)perylene	ND	U	4.8	0.90	1	12/28/13	01/14/14	KWG1314063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	69	39-96	01/14/14	Acceptable
Fluoranthene-d10	75	41-100	01/14/14	Acceptable
Terphenyl-d14	83	39-111	01/14/14	Acceptable

Comments:

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Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SH hdell MounL hurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HAZ-21	**Units:**	ug/Kg
Lab Code:	K1313763-013	**Basis:**	Wet
Extraction Method:	EPA 35S1	**Level:**	2ow
Analysis Method:	8970D hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Napdtdalene	ND	U	4.5	1.5	1	19/98/13	01/1S/1S	KWG131S063	
9-Metdylnapdtdalene	ND	U	4.5	1.9	1	19/98/13	01/1S/1S	KWG131S063	
Acenapdtdylene	ND	U	S.8	0.SS	1	19/98/13	01/1S/1S	KWG131S063	
Acenapdtdene	ND	U	S.8	0.S5	1	19/98/13	01/1S/1S	KWG131S063	
DiJenbofuran	ND	U	S.8	0.S3	1	19/98/13	01/1S/1S	KWG131S063	
zluorene	ND	U	S.8	0.50	1	19/98/13	01/1S/1S	KWG131S063	
Pdenantdrene	**0.66**	F	S.8	0.63	1	19/98/13	01/1S/1S	KWG131S063	
Antdracene	ND	U	S.8	0.36	1	19/98/13	01/1S/1S	KWG131S063	
zluorantdene	ND	U	S.8	0.S7	1	19/98/13	01/1S/1S	KWG131S063	
Pyrene	ND	U	S.8	0.S8	1	19/98/13	01/1S/1S	KWG131S063	
Benb(a)antdracene	ND	U	S.8	0.36	1	19/98/13	01/1S/1S	KWG131S063	
Cdrysene	ND	U	S.8	0.53	1	19/98/13	01/1S/1S	KWG131S063	
Benbo(J)fluorantdene	ND	U	S.8	0.63	1	19/98/13	01/1S/1S	KWG131S063	
Benbo(k)fluorantdene	ND	U	S.8	0.5S	1	19/98/13	01/1S/1S	KWG131S063	
Benbo(a)pyrene	ND	U	S.8	0.70	1	19/98/13	01/1S/1S	KWG131S063	
InLeno(1,9,3-cL)pyrene	ND	U	S.8	0.41	1	19/98/13	01/1S/1S	KWG131S063	
DiJenb(a,d)antdracene	ND	U	S.8	0.89	1	19/98/13	01/1S/1S	KWG131S063	
Benbo(g,d,i)perylene	ND	U	S.8	0.40	1	19/98/13	01/1S/1S	KWG131S063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
zluorene-L10	66	34-46	01/1S/1S	AcceptaJle
zluorantdene-L10	73	S1-100	01/1S/1S	AcceptaJle
Terpdenyl-L1S	7S	34-111	01/1S/1S	AcceptaJle

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	gZ hdell MounL hurvey	**Date Collected:**	14W0W4013
Sample Matrix:	Animal tissue	**Date Received:**	14WSW4013

Polynuclear Aromatic Hydrocarbons

Sample Name:	ZA2-94	**Units:**	u/ WK/
Lab Code:	K1313763-01g	**Basis:**	H et
Extraction Method:	EPA 35g1	**Level:**	9ow
Analysis Method:	8470D hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Napdtdalene	ND	U	S.S	1.5	1	14W8W3	01WgWg	KH G131g063	
4-Metdylnapdtdalene	ND	U	S.S	1.4	1	14W8W3	01WgWg	KH G131g063	
Acenapdtdylene	ND	U	5.0	0.g6	1	14W8W3	01WgWg	KH G131g063	
Acenapdtdene	ND	U	5.0	0.g7	1	14W8W3	01WgWg	KH G131g063	
DiJenbofuran	ND	U	5.0	0.g5	1	14W8W3	01WgWg	KH G131g063	
Fluorene	**1.7**	z	5.0	0.54	1	14W8W3	01WgWg	KH G131g063	
Pdenantdrene	**7.09**	z	5.0	0.66	1	14W8W3	01WgWg	KH G131g063	
Antdracene	ND	U	5.0	0.38	1	14W8W3	01WgWg	KH G131g063	
Fluorantdene	ND	U	5.0	0.gS	1	14W8W3	01WgWg	KH G131g063	
Pyrene	ND	U	5.0	0.50	1	14W8W3	01WgWg	KH G131g063	
Benb(a)antdracene	ND	U	5.0	0.38	1	14W8W3	01WgWg	KH G131g063	
Cdrysene	ND	U	5.0	0.55	1	14W8W3	01WgWg	KH G131g063	
Benbo(J)fluorantdene	ND	U	5.0	0.66	1	14W8W3	01WgWg	KH G131g063	
Benbo(k)fluorantdene	ND	U	5.0	0.57	1	14W8W3	01WgWg	KH G131g063	
Benbo(a)pyrene	ND	Ui	5.0	1.1	1	14W8W3	01WgWg	KH G131g063	
InLeno(1,4,3-cL)pyrene	ND	U	5.0	0.S5	1	14W8W3	01WgWg	KH G131g063	
DiJenb(a,d)antdracene	ND	U	5.0	0.85	1	14W8W3	01WgWg	KH G131g063	
Benbo(/ ,d,i)perylene	ND	U	5.0	0.Sg	1	14W8W3	01WgWg	KH G131g063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-L10	67	3S-S6	01WgWg	AcceptaJ le
Fluorantdene-L10	75	g1-100	01WgWg	AcceptaJ le
Terpdenyl-L1g	76	3S-111	01WgWg	AcceptaJ le

Comments:

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4S hdell Mounwhurvey	**Date Collected:**	12/10/2013
Sample Matrix:	Animal tissue	**Date Received:**	12/19/2013

Polynuclear Aromatic Hydrocarbons

Sample Name:	REH-L1	**Units:**	ug/Kg
Lab Code:	K1313763-015	**Basis:**	Wet
Extraction Method:	E8A 3541	**Level:**	LoP
Analysis Method:	D270G hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p abdtdalene	**1.7**	N	9.7	1.5	1	12/2D/13	01/14/14	KWU1314063	
2-Metdylnabdtdalene	p G	z	9.7	1.2	1	12/2D/13	01/14/14	KWU1314063	
Acenabdtdylene	p G	z	4.9	0.45	1	12/2D/13	01/14/14	KWU1314063	
Acenabdtdene	p G	z	4.9	0.46	1	12/2D/13	01/14/14	KWU1314063	
GiJ enFofuran	p G	z	4.9	0.44	1	12/2D/13	01/14/14	KWU1314063	
Hluorene	**1.0**	N	4.9	0.51	1	12/2D/13	01/14/14	KWU1314063	
8denantdrene	**1.2**	N	4.9	0.64	1	12/2D/13	01/14/14	KWU1314063	
Antdracene	p G	z	4.9	0.37	1	12/2D/13	01/14/14	KWU1314063	
Hluorantdene	**0.48**	N	4.9	0.4D	1	12/2D/13	01/14/14	KWU1314063	
8yrene	p G	z	4.9	0.49	1	12/2D/13	01/14/14	KWU1314063	
BenF(a)antdracene	**0.78**	N	4.9	0.37	1	12/2D/13	01/14/14	KWU1314063	
Cdrysene	**0.61**	N	4.9	0.54	1	12/2D/13	01/14/14	KWU1314063	
BenFo(J)fluorantdene	**1.2**	N	4.9	0.64	1	12/2D/13	01/14/14	KWU1314063	
BenFo(k)fluorantdene	**0.67**	N	4.9	0.56	1	12/2D/13	01/14/14	KWU1314063	
BenFo(a)byrene	p G	z i	4.9	1.D	1	12/2D/13	01/14/14	KWU1314063	
Inweno(1,2,3-cw)byrene	**1.3**	N	4.9	0.94	1	12/2D/13	01/14/14	KWU1314063	
GiJ enF(a,d)antdracene	**1.1**	N	4.9	0.D4	1	12/2D/13	01/14/14	KWU1314063	
BenFo(g,d,i)berylene	**2.2**	N	4.9	0.93	1	12/2D/13	01/14/14	KWU1314063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Hluorene-wl0	72	39-96	01/14/14	AccebtaJ le
Hluorantdene-wl0	Dl	41-100	01/14/14	AccebtaJ le
Terbdenyl-wl4	D0	39-111	01/14/14	AccebtaJ le

Comments:

Analytical Results

Client: AMEC Environment & Infrastructure, Inc. **Service Request:** K1313763
Project: 94 Shell Mound Survey **Date Collected:** 1Lg10gL013
Sample Matrix: Animal tissue **Date Received:** 1Lg12gL013

Polynuclear Aromatic Hydrocarbons

Sample Name: REWHL **Units:** u5gK5
Lab Code: K1313763-016 **Basis:** / et

Extraction Method: EPA 3891 **Level:** How
Analysis Method: DL70G SIM

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
p abhthalene	p G	N	2.D	1.8	1	1LgLDg13	01g19g19	K/ U1319063	
L-Methylnabhthalene	p G	N	2.D	1.L	1	1LgLDg13	01g19g19	K/ U1319063	
Acenabhthylene	p G	N	9.2	0.98	1	1LgLDg13	01g19g19	K/ U1319063	
Acenabhthene	p G	N	9.2	0.96	1	1LgLDg13	01g19g19	K/ U1319063	
GizenJofuran	p G	N	9.2	0.99	1	1LgLDg13	01g19g19	K/ U1319063	
Wuorene	**0.64**	F	9.2	0.81	1	1LgLDg13	01g19g19	K/ U1319063	
Phenanthrene	**1.4**	F	9.2	0.68	1	1LgLDg13	01g19g19	K/ U1319063	
Anthracene	p G	N	9.2	0.37	1	1LgLDg13	01g19g19	K/ U1319063	
Wuoranthene	**0.64**	F	9.2	0.9D	1	1LgLDg13	01g19g19	K/ U1319063	
Pyrene	**0.88**	F	9.2	0.92	1	1LgLDg13	01g19g19	K/ U1319063	
BenJ(a)anthracene	p G	N	9.2	0.37	1	1LgLDg13	01g19g19	K/ U1319063	
Chrysene	p G	N	9.2	0.89	1	1LgLDg13	01g19g19	K/ U1319063	
BenJo(z)fluoranthene	p G	N	9.2	0.68	1	1LgLDg13	01g19g19	K/ U1319063	
BenJo(k)fluoranthene	p G	N	9.2	0.86	1	1LgLDg13	01g19g19	K/ U1319063	
BenJo(a)byrene	p G	Ni	9.2	1.1	1	1LgLDg13	01g19g19	K/ U1319063	
Indeno(1,L,3-cd)byrene	p G	N	9.2	0.29	1	1LgLDg13	01g19g19	K/ U1319063	
GizenJ(a,h)anthracene	p G	N	9.2	0.D9	1	1LgLDg13	01g19g19	K/ U1319063	
BenJo(5,h,i)berylene	p G	N	9.2	0.23	1	1LgLDg13	01g19g19	K/ U1319063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Wuorene-d10	79	32-26	01g19g19	Accebtazle
Wuoranthene-d10	72	91-100	01g19g19	Accebtazle
Terbhenyl-d19	72	32-111	01g19g19	Accebtazle

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	SH hdell MounL hurvey	**Date Collected:**	19/10/9013
Sample Matrix:	Animal tissue	**Date Received:**	19/14/9013

Polynuclear Aromatic Hydrocarbons

Sample Name:	HAZ-23	**Units:**	ug/Kg
Lab Code:	K1313763-017	**Basis:**	Wet
Extraction Method:	EPA 35S1	**Level:**	2ow
Analysis Method:	8970D hIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Napdtdalene	**1.5**	U	4.9	1.S	1	19/98/13	01/1S/1S	KWG131S063	
9-Metdylnapdtdalene	ND	J	4.9	1.9	1	19/98/13	01/1S/1S	KWG131S063	
Acenapdtdylene	ND	J	S.6	0.S3	1	19/98/13	01/1S/1S	KWG131S063	
Acenapdtdene	ND	J	S.6	0.SS	1	19/98/13	01/1S/1S	KWG131S063	
Dibenzofuran	ND	J	S.6	0.S9	1	19/98/13	01/1S/1S	KWG131S063	
Fluorene	**0.90**	U	S.6	0.S8	1	19/98/13	01/1S/1S	KWG131S063	
Pdenantdrene	**0.76**	U	S.6	0.61	1	19/98/13	01/1S/1S	KWG131S063	
Antdracene	ND	J	S.6	0.35	1	19/98/13	01/1S/1S	KWG131S063	
Fluorantdene	ND	J	S.6	0.S6	1	19/98/13	01/1S/1S	KWG131S063	
Pyrene	ND	J	S.6	0.S6	1	19/98/13	01/1S/1S	KWG131S063	
Benz(a)antdracene	ND	J	S.6	0.35	1	19/98/13	01/1S/1S	KWG131S063	
Cdrysene	ND	J	S.6	0.51	1	19/98/13	01/1S/1S	KWG131S063	
Benzo(b)fluorantdene	ND	J	S.6	0.61	1	19/98/13	01/1S/1S	KWG131S063	
Benzo(k)fluorantdene	ND	J	S.6	0.53	1	19/98/13	01/1S/1S	KWG131S063	
Benzo(a)pyrene	ND	J i	S.6	0.88	1	19/98/13	01/1S/1S	KWG131S063	
InLeno(1,9,3-cL)pyrene	ND	J	S.6	0.84	1	19/98/13	01/1S/1S	KWG131S063	
Dibenz(a,d)antdracene	ND	J	S.6	0.80	1	19/98/13	01/1S/1S	KWG131S063	
Benzo(g,d,i)perylene	ND	J	S.6	0.88	1	19/98/13	01/1S/1S	KWG131S063	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-L10	71	34-46	01/1S/1S	Acceptable
Fluorantdene-L10	78	S1-100	01/1S/1S	Acceptable
Terpdenyl-L1S	77	34-111	01/1S/1S	Acceptable

Comments:

Analytical Results

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	5d w2ell Moun9 wurvey	**Date Collected:**	h A
Sample Matrix:	Animal tissue	**Date Received:**	h A

Polynuclear Aromatic Hydrocarbons

Sample Name:	Met2o9 4 lanS	**Units:**	uHKH
Lab Code:	K- 0 1315g63/W	**Basis:**	- et
Extraction Method:	EDA 3W51	**Level:**	Po8
Analysis Method:	GU7gN wIM		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
h ab2t2alene	h N	p	G6	1.3	1	1UUUG113	g1I15I15	K- 0 1315g63	
U'Met2ylnab2t2alene	h N	p	G6	1.1	1	1UUUG113	g1I15I15	K- 0 1315g63	
Acenab2t2ylene	h N	p	5.3	g.5g	1	1UUUG113	g1I15I15	K- 0 1315g63	
Acenab2t2ene	h N	p	5.3	g.51	1	1UUUG113	g1I15I15	K- 0 1315g63	
NiJ enFofuran	h N	p	5.3	g.3z	1	1UUUG113	g1I15I15	K- 0 1315g63	
Bluorene	h N	p	5.3	g.5W	1	1UUUG113	g1I15I15	K- 0 1315g63	
D2enant2rene	h N	p	5.3	g.W7	1	1UUUG113	g1I15I15	K- 0 1315g63	
Ant2racene	h N	p	5.3	g.33	1	1UUUG113	g1I15I15	K- 0 1315g63	
Bluorant2ene	h N	p	5.3	g.5U	1	1UUUG113	g1I15I15	K- 0 1315g63	
Dyrene	h N	p	5.3	g.53	1	1UUUG113	g1I15I15	K- 0 1315g63	
4 enF)akant2racene	**0.48**	(	5.3	g.33	1	1UUUG113	g1I15I15	K- 0 1315g63	
C2rysene	h N	p	5.3	g.5G	1	1UUUG113	g1I15I15	K- 0 1315g63	
4 enFo)J kfluorant2ene	h N	p	5.3	g.W7	1	1UUUG113	g1I15I15	K- 0 1315g63	
4 enFo)Skfluorant2ene	h N	p	5.3	g.5z	1	1UUUG113	g1I15I15	K- 0 1315g63	
4 enFo)akbyrene	h N	p	5.3	g.63	1	1UUUG113	g1I15I15	K- 0 1315g63	
In9eno)1,U,3/c9kbyrene	h N	p	5.3	g.G3	1	1UUUG113	g1I15I15	K- 0 1315g63	
NiJ enF)a,2kant2racene	h N	p	5.3	g.75	1	1UUUG113	g1I15I15	K- 0 1315g63	
4 enFo)H,2,ikberylene	h N	p	5.3	g.GU	1	1UUUG113	g1I15I15	K- 0 1315g63	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Bluorene/91g	75	3z/z6	g1I15I15	AccebtaJ le
Bluorant2ene/91g	G3	51/1gg	g1I15I15	AccebtaJ le
Terb2enyl/915	GG	3z/111	g1I15I15	AccebtaJ le

Comments:

ALS Group USA, Corp. dba ALS Environmental

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey		
Sample Matrix:	Animal tissue		

Surrogate Recovery Summary
Polynuclear Aromatic Hydrocarbons

Extraction Method:	EPA 3541	**Units:**	Percent
Analysis Method:	8270D SIM	**Level:**	Low

Sample Name	Lab Code	Sur1	Sur2	Sur3
HAZ-C1	K1313763-001	70	76	78
HAZ-C2	K1313763-002	68	75	79
HAZ-C3	K1313763-003	70	73	84
HAZ-C4	K1313763-004	68	75	77
HIL-C1	K1313763-005	71	80	84
HIL-C2	K1313763-006	67	74	75
HIL-C3	K1313763-007	71	79	81
HIL-C4	K1313763-008	66	68	81
HAZ-B1	K1313763-009	69	79	84
HAZ-B2	K1313763-010	72	78	84
HAZ-B3	K1313763-011	67	71	77
HIL-B1	K1313763-012	69	75	83
HAZ-L1	K1313763-013	66	73	74
HAZ-L2	K1313763-014	67	75	76
REF-L1	K1313763-015	72	81	80
REF-L2	K1313763-016	74	79	79
HAZ-L3	K1313763-017	71	78	77
Method Blank	KWG1314063-5	74	83	88
REF-L1MS	KWG1314063-1	71	83	81
REF-L1DMS	KWG1314063-2	71	80	78
Lab Control Sample	KWG1314063-3	70	84	91
Duplicate Lab Control Sample	KWG1314063-4	75	90	93

Surrogate Recovery Control Limits (%)

Sur1	=	Fluorene-d10	39-96
Sur2	=	Fluoranthene-d10	41-100
Sur3	=	Terphenyl-d14	39-111

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K5151371
Project:	w4 SHell Mounh Surved	**Date Extracted:**	52/28/2651
Sample Matrix:	Animal tissue	**Date Analyzed:**	65/5w/265w

Matrix Spike/Duplicate Matrix Spike Summary
Polynuclear Aromatic Hydrocarbons

Sample Name:	REF-B5	**Units:**	ug/Kg
Lab Code:	K5151371-650	**Basis:**	Wet
Extraction Method:	EyA 10w5	**Level:**	BoL
Analysis Method:	8236D SIM	**Extraction Lot:**	KW9 515w671

		REF-B5MS KW9 515w671-5 Matrix Spike			REF-B5DMS KW9 515w671-2 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
GapHHalene	5.3	w55	w37	87	17P	wP2	30	wl-562	55	w6
2-MetHdlnapHHalene	GD	1P1	w37	81	102	wP2	35	wl-55w	55	w6
AcenapHHdlene	GD	w50	w37	83	1P2	wP2	86	01-566	7	w6
AcenapHHene	GD	w27	w37	P6	w65	wP2	85	02-565	7	w6
DiNenbofuran	GD	w20	w37	8P	w62	wP2	82	00-561	7	w6
Fluorene	5.6	wl6	w37	P6	w67	wP2	82	07-56w	7	w6
yHenantHene	5.2	www	w37	P1	w5P	wP2	80	0w-566	7	w6
AntHracene	GD	w0w	w37	P0	w20	wP2	87	03-561	3	w6
FluorantHene	6.w8	w05	w37	P0	w53	wP2	80	00-568	8	w6
ydrene	GD	w6P	w37	87	188	wP2	3P	w8-553	0	w6
z enb*a(antHracene	6.38	w07	w37	P7	w22	wP2	87	00-560	8	w6
CHrdsene	6.75	w83	w37	562	w01	wP2	P2	08-552	3	w6
z enbo*N(fluorantHene	5.2	0w5	w37	551)	066	wP2	565	76-563	8	w6
z enbo*k(fluorantHene	6.73	w73	w37	P8	wl7	wP2	88	08-550	3	w6
z enbo*a(pdrene	GD	w08	w37	P7	w25	wP2	80	07-556	8	w6
Inheno*5,2,1-ch(pdrene	5.1	758	w37	516)	038	wP2	553	06-553	3	w6
DiNenb*a,H(antHracene	5.5	0P1	w37	52w)	0w3	wP2	555	02-552	8	w6
z enbo*g,H,i(perdlene	2.2	717	w37	511)	08P	wP2	55P)	07-553	8	w6

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

yercent recoveries anh relative percent hifferences *RyD(are hetermineh Nd tHe softL are using values in tHe calculation L HicH Have not Neen rounheh.

QA/QC Report

Client:	AMEC Environment & Infrastructure, Inc.	**Service Request:**	K1313763
Project:	4H Shell Mound Survey	**Date Extracted:**	12/28/2013
Sample Matrix:	Animal tissue	**Date Analyzed:**	01/14/2014

Lab Control Spike/Duplicate Lab Control Spike Summary
Polynuclear Aromatic Hydrocarbons

Extraction Method:	EPA 3541	**Units:**	ug/Kg
Analysis Method:	8270D SIM	**Basis:**	Wet
		Level:	Low
		Extraction Lot:	KWG1314063

	Lab Control Sample KWG1314063-3 **Lab Control Spike**			Duplicate Lab Control Sample KWG1314063-4 **Duplicate Lab Control Spike**					
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Naphthalene	423	500	85	434	500	87	43-102	3	40
2-Methylnaphthalene	394	500	79	397	500	79	43-114	1	40
Acenaphthylene	438	500	88	442	500	88	53-100	1	40
Acenaphthene	452	500	90	453	500	91	52-101	0	40
Dibenzofuran	444	500	89	453	500	91	55-103	2	40
Fluorene	441	500	88	451	500	90	56-104	2	40
Phenanthrene	460	500	92	471	500	94	54-100	2	40
Anthracene	480	500	96	486	500	97	57-103	1	40
Fluoranthene	478	500	96	490	500	98	55-108	2	40
Pyrene	487	500	97	489	500	98	48-117	1	40
Benz(a)anthracene	519	500	104	506	500	101	55-105	3	40
Chrysene	536	500	107	522	500	104	58-112	3	40
Benzo(b)fluoranthene	537	500	107	529	500	106	60-107	1	40
Benzo(k)fluoranthene	509	500	102	503	500	101	58-115	1	40
Benzo(a)pyrene	523	500	105	513	500	103	56-110	2	40
Indeno(1,2,3-cd)pyrene	556	500	111	548	500	110	50-117	1	40
Dibenz(a,h)anthracene	533	500	107	522	500	104	52-112	2	40
Benzo(g,h,i)perylene	566	500	113	561	500	112	56-117	1	40

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Appendix C2

Mussel Growth and Tissue Contamination Study at the 4H Shell Mounds (2024)

2023 Caged Mussel Bioassay Study: 4H Shell Mounds, Santa Barbara Channel.

February, 2024

ESLO2024-026

Submitted to:
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DUDEK

Prepared by:
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List of Abbreviations and Acronyms

ANOVA	Analysis of Variance
BOT	beginning of test
CSLC	California State Lands Commission
DR	Deep Reference Site
EOT	end of test
ft	feet
g	grams
GIS	geographic information system
HA	Hazel Shell Mound
HE	Heidi Shell Mound
HI	Hilda Shell Mound
HO	Hope Shell Mound
km	kilometers (1×10^3 m)
lb	pounds
m	meters
MDL	method detection limits
mm	millimeters (1×10^{-2} m)
ND	no detection
ng	nanograms (1×10^{-9} g)
nm	nautical miles
PCBs	polychlorinated biphenyls
PAHs	polycyclic aromatic hydrocarbons
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
SAIC	Science Applications International Corporation
SNK	Student-Newman-Keuls test
SR	Shallow Reference Site
ug	micrograms (1×10^{-6} g)

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Abstract

This report describes and compares results of two bioaccumulation studies to determine whether metals and other contaminants may be leaching from mounds of oil well drill cuttings covered by seashell and sedimentary material located on the seafloor in the Santa Barbara Channel. These mounds are referred to as the 4H Shell Mounds. The first study was completed by a team led by SAIC in 2003. The second study aimed to repeat the bioaccumulation approach developed in the SAIC study. It was completed by Tenera Environmental, Inc in 2023. In both studies, live mussels (*Mytilus galloprovincialis*) were deployed above the surface of each of the four shell mounds in the Santa Barbara Channel, California and at two reference sites located far enough away from the shell mounds to remain unaffected by potentially leaching material. This allowed for comparisons between mound and reference sites. After remaining alive for several weeks at these sites, mussels were recovered and concentrations of a suite of potential contaminants in the mussel tissues were tested in a laboratory.

The approach taken by both studies was designed to determine if contaminants were leaching from the mounds in sufficient quantities to show accumulation in the tissue of these filter-feeding organisms while controlling with reference sites that account for regional-scale bioaccumulation potential. The 2023 study was designed to follow similar methods to the 2003 study to allow for a comparison between the two time periods to determine whether changes may have occurred at the mounds since the 2003 study was completed.

Statistical tests of laboratory test results indicate no pattern of increased toxic substances in the tissues of mussels recovered from the shell mounds when compared to the reference sites. This is consistent with the findings of the 2003 study. The lack of evidence of a pattern of increased contaminant levels in tissues exposed at the shell mounds compared to reference sites in both studies, separated by 20 years, indicates that the mounds are not likely to be leaching material in sufficient quantities to be incorporated into the food web. Results also indicate that the mounds have not changed over the intervening 20 years since the 2003 study was completed such that increases in leaching contaminants is evident in the mussel tissues.

1.0 Introduction

This report describes a study to collect information on the potential leaching of contaminants from the 4H Shell Mounds. The 4H Shell Mounds are located in the Santa Barbara Channel offshore of southern California. They consist of four mounds located on the seafloor that formed at the base of four oil and gas platforms during their operational life from 1958 until the platforms were decommissioned and removed in 1996. The four platforms and the subsequent shell mounds left behind are referred to in this report as Hazel (HA), Hilda (HI), Heidi (HE), and Hope (HO).

The mounds initially formed because drilling muds were deposited onto the seafloor during the drilling of the wells in the 1970s. Subsequently, communities of marine organisms established on the platform structures overlying the mounds, particularly the legs (jackets) of the oil and gas platforms. These marine organisms included shelled invertebrates such as mussels, oysters, and other animals. When these organisms died or were removed by divers during cleaning operations, the shells dropped to the seafloor. Over time, the mound of drilling muds were overlaid by broken shells and natural sediment deposits. Historical studies of the shell mounds included sampling of material within the mounds by way of a drill-coring technique called vibracore sampling (de Wit 2001 and Phillips et al. 2006) and sediment sampling of adjacent muds (MEC 2002, Phillips et al 2006), to determine if contaminants occurred within the mounds and whether those contaminants were leaching from the mounds to the adjacent natural environment. In addition to these sampling techniques, bioaccumulation studies that sampled the tissue of organisms from the mounds were also conducted (de Wit 1999 and 2001; SAIC 2003, AMEC 2015) to determine if potential pollutants from the mounds were accumulating in these organisms. These included studies that sampled organisms living naturally on and adjacent to the mounds. The SAIC (2003) study is the only study that sampled mussels intentionally placed on or closely adjacent to the mounds for several weeks. The bioaccumulation studies sought to determine if levels of any potential contaminants that could be reliably detected in organisms, were elevated at the mounds compared to reference sites. Reference sites were located a sufficient distance away from the mounds that they would not be affected by contaminants leaching from the mounds.

This report describes a study intended to repeat a mussel bioaccumulation study conducted on the 4H Shell Mounds in 2003 (SAIC 2003). The SAIC (2003) study concluded in part that there were no differences in contaminant concentrations in mussel tissues exposed to the mound and reference stations. The 2023 study described here sought to reproduce the mussel bioaccumulation analysis reported in SAIC (2003) to determine if any changes may have occurred since 2003 in contaminant leaching from the mounds. This report also provides a comparative analysis of the data collected from both studies. The objective of this assessment is to use a quantitative assessment to inform decision makers that are evaluating whether the mounds are likely to be relatively inert seafloor structures or represent an environmental risk that should be considered for some form of remediation.

As in the SAIC (2003) study, caged mussels were deployed on each of the four shell mounds and two reference locations for approximately two months in 2023 before they were collected and sent to laboratories for analysis. The following sections describe the methods used to deploy and recover the mussels, the methods used to test for toxins in the tissue of the mussels, and the results of those tests. The method section also includes a summary of the information available from the SAIC (2003) study and the results of the 2023 study are compared to data available from the SAIC (2003) study. The results describe the outcomes of both studies, in particular the concentrations of a suite of 163 parameters that were tested across the two studies.

2.0 Methods

2.1 Interpretation of the 2003 Laboratory Analyses

The following section describes the interpretation of raw data understood to be the data analyzed in SAIC (2003). It is necessary to document the interpretation of these data because the 2003 data was provided on a spreadsheet and data labelling was not explained in detail in the original SAIC (2003) report. Further details on the study itself can be found in SAIC (2003). Data from the SAIC (2003) assessment is included in Appendix A of this report.

The SAIC (2003) states that, prior to mussels being deployed to the field stations for the 2003 study, three samples of mussels were sent by SAIC for laboratory analysis for all parameters. Raw data for three samples generally referred to as 4H-T0-03, 4H-T0-12, and 4H-T0-20, are available for all parameters. However, test results for polycyclic aromatic hydrocarbons (PAH) include three separate sets of test results for sample 4H-T0-03. These are alternatively labelled as Battelle Sample ID U7058-ECD, U7058MS-ECD, and U7058MSD-ECD. The data provided for these test results include a percentage recovered value. Furthermore, the concentrations of parameters in the 'MS' and 'MSD' replicates are considerably higher than the Battelle Sample ID U7058-ECD replicate for most parameters. The data files provided for review included a 'Final' tab, which only included data for Battelle Sample ID U7058-ECD. It is assumed that 'MS' stands for matrix spike and 'MSD' refers to a duplicated matrix spike. This is a testing method where a known concentration of analyte is introduced into a sample. Therefore, these records are not considered part of the field test results and only the test results from Battelle Sample ID U7058-ECD are included in this assessment.

The mooring and cage design used to deploy mussels on the 4H Shell Mounds in 2003 was essentially identical to the approach used in 2023 described below in Sections 2.5 and 2.6. More detail can be found in SAIC (2003). Three mussel bags were deployed at each of the four shell mounds and four mussel bags were deployed at each of the two reference sites. However, the SAIC (2003) report notes that three samples were lost during the course of the 2003 study: one each from Hope, Hazel, and the shallow reference site.

Although the SAIC (2003) report indicates that four samples were recovered at the deep reference station, raw data were only identified for three samples at this station. A separate raw data record (filename 'Shellmounds Samples.xls') was provided that appears to indicate site names and recovery statuses. These data indicate a sample that was likely to have been referred to as 4H-DR-04 is the missing sample in the test data set. It is assumed that the reason this sample was not tested for any parameters is that no other station contained four samples.

There are three replicate concentration values for metal and percent solids for the Hazel site included in the raw data, even though only two samples were recovered from this site. The sample generally referred to as 4H-HA-10 contains two sets of test results labelled with 'MSL Codes' 2011-3 r1 and 2011-3 r2. It is unclear what the acronym 'MSL' refers to. Similarly, metal and percent solid test results for the Shallow Reference site include data for four replicates, even though only three samples were collected at this site. The sample generally referred to as 4H-SR-01 contains two sets of test results labelled with MSL Codes 2011-7 r1 and 2011-7 r2. It is assumed, therefore, that these represent sub-samples of mussels from each sample recovered from the site. On this basis, test results for each parameter for sample 4H-SR-01 have been averaged using a mean value.

PAH test results for the Heidi and Shallow Reference sites include four sets of test results, even though only three samples were collected from each of these sites. Two sets of PAH results correspond to the 4H-HE-06 sample recovered from the Heidi site. These two sets of PAH results are labelled Battelle Sample ID ‘T1736-ECD’ and ‘T1736DUP-ECD’. Similarly, two sets of PAH results correspond to the 4H-SR-22 sample recovered from the Shallow Reference site. These two sets of PAH results are labelled Battelle Sample ID ‘T1725-ECD’ and ‘T1725DUP-ECD’. It is assumed that the initials ‘DUP’ refers to ‘duplicated’. Alongside these duplicated results is a column titled RPD, which is assumed to stand for Relative Percent Difference. RPD is used to estimate laboratory test precision (how similar repeated tests are to each other). Together, these assumptions indicate Battelle duplicated the testing on these two samples to check the precision of their laboratory testing of PAH parameters. Each set of test results for a sample are valid replicate results, therefore the results of the two replicate tests for each parameter from each sample have been recombined as a mean value for each sample.

The PAH data set includes two samples labelled SRM 1974a. These are also referred to as BC255SRM-ECD and BC255SRMD-ECD. The abbreviation SRM is defined in the SAIC (2003) abbreviations list as Standard Reference Material, although no mention of this term appears in the report. It is assumed that the results of these samples are part of an internal QA/QC testing process and so these results have not been included in any further analysis in this study.

2.2 Parameters Tested

The pollutant parameters tested in this study fall into five broad categories of parameters:

1. Metals;
2. Chlorinated pesticides;
3. Aroclor polychlorinated biphenyls (PCBs);
4. Other PCB congeners; and
5. Polycyclic aromatic hydrocarbons (PAHs).

In addition, percent solids and percent lipids in the mussel tissues (referred to as ‘Conventionals’) were measured.

Prior to the initiation of this study, information was not available on which parameters were tested in 2003. Data describing the parameters tested in 2003 became available after tests for the 2023 study were confirmed. Consequently, some parameters tested in 2023 were different to those tested in 2003. Parameters tested in both years are shown in **Table 2-1** below. Additional parameters tested only in either 2003 or 2023 are shown in **Table 2-2** and **Table 2-3**. While speciated PAHs[1] for six parameters were only collected in 2003 (Fluoranthenes/Pyrenes, Naphthalenes, Dibenzothiophenes, Phenanthrenes/Anthracenes, Fluorenes, and Chrysenes), total values for these parameters were quantified in both years.

Table 2-1. Parameters tested in both studies (2003 and 2023).

PAHs	PCB Congeners	Metals	Aroclor PCBs
1-Methylnaphthalene	PCB 008	Aluminum	Aroclor 1016
1-Methylphenanthrene	PCB 018	Antimony	Aroclor 1221
2,3,5-Trimethylnaphthalene	PCB 028	Arsenic	Aroclor 1232
2,6-Dimethylnaphthalene	PCB 044	Barium	Aroclor 1242
2-Methylnaphthalene	PCB 049	Beryllium	Aroclor 1248
Acenaphthene	PCB 052	Cadmium	Aroclor 1254
Acenaphthylene	PCB 066	Chromium	Aroclor 1260
Anthracene	PCB 087	Cobalt	**Chlorinated Pesticides**
Benz[a]anthracene	PCB 101	Copper	2,4'-DDD
Benzo[a]pyrene	PCB 105	Iron	2,4'-DDE
Benzo[b]fluoranthene	PCB 110	Lead	2,4'-DDT
Benzo[e]pyrene	PCB 118	Mercury	4,4'-DDD
Benzo[g,h,i]perylene	PCB 128	Molybdenum	4,4'-DDE
Benzo[k]fluoranthene	PCB 138	Nickel	4,4'-DDT
Biphenyl	PCB 153	Selenium	BHC-alpha
Chrysene	PCB 170	Silver	BHC-beta
Dibenz[a,h]anthracene	PCB 180	Thallium	BHC-delta
Dibenzothiophene	PCB 183	Vanadium	BHC-gamma
Fluoranthene	PCB 187	Zinc	Chlordane-alpha
Fluorene	PCB 195	**Conventionals**	Chlordane-gamma
Indeno[1,2,3-cd]pyrene	PCB 206	Percent Lipids	cis-Nonachlor
Naphthalene	PCB 209	Percent Solids	Dieldrin
Perylene			trans-Nonachlor
Phenanthrene			
Pyrene			

[1] Speciation of PAHs refers to the position of substituents (such as methyl, hydroxyl, or other groups) on the PAH molecule.

Table 2-2. Parameters tested in the 2023 study only.

PCB Congeners			
PCB 003	PCB 081	PCB 132/168	PCB 169
PCB 031	PCB 095	PCB 141	PCB 174
PCB 033	PCB 097	PCB 149	PCB 177
PCB 037	PCB 099	PCB 151	PCB 189
PCB 056/60	PCB 114	PCB 156	PCB 194
PCB 070	PCB 119	PCB 157	PCB 199
PCB 074	PCB 123	PCB 158	PCB 201
PCB 077	PCB 126	PCB 167	
Chlorinated Pesticides			
Oxychlordane			

Table 2-3. Parameters tested in the 2003 study only.

Chlorinated Pesticides	
Aldrin	Endosulfan I
Heptachlor	Endosulfan II
Heptachlor epoxide	Endosulfan sulfate
Endrin	Methoxychlor
Endrin Aldehyde	Toxaphene
PCB Congeners	
PCB 184	
Speciated PAHs	
C1 through 3	C1 through 4
Fluoranthenes/Pyrenes	Naphthalenes
Dibenzothiophenes	Phenanthrenes/Anthracenes
Fluorenes	Chrysenes

2.3 Mussel stock

Mytilus galloprovincialis mussels were purchased from Santa Barbara Mariculture. Mussels from this source are grown within the Santa Barbara Channel and therefore are likely to be better acclimated to environmental conditions similar to the deployment sites, as compared to other readily available mussel supplies. Santa Barbara Mariculture also promotes an ‘eco-friendly’ approach to mariculture that uses no chemicals, feeds, or fresh water that differ from what the mussel would naturally be exposed to. In addition to reducing contamination in the mussel tissues from pre-deployment exposures, this approach was also assumed to reduce the likelihood of the mussels suffering shock during deployment at the study locations compared to other cultured mussels. The mussels are grown ¾-miles off Hope Ranch in the Santa Barbara Channel using a New Zealand style of rope culture. Mussels for the SAIC (2003) study were harvested from the jackets of platform Emmy for similar reasons. The mariculture company, Ecomar Inc., was a predecessor to Santa Barbara Mariculture, which was the company used to obtain mussels for the SAIC 2003 study.

Mussels were sorted into seven groups of three samples. Each sample contained approximately 50-80 mussels and an attempt was made to ensure mussel size and general condition was evenly distributed across all samples and groups. **Figure 2-1** shows a schematic representation of the study design.

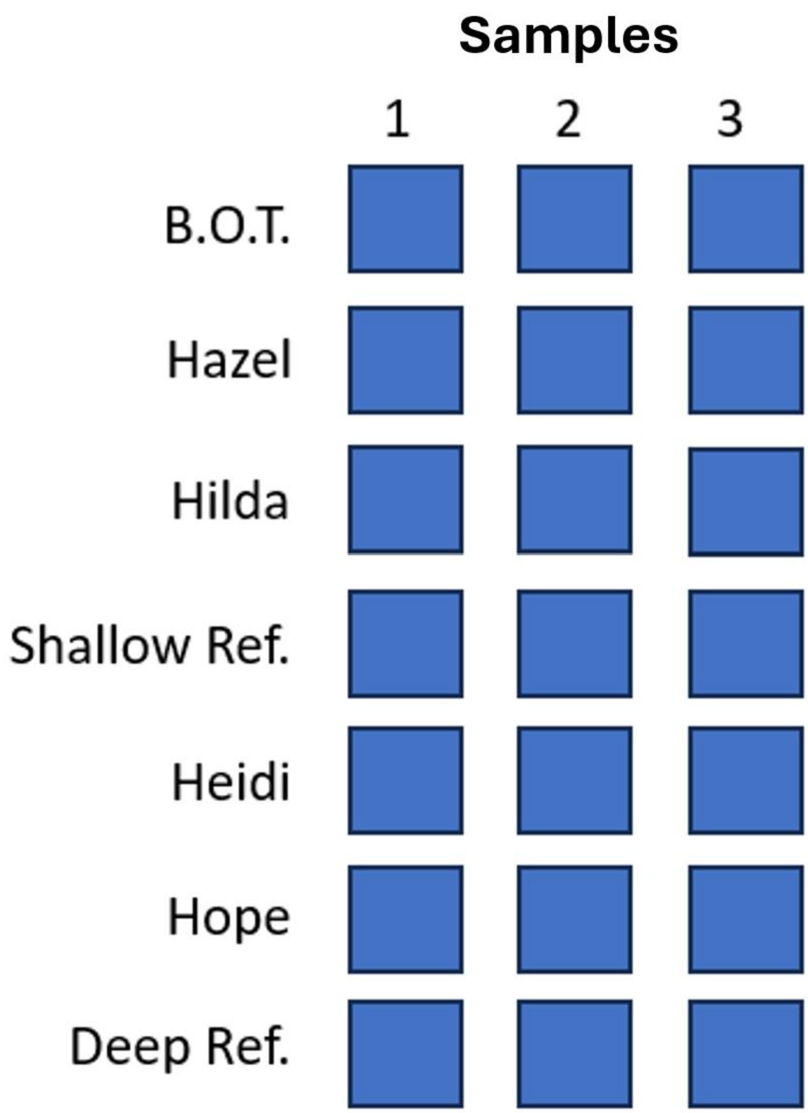

Figure 2-1. Schematic presentation of the study design.
BOT = beginning of test samples; Ref. = reference site.

The BOT (beginning of test) group of three samples were sent directly to the laboratory for testing before any mussels were deployed at the sampling locations. The remaining six groups of three samples of mussels were distributed across the field sampling sites as described below.

2.4 Sampling Locations

Mussels were placed at six discrete locations in the Santa Barbara Channel for this study consistent with the locations studied in the 2003 SAIC study: on each of the four 4H Shell Mounds and at two additional reference locations. **Figure 2-2** is a map showing the location of the six sampling locations.

Each shell mound is named after the oil platform that formed the mounds. The shell mounds Hazel (34°22.993' N, 119°34.083' W) and Hilda (34°23.313' N, 119°35.766' W) are located approximately 1.5 nautical miles (nm) offshore from the city of Summerland in depths around 100 ft. The shell mounds Heidi (34°20.543' N, 119°31.181' W) and Hope (34°20.445' N, 119°31.908' W) are located approximately 2.5 nm offshore from the city of Carpinteria in depths around 130 ft.

The locations of the two reference sites were chosen based on information provided in the SAIC (2003) study. The study did not include coordinates, so locations were selected based on a map figure from the report that was georeferenced in GIS software and descriptions of the site depths in the report matched bathymetry data in GIS software. The ‘shallow’ reference site occurs in water with a similar depth to the Hilda and Hazel shell mounds and the ‘deep’ reference site occurs in water with a similar depth to the Hope and Heidi shell mounds.

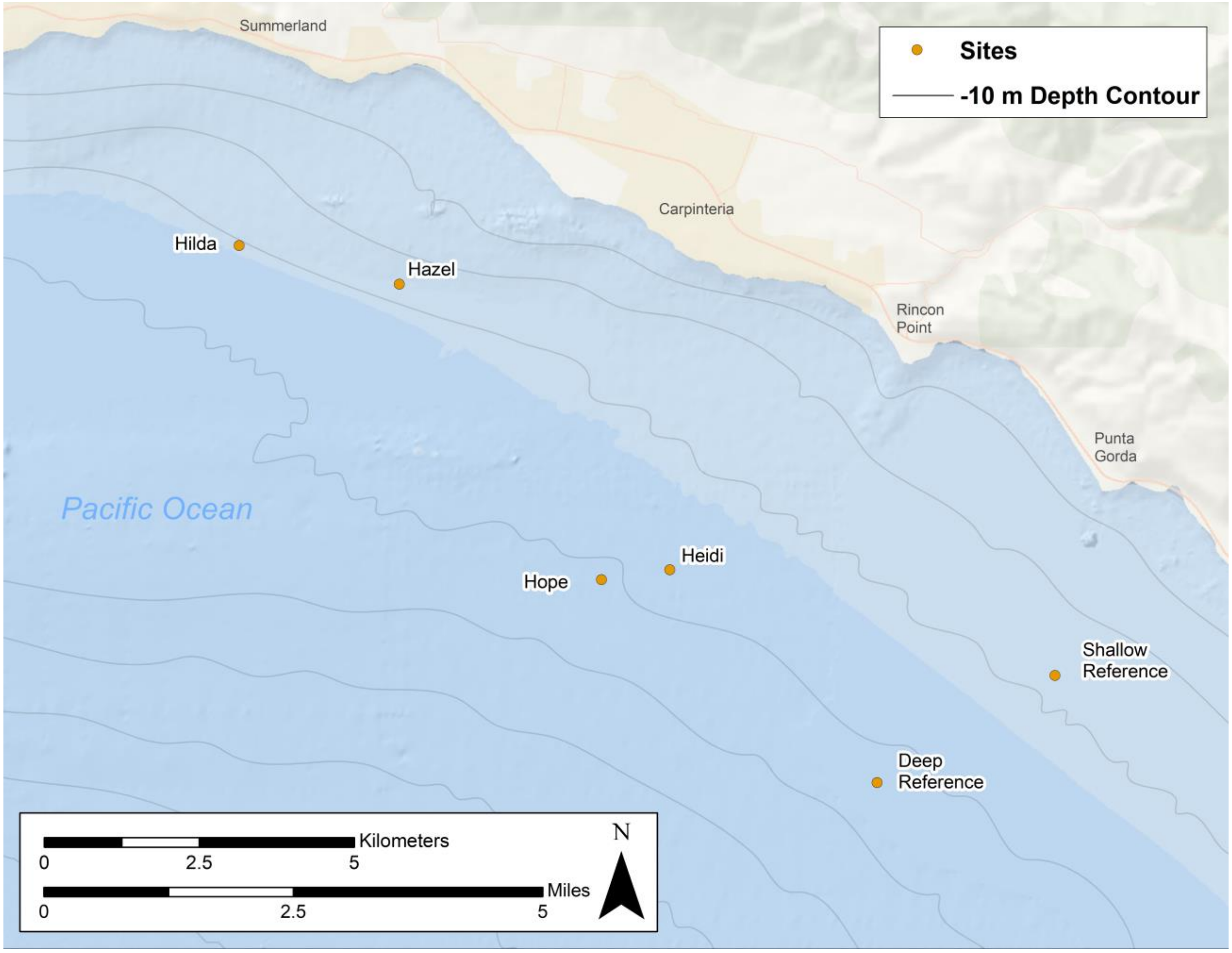

Figure 2-2. 4-H shell mounds and reference sampling locations off the coast of Santa Barbara and Ventura counties in California.

2.5 Mussel Containment Design

The mussels were contained within mesh bags configured on a mooring system designed to closely resemble the method used during the original SAIC (2003) study. The design primarily differs in the mooring configuration, which is reconfigured to reduce marine animal entanglement risk at the request of the California State Lands Commission and their sister agencies. **Figure 2-3**, a portion of which is taken directly from the 2003 SAIC study report, shows the configuration of the mussel containment structure used in the SAIC study.

In the SAIC study the mussels were deployed in "mussel bags" consisting of nylon mesh netting suspended in the center of rectangular frames made from 0.75-inch PVC-pipe. The frames were approximately 20 inches wide and 40 inches tall. To deter predation, the PVC frame and attached bags were enclosed with 0.25-inch heavy-duty mesh. A single sample consisted of 55 individual mussels placed on each mooring.

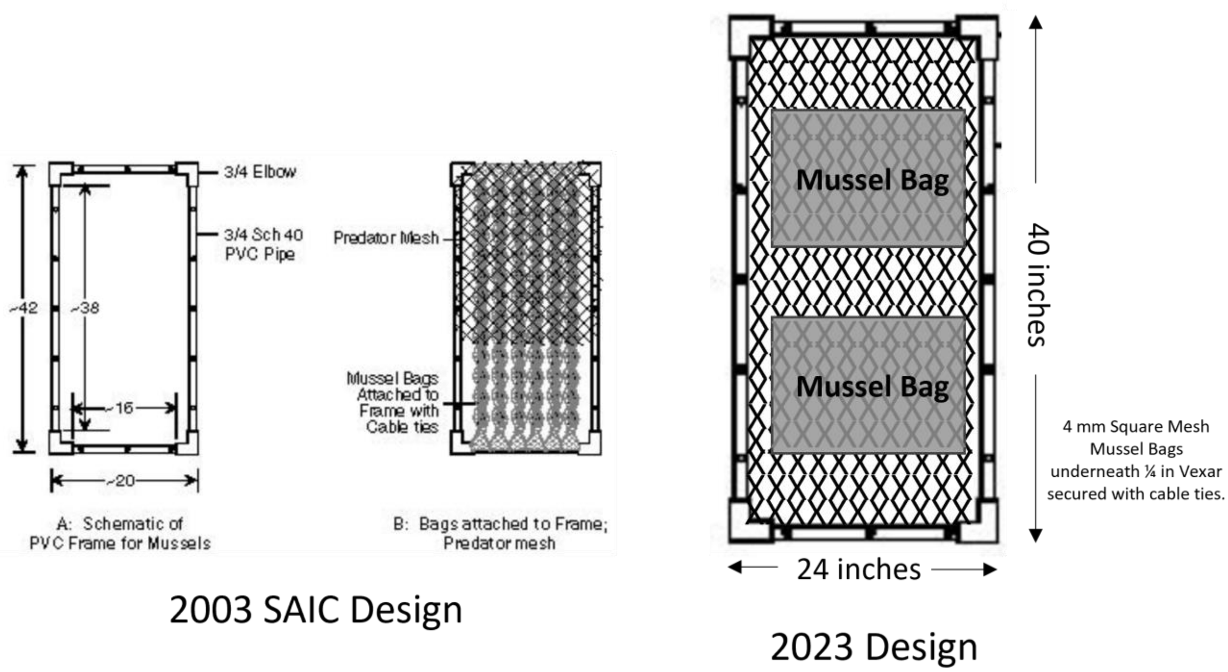

Figure 2-3. A schematic drawing of the mussel deployment configuration used during the SAIC Study from SAIC (2003) in comparison to the 2023 design, which utilized a similar style of predator mesh enclosed around 4 mm square mesh mussel bags.

For the current study, we utilized a similar configuration of PVC frames, 4 mm square mesh mussel bags, and 0.25-inch Vexar predator mesh. Approximately 50-80 mussels were placed within the mesh bags in each frame and were cable tied as shown in **Figure 2-3**. The number of mussels deployed varied depending on the size of the individual animal to ensure sufficient mussel tissue for laboratory testing plus contingency material to cover any mussel mortality.

2.6 Mooring Configuration

Figure 2-4 provides a schematic depiction comparing the SAIC mooring configuration and the mooring configuration used on this study. During the SAIC study, each mussel frame was attached to a clump anchor and suspended below a subsurface buoy. Three moorings were placed at each site to provide replicated mussel samples across the site. A recovery line leading to a spar buoy at the surface was secured to each mooring, resulting in three surface expressions at each site. The image on the far left in **Figure 2-4** shows a conceptual diagram of one of the three mooring configurations from each sampling location used in the 2003 SAIC study, based on the narrative description provided in SAIC (2003). No diagram of the mooring design was provided in the SAIC (2003) report.

The mooring configuration for this study consisted of three mussel frames attached to 3-m long polypropylene mooring lines. Each mussel frame was secured to the seafloor by a 110-lb concrete clump anchor and was suspended approximately 1 m above the substrate by a subsurface float. A 75-ft long polypropylene line was strung between adjacent moored frames and subsurface floats. This line was lifted from the seafloor with small, attached floats to reduce the risk of mooring line abrasion due to contact with structure on the seafloor, as well as entanglement due to water currents and swell twisting any slack line, should the moorings be deployed too close together. An acoustic release device (Sonardyne RT 6-1000) paired with a Sonardyne-designed rope canister was suspended by two smaller buoys above the first subsurface float. The device was configured to release floats attached to rope in the rope canister when triggered by a surface-based device, allowing a surface team to locate and recover the moorings. This eliminated the need for a continuous surface expression and reduced the amount of rope suspended in the water column during the deployment of the moorings. The main objective of this design was to reduce the risk of whale or boat entanglement.

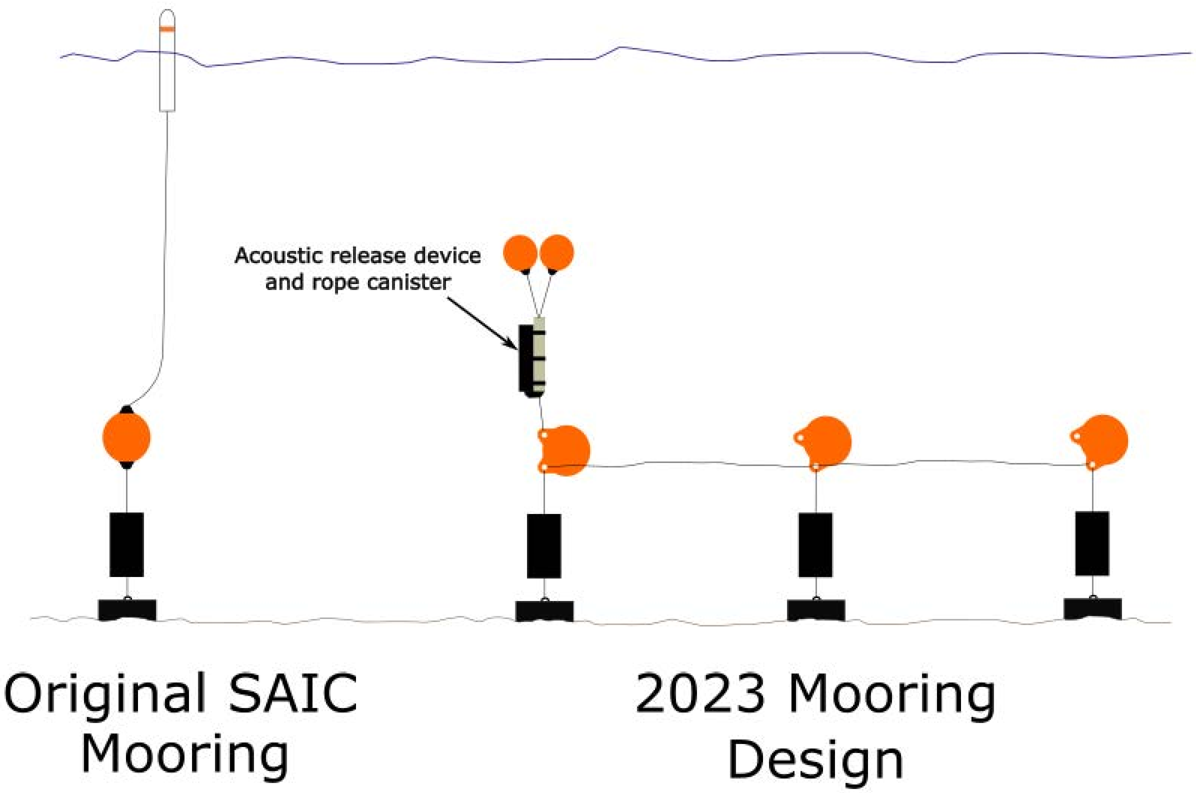

Figure 2-4. Schematic depiction comparing a single sampling mooring configuration from the original SAIC study and the configuration of three "strung" moorings used in the 2023 study (note that the schematic is not to scale).

2.7 Deployment Protocol

Moorings were deployed linearly along the seafloor at the sites by boat. The boat used on the study was a 36-ft radon-style commercial fishing vessel. Anchors with PVC frames and floats were deployed in sequence from the surface, beginning with the last anchor to be recovered and ending with the anchor closest to the acoustic release device. Prior to deployment, the vessel navigated to the site location. A fish finder was used to confirm the location reflected bathymetry indicative of the location. For example, the mounds could be seen as changes in seafloor depth.

The vessel then approached the mound on a bearing predetermined by GIS and sounder positioning of the mound and sea conditions to ensure a correct approach velocity. The skipper notified the deck hands as they approached the edge of the mound, marked the first deployment on the plotter, and ensured the bearing was maintained. Upon deployment of the second mooring, the skipper maintained his bearing and speed to ensure the moorings would be spaced as evenly as possible across the mounds and marked the final position of the last mooring.

Moorings were checked half-way through the 8-week minimum deployment period. To recover the moorings, the vessel captain traveled to each location using GPS. When on station, the captain and crew initiated the transponder sequence for deploying the acoustic release attached to the mooring on the seafloor in accordance with the Sonardyne protocols. Surface floats were visually located and then approached to bring them alongside the vessel. Recovery lines were gaffed and brought aboard the vessel and a capstan and davit was used to recover the moorings fully. Strings were inspected for damage before re-deploying in the same configuration using previous marks and bearings.

During the check in on the Shallow Reference site the field team discovered that the mooring had been dragged off its original location and was now approximately 0.76 nm away from its original drop location. The mooring was only found due to the use of sounding distances retrieved from the Sonardyne top unit that was able to communicate with the deployed unit on this mooring. Upon retrieval it was apparent that the line between the final and middle mooring had been cut and the third mooring was unrecoverable. The field team assumed that the mooring may have been snagged accidentally by a trawler fisherman. The two remaining moorings from the Shallow Reference site were still intact and were redeployed at the location found rather than moving them back to the original location. The redeployment location was chosen because it had a similar depth profile to the original Shallow Reference location. Furthermore, the field team hypothesized that the captain of the vessel that originally snagged the mooring may have redeployed the mooring in a location they were unlikely to accidentally trawl again. Final recovery followed the same protocols as the mid-way check and all moorings were recovered successfully.

2.8 Handling and QA/QC

Tenera shipped whole mussels transported on ice to Physis in accordance with standard collection and delivery methods for mussel bioaccumulation studies in California. Transport and delivery were documented on Chain of Custody forms to ensure tracking and quality control was maintained throughout the collection, testing, and reporting process. The mussels were shucked, dissected, composited, and homogenized by Physis prior to the extraction and parameter testing at their laboratory facility. Laboratory QA/QC results are included with the raw data in Appendix B.

2.9 Analysis Approach

While this assessment includes the first presentation of the 2023 data, the analysis presented below includes presentation of data from the 2003 and 2023 studies. The number of samples per site and from the beginning of the study (BOT samples) are shown in **Table 2-4**. The number of samples recovered varies between years for some sites. Laboratory test procedures also differed with respect to some of the techniques used to extract, concentrate and potentially detect parameters in extractants. The implication of these two key differences between the studies are discussed throughout the results where information was pertinent and available to the authors of this report.

Table 2-4. Number of samples at the beginning of the study (BOT) and successfully recovered from each station for the 2003 and 2023 studies.

Year	BOT	Shallow Reference	Hilda	Hazel	Deep Reference	Heidi	Hope
2003	3	3	3	2	3	3	2
2023	3	2	3	3	3	3	3

All tests performed were subject to method detection limits (MDLs), which represent the lowest concentration of a parameter the laboratory test could identify in the mussel tissue. The analysis presented in Section 3.0 includes a summary of the number of detections achieved by the laboratory testing undertaken in 2003 and 2023. The number of samples where a parameter was detected in mussel tissue are tabulated and the proportions indicated with a color map for rapid comparison between variables (sites, years, parameters, and parameter types). This qualitative analysis provides a basis for interpreting the results of later analyses, such as the presentation of estimated concentrations and the results of hypothesis testing with ANOVA.

A non-detect value is challenging to interpret in the context of this study because this study is designed to compare between locations (mounds and reference locations) and time periods (2003 and 2023 or beginning and end of test). Often, laboratory test procedures are designed to test against regulatory thresholds. In these cases, the concentration of a parameter in a water, sediment, or tissue sample is tested to ensure they remain below that of an environmentally harmful level. Therefore, as long as a laboratory test detection limit is below the threshold of environmental harm, it is sufficient for informing the decision process. Furthermore, it is common in these circumstances to estimate the concentration conservatively by assigning the detection limit value to that sample. In this respect, this is the highest the concentration could be in the tissue, even though it may be lower or not present.

For this study, sample estimates have been assumed to be zero when the parameter is not detected in any samples at a site. It is worth noting that the SAIC (2003) study did not take this approach; instead they replaced missing values with the detection limit for the test. The assumption taken in this analysis that the concentration is zero if no sample at the site detects the parameter implies that the parameter was not present at the site, which is not necessarily the case. However, because comparisons are being made between mounds and reference sites, between years, or between samples at the beginning and end of the test, it is important to take a conservative approach to the differences among sites. Therefore, a site where the parameter is not detected has been set to zero and are not included in statistical tests to decrease the likelihood that a difference between sites is not detected when it does occur. However, if a parameter is detected at a site in at least one sample, all other non-detect values for the samples from that site were set to the MDL for purposes of further analysis and these sites are included in the statistical tests. This assumption implies that the parameter is likely to be present in mussel tissues based on its detection at the site in another sample. This differs from the statistical testing approach used in SAIC (2003), where it appears that all non-detect values were set to the MDL.

Tests were run to determine if concentration in mussel tissue of any parameter at the mounds were higher in 2023 compared to 2003. If so, this might indicate deterioration of the mounds resulting in the leaching of contaminants may have occurred since the 2003 study was completed. However, when comparing between the two studies, MDL values may differ. This can introduce artificial bias into the comparison because, if parameters are detected at concentrations below the highest MDL among tests in one year, the mean concentration estimated for that year will be lower than the mean concentration of the study with the higher MDL. This is most problematic if MDLs are consistently lower in one study compared to the other, which is the case for some groups of parameters. The MDLs for PAH and Chlorinated Pesticide tests conducted in 2003 are consistently lower than in 2023. It is clear that several parameters were detected in 2003 below the MDLs of tests run in 2023.

Therefore, to compare between years it is necessary to convert any data point that lies below the highest MDL to the value of the highest MDL. By adjusting all values below the maximum MDL in this way this bias is eliminated. Boxplots showing the raw data range (i.e. before adjustments) and the mean values of sample results are presented in Appendix C alongside the test MDLs for both years at each site and are discussed in Section 4.

After pooling all replicates on the mounds and adjusting MDLs, t-tests were run for each parameter tested in both studies. If the t-test detected differences between years for the mounds, data at the reference stations was tested in the same way. If differences between years at the mounds matched differences between years at the reference stations, then it was concluded that the differences between mounds was a regional occurrence and unrelated to the mounds.

Statistical tests of differences between the parameter levels at the beginning of the test versus the end of the study are completed using t-tests with uneven sample sizes. Similar tests were used to determine whether there were differences between studies for parameter concentrations in all the samples. Only those sites with at least one detection were included in these comparisons. Non-detect values for these sites were set to the MDL. Differences between study years compared all sites (mounds and reference sites) plus the BOT samples. Differences between the beginning of test and end of test results were conducted separately for each study. All locations (mounds and reference sites) were pooled under the end-of-test (EOT) conditions and compared against the BOT samples. All tests had unequal variances, so Welch's test was used to determine whether mean values for these conditions were significantly different. Differences were determined at a p-value of 0.05.

Analysis of variance (ANOVA) statistical tests were run on the data with sufficient replicates to allow for hypothesis testing to determine whether concentrations of parameters were different between any sites. Differences were assessed when the p-value was lower than 0.05. If differences were found for a parameter, the mean values for each site were examined with post hoc tests to determine which site was likely to be contributing to the differences. These tests were performed separately for 2003 and 2023 to determine if there were differences between the results of the two studies.

ANOVA requires that samples are independent, that data are normally distributed, and that variance among samples within conditions (years or sites, respectively) are equal. All samples in this study met the independence criteria. Because sample sizes were small (n = 3) it was difficult to statistically test for normality among all the statistical conditions (parameters within sites and years). However, it is unlikely that sample results are not normally distributed and generally the ANOVA test is robust to minor departures from normality when sample sizes are equal, and variance is even. Testing was restricted to sites with n=3, so sample sizes are always equal in the tests. Levene's tests were performed to determine equal variance prior to performing the ANOVA. If the raw data failed the equal variance test, raw data were manually examined using boxplots with raw data overlaid and the following decisions were made on whether, and how, to test for differences between mean concentrations with unequal variances:

1. If unequal variance was caused by an outlier sample, the site was eliminated from the test and the test was performed on the remaining sites. This is because a single outlier sample is assumed to be a testing error. By removing an erroneous value, a site fell below the n=3 requirement for statistical testing and therefore the site was eliminated from subsequent statistical testing.

2. ANOVA is generally robust to unequal variances assuming data are normally distributed and sample sizes are equal. Therefore, where within-site variance was significantly different, but those differences were not due to an outlier data point and the mean values remain similar (the largest mean is no more than four times that of the smallest mean value) an ANOVA was still performed.

3. It is possible that variance could increase with the mean for parameters tested in this study. In this instance, transformation of data is effective in overcoming uneven variances for purposes of ANOVA testing. Therefore, in rare cases where the evidence strongly indicated variance was increasing with mean values, transformations would be selected. However, in general, transformations were not favored because sample sizes for this study were very small (n = 3), which makes it very difficult to determine relationships between mean and variance.

4. If conditions 1 through 3 above were not selected, one of two non-parametric tests was performed. A Kruskal-Wallis test was performed when more than two sites were tested and a Mann-Whitney test was performed if only two sites were tested.

Tukey's and Student-Newman-Kuels (SNK) tests were used for post hoc analyses of ANOVA test results that indicated significant differences. These allowed for determination of which means differed and whether they were higher or lower in concentration than other sites. For post hoc analysis of Kruskal-Wallis test results, a Dunn's test was used. For post-hoc assessment of Mann-Whitney test results, a comparison between the two mean values was used. Tukey's test is less likely to detect a difference when one does not occur (a Type 1 error) and therefore was favored in the final analysis of ANOVA test results, however results of both post hoc ANOVA tests were reviewed in the course of the analysis and are presented in the Appendix D to this report.

All analyses were completed in the R software environment (R Core Team 2023). Plots were generated with the ‘ggplot2’ package (Wickham 2016). Levene’s test was performed using the ‘car’ package (Fox and Weisberg 2019). ANOVA tests were performed using the base function ‘aov’. Tukey’s and SNK tests were performed using the ‘agricolae’ package (de Mendiburu 2023). Dunn’s test was performed using the ‘FSA’ package (Ogle et al. 2023) with the assistance of the ‘rcompanion’ package for deriving groups from the Dunn’s test (Mangiafico 2023).

3.0 Results

3.1 Mussel Growth and Survival

Mussels recovered from the 2023 field sites were in good condition and visual observations indicated that all the mussels had survived the deployment. The only exception was the lack of recovery of one of three mussel bags at the Shallow Reference location, which was lost, presumably due to dragging by another party.

Percent solids and percent lipids were measured by the testing laboratory for samples. The mean concentration for these health indicators are shown in **Table 3-1**. It is apparent that lipids generally accumulated in mussel tissue during the 2003 study and declined during the 2023 study. Percent solids generally declined in the 2003 study and remained similar in the 2023 study.

Table 3-1. Mean percent (% wet weight) of lipids and solids from mussels sampled in 2003 and 2023.

Parameter	BOT	SR	HI	HA	DR	HE	HO
2003							
Percent Lipids	1.23	1.51	1.62	1.65	1.25	1.27	1.42
Percent Solids	20.8	18.8	18.4	18.8	17.8	17.6	17.8
2023							
Percent Lipids	1.81	1.43	1.61	1.63	1.4	1.28	1.23
Percent Solids	16.5	15	17.6	17.9	15.6	16	15

3.2 Laboratory Testing

The following series of tables provide estimated mean concentrations for parameters detected in mussel tissues during the 2023 and 2003 studies. Appendix C provides boxplots of the mean and standard deviations for all parameters that occurred in the testing in both years. The lower and upper ends of the box in the boxplot correspond to the first and third quartiles of the data range. The center line of the boxplot corresponds to the median value. Whiskers extend to the largest and smallest values in the data that are inside of 1.5 times the inter quartile range. Any sample values lying outside this range are plotted as points. MDLs are overlaid on these boxplots. However, some MDLs were not reported for 2003 data[2].

In many instances, the laboratory testing did not detect parameters among the samples for each location or the BOT condition. For parameters that were detected in at least one replicate at a site

[2] MDL values were only reported in the raw data for instances where a parameter was not detected in the laboratory test for a replicate.

during a study, non-detect values are assumed to be at the MDL for that study. Otherwise, the concentration of these parameters is assumed to be zero at a site for that study for purposes of estimating mean concentrations at a site. This approach presents a conservative estimate of the concentration of the parameter in mussel tissues. Raw data results are provided in Appendices A and B.

3.2.1 Metals

Table 3-2 and **Table 3-3** show the number of metals detected above the MDL of the test for the 2003 and 2023 samples, respectively. The estimated concentration of metals detected in mussel tissue at each site for the 2003 study are shown in **Table 3-4** and the estimated concentrations for the 2023 study are shown in **Table 3-5**. Boxplots of the concentrations of metals in mussel tissues at all sites for the 2003 and 2023 studies are shown in Appendix D with MDL for the tests overlaid on the boxplots.

In 2003, metals were detected in all samples recovered from the study and in the BOT samples, except for silver. However, in 2023, three metals were not detected in the tissue samples collected at any sites: Antimony, Beryllium, and Thallium. Examination of boxplots shown in Appendix D indicates that MDLs for the 2003 study were much lower for these parameters than in the 2023 study and the levels detected in 2003 were below the MDLs for 2023. Therefore, it is possible that these metals were present in mussel tissues during the 2023 study but were not detected by the tests performed. Silver was detected in one of the samples tested for each site in both years. While the 2023 MDL was higher than the 2003 concentrations, the 2023 concentrations appear to be sufficiently high that the MDL was not a limiting factor on detections. It is unclear why silver concentrations seem to be higher in 2023 compared to 2003.

Table 3-2. Number of samples with metal detections above the MDL of the test for mussel tissue sampled in 2003. Colors indicate the percentage of replicates detected (see table notes for details).

Metal	BOT	SR	HI	HA	DR	HE	HO
Aluminum	3	3	3	2	3	3	2
Antimony	3	3	3	2	3	3	2
Arsenic	3	3	3	2	3	3	2
Barium	3	3	3	2	3	3	2
Beryllium	3	3	3	2	3	3	2
Cadmium	3	3	3	2	3	3	2
Chromium	3	3	3	2	3	3	2
Cobalt	3	3	3	2	3	3	2
Copper	3	3	3	2	3	3	2
Iron	3	3	3	2	3	3	2
Lead	3	3	3	2	3	3	2
Mercury	3	3	3	2	3	3	2
Molybdenum	3	3	3	2	3	3	2
Nickel	3	3	3	2	3	3	2
Selenium	3	3	3	2	3	3	2
Silver	0	0	0	2	0	0	0
Thallium	1	3	3	2	3	3	2
Vanadium	3	3	3	2	3	3	2
Zinc	3	3	3	2	3	3	2

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-3. Number of samples with metal detections above the MDL of the test for mussel tissue sampled in 2023. Colors indicate the percentage of replicates detected (see table notes for details).

Metal	BOT	SR	HI	HA	DR	HE	HO
Aluminum	3	2	3	3	3	3	3
Antimony	0	0	0	0	0	0	0
Arsenic	3	2	3	3	3	3	3
Barium	3	2	3	3	3	3	3
Beryllium	0	0	0	0	0	0	0
Cadmium	3	2	3	3	3	3	3
Chromium	3	2	3	3	3	3	3
Cobalt	3	2	3	3	3	3	3
Copper	3	2	3	3	3	3	3
Iron	3	2	3	3	3	3	3
Lead	3	2	3	3	3	3	3
Mercury	3	2	3	3	3	3	3
Molybdenum	3	2	3	3	3	3	3
Nickel	3	2	3	3	3	3	3
Selenium	3	2	3	3	3	3	3
Silver	1	1	1	1	2	3	2
Thallium	0	0	0	0	0	0	0
Vanadium	3	2	3	3	3	3	3
Zinc	3	2	3	3	3	3	3

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-4. Mean concentration (µg/g wet weight) of metals in mussel tissue sampled in 2003.

Metal	BOT	SR	HI	HA	DR	HE	HO
Aluminum	19.6	34.6	22.0	36.8	42.0	32.4	33.5
Antimony	0.00477	0.00439	0.00494	0.00421	0.00595	0.00429	0.00444
Arsenic	1.63	2.09	1.92	1.99	1.99	1.87	1.98
Barium	0.158	0.447	0.286	0.426	0.383	0.406	0.398
Beryllium	0.00842	0.0101	0.00837	0.00557	0.0081	0.00943	0.00617
Cadmium	0.233	1.32	1.54	1.34	1.2	1.34	1.25
Chromium	0.349	0.485	0.474	0.505	0.675	0.661	0.732
Cobalt	0.0707	0.125	0.127	0.12	0.115	0.111	0.107
Copper	1.01	1.11	1.12	1.14	1.02	1.02	1.09
Iron	26.7	43.3	31.2	40.8	48.6	37.3	38.5
Lead	0.205	0.115	0.0915	0.106	0.125	0.105	0.117
Mercury	0.0105	0.0104	0.00964	0.00978	0.0127	0.0107	0.0122
Molybdenum	0.223	1.97	0.69	0.719	0.919	0.818	0.742
Nickel	0.193	0.332	0.318	0.291	0.314	0.279	0.282
Selenium	1.15	1.45	1.35	1.33	1.54	1.46	1.51
Silver	0	0	0	0.00881	0	0	0
Thallium	0.00391	0.00772	0.00856	0.00868	0.00689	0.00692	0.00647
Vanadium	0.102	0.313	0.218	0.203	0.252	0.182	0.157
Zinc	24.9	23	23.4	22.1	25.9	24.7	26.1

Table 3-5. Mean concentration (µg/g wet weight) of metals in mussel tissue sampled in 2023.

Metals	BOT	SR	HI	HA	DR	HE	HO
Aluminum	13.2	98.9	54.5	57.0	52.9	51.4	55.4
Antimony	0	0	0	0	0	0	0
Arsenic	1.17	1.19	1.31	1.53	1.27	1.27	1.19
Barium	0.216	0.999	0.782	2.04	0.634	0.672	0.827
Beryllium	0	0	0	0	0	0	0
Cadmium	1.56	1.02	0.863	0.850	1.20	1.13	0.975
Chromium	0.0790	2.42	0.457	0.267	0.212	0.208	0.202
Cobalt	0.131	0.0975	0.102	0.100	0.0753	0.0937	0.0793
Copper	1.61	1.58	1.02	0.963	0.854	1.38	0.904
Iron	26.3	121	80.8	93.6	85.2	83.7	87.7
Lead	0.0467	0.0610	0.0437	0.0537	0.0563	0.0520	0.0497
Mercury	0.00282	0.00548	0.00589	0.0057	0.0056	0.00685	0.00518
Molybdenum	0.243	0.672	0.344	0.352	0.347	0.409	0.341
Nickel	0.206	1.15	0.326	0.307	0.236	0.276	0.249
Selenium	0.523	0.52	0.62	0.643	0.596	0.568	0.534
Silver	0.0347	0.0425	0.0257	0.0250	0.0293	0.0360	0.0273
Thallium	0	0	0	0	0	0	0
Vanadium	0.118	0.404	0.327	0.322	0.272	0.307	0.348
Zinc	13.4	13.9	12.9	14.1	15.3	14.5	14.1

3.2.2 Chlorinate Pesticides

Table 3-6 and **Table 3-7** show the number of chlorinate pesticides detected above the MDL of the test for the 2003 and 2023 samples, respectively. The estimated concentration of chlorinated pesticides detected in mussel tissue at each site for the 2003 study are shown in **Table 3-8** and the estimated concentrations for the 2023 study are shown in **Table 3-9**. Boxplots of the concentrations of chlorinated pesticides in mussel tissues at all sites for the 2003 and 2023 studies are shown in Appendix C with MDL for the tests overlaid on the boxplots.

Considerably fewer chlorinated pesticides were detected in the 2023 study than during the 2003 study. However, this is likely to be because the MDLs for the laboratory testing in 2023 were generally above that of the 2003 study and detected values in 2003 were often lower than the 2023 MDLs.

Table 3-6. Number of samples with chlorinated pesticide detections above the MDL of the test for mussel tissue sampled in 2003. Colors indicate the percentage of replicates detected (see table notes for details).

Chlorinated Pesticides	BOT	SR	HI	HA	DR	HE	HO
2,4'-DDD	3	3	3	2	3	3	2
2,4'-DDE	3	3	3	2	3	3	2
2,4'-DDT	2	3	3	2	3	3	2
4,4'-DDD	3	3	3	2	3	3	2
4,4'-DDE	3	3	3	2	3	3	2
4,4'-DDT	3	2	3	2	3	3	2
Aldrin	0	0	0	0	0	0	0
BHC-alpha	3	3	3	2	3	3	2
BHC-beta	1	0	0	0	0	0	0
BHC-delta	0	0	0	0	0	0	0
BHC-gamma	2	0	0	0	0	0	0
Chlordane-alpha	3	3	3	2	3	3	2
Chlordane-gamma	3	3	3	2	3	3	2
cis-Nonachlor	3	3	3	2	3	2	2
Dieldrin	3	3	2	2	3	3	2
Endosulfan I	0	0	0	0	0	0	0
Endosulfan II	1	0	0	0	0	0	0
Endosulfan sulfate	1	1	2	2	0	0	0
Endrin	2	0	0	0	0	0	0
Endrin Aldehyde	0	0	0	0	0	0	0
Heptachlor	1	0	0	0	0	0	0
Heptachlor epoxide	0	0	0	0	0	0	0
Methoxychlor	0	0	0	0	0	0	0
Toxaphene	0	0	0	0	0	0	0
trans-Nonachlor	3	3	3	2	3	3	2

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-7. Number of samples with chlorinated pesticide detections above the MDL of the test for mussel tissue sampled in 2023. Colors indicate the percentage of replicates detected (see table notes for details).

Chlorinated Pesticides	BOT	SR	HI	HA	DR	HE	HO
2,4'-DDD	0	0	0	0	0	0	0
2,4'-DDE	0	2	3	3	3	2	2
2,4'-DDT	0	0	0	0	0	0	0
4,4'-DDD	0	2	1	2	3	1	0
4,4'-DDE	3	2	3	3	3	3	3
4,4'-DDT	0	0	0	0	0	0	0
BHC-alpha	0	0	0	0	0	0	0
BHC-beta	0	0	0	0	0	0	0
BHC-delta	0	0	0	0	0	0	0
BHC-gamma	0	0	0	0	0	0	0
Chlordane-alpha	0	1	0	0	0	0	0
Chlordane-gamma	0	0	0	0	0	0	0
cis-Nonachlor	0	1	0	0	0	1	0
Dieldrin	0	0	0	0	0	0	0
Oxychlordane	0	0	0	0	0	0	0
trans-Nonachlor	3	2	3	3	3	3	3

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-8. Mean concentration (ng/g wet weight) of chlorinated pesticides in mussel tissue sampled in 2003.

Chlorinated Pesticides	BOT	SR	HI	HA	DR	HE	HO
2,4'-DDD	0.325	0.241	0.202	0.184	0.179	0.194	0.181
2,4'-DDE	1.43	0.58	0.679	0.677	0.618	0.707	0.851
2,4'-DDT	0.133	0.136	0.0783	0.079	0.096	0.114	0.136
4,4'-DDD	0.987	0.609	0.516	0.517	0.531	0.541	0.575
4,4'-DDE	9.42	4.64	5.08	3.85	3.31	3.49	3.45
4,4'-DDT	0.369	0.208	0.236	0.270	0.172	0.239	0.243
Aldrin	0	0	0	0	0	0	0
BHC-alpha	0.582	0.729	0.861	0.725	0.522	0.719	0.625
BHC-beta	0.103	0	0	0	0	0	0
BHC-delta	0	0	0	0	0	0	0
BHC-gamma	0.0657	0	0	0	0	0	0
Chlordane-alpha	0.452	0.293	0.286	0.299	0.200	0.242	0.258
Chlordane-gamma	0.346	0.140	0.113	0.125	0.0973	0.110	0.114
cis-Nonachlor	0.233	0.0827	0.0780	0.0805	0.0497	0.0653	0.0805
Dieldrin	0.170	0.0710	0.0587	0.0645	0.0570	0.0633	0.0740
Endosulfan I	0	0	0	0	0	0	0
Endosulfan II	0.124	0	0	0	0	0	0
Endosulfan sulfate	0.121	0.0720	0.0630	0.0545	0	0	0
Endrin	0.0833	0	0	0	0	0	0
Endrin Aldehyde	0	0	0	0	0	0	0
Heptachlor	0.0390	0	0	0	0	0	0
Heptachlor epoxide	0	0	0	0	0	0	0
Methoxychlor	0	0	0	0	0	0	0
Toxaphene	0	0	0	0	0	0	0
trans-Nonachlor	0.395	0.177	0.140	0.154	0.142	0.143	0.175

Table 3-9. Mean concentration (ng/g wet weight) of chlorinated pesticides in mussel tissue sampled in 2023.

Chlorinated Pesticides	BOT	SR	HI	HA	DR	HE	HO
2,4'-DDD	0	0	0	0	0	0	0
2,4'-DDE	0	0.997	1.15	0.897	1.42	0.545	0.514
2,4'-DDT	0	0	0	0	0	0	0
4,4'-DDD	0	0.815	0.385	0.732	0.848	0.391	0
4,4'-DDE	1.87	5.81	4.13	5.40	5.67	6.63	3.97
4,4'-DDT	0	0	0	0	0	0	0
BHC-alpha	0	0	0	0	0	0	0
BHC-beta	0	0	0	0	0	0	0
BHC-delta	0	0	0	0	0	0	0
BHC-gamma	0	0	0	0	0	0	0
Chlordane-alpha	0	0.472	0	0	0	0	0
Chlordane-gamma	0	0	0	0	0	0	0
cis-Nonachlor	0	0.279	0	0	0	0.238	0
Dieldrin	0	0	0	0	0	0	0
Oxychlordane	0	0	0	0	0	0	0

3.2.3 Aroclor PCBs

Table 3-10 and **Table 3-11** show the number of Aroclor PCBs detected above the MDL of the test for the 2003 and 2023 samples, respectively. The estimated concentration of Aroclor PCBs detected in mussel tissue at each site for the 2003 study are shown in **Table 3-12** and the estimated concentrations for the 2023 study are shown in **Table 3-13**. Boxplots of the concentrations of Aroclor PCBs in mussel tissues at all sites for the 2003 and 2023 studies are shown in Appendix C with MDLs for the tests overlaid on the boxplots.

Very few Aroclor PCB variants were detected in either study. During the 2003 study, Aroclor 1254 was detected at all the sites sampled, including in the BOT samples. However, this parameter was not detected in 2023. The mean concentration of Aroclor 1254 ranged from 7 ng/g to 15 ng/g wet weight in 2003, with the highest concentration occurring in the mussels sampled at the beginning of the study (BOT). The minimum detection limit for Aroclor 1254 in the 2023 testing was 10 ng/g. The MDL levels for the 2023 laboratory analysis may be too high to detect parameter levels similar to those recorded in 2003.

Table 3-10. Number of samples with Aroclor PCBs detections above the MDL of the test for mussel tissue sampled in 2003. Colors indicate the percentage of replicates detected (see table notes for details).

Aroclor PCBs	BOT	SR	HI	HA	DR	HE	HO
Aroclor 1016	0	0	0	0	0	0	0
Aroclor 1221	0	0	0	0	0	0	0
Aroclor 1232	0	0	0	0	0	0	0
Aroclor 1242	0	0	0	0	0	0	0
Aroclor 1248	0	0	0	0	0	0	0
Aroclor 1254	3	3	3	2	3	3	2
Aroclor 1260	0	0	0	0	0	0	0

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-11. Number of samples with Aroclor PCBs detections above the MDL of the test for mussel tissue sampled in 2023. Colors indicate the percentage of replicates detected (see table notes for details).

Aroclor PCBs	BOT	SR	HI	HA	DR	HE	HO
Aroclor 1016	0	0	0	0	0	0	0
Aroclor 1221	0	0	0	0	0	0	0
Aroclor 1232	0	0	0	0	0	0	0
Aroclor 1242	0	0	0	0	0	0	0
Aroclor 1248	0	0	0	0	0	0	0
Aroclor 1254	0	0	0	0	0	0	0
Aroclor 1260	0	0	0	0	0	0	0

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-12. Mean concentration (ng/g wet weight) of Aroclor PCBs in mussel tissue sampled in 2003.

Aroclor PCBs	BOT	SR	HI	HA	DR	HE	HO
Aroclor 1016	0	0	0	0	0	0	0
Aroclor 1221	0	0	0	0	0	0	0
Aroclor 1232	0	0	0	0	0	0	0
Aroclor 1242	0	0	0	0	0	0	0
Aroclor 1248	0	0	0	0	0	0	0
Aroclor 1254	15.0	7.72	7.73	7.76	7.04	7.40	8.23
Aroclor 1260	0	0	0	0	0	0	0

Table 3-13. Mean concentration (ng/g wet weight) of Aroclor PCBs in mussel tissue sampled in 2023.

Aroclor PCBs	BOT	SR	HI	HA	DR	HE	HO
Aroclor 1016	0	0	0	0	0	0	0
Aroclor 1221	0	0	0	0	0	0	0
Aroclor 1232	0	0	0	0	0	0	0
Aroclor 1242	0	0	0	0	0	0	0
Aroclor 1248	0	0	0	0	0	0	0
Aroclor 1254	0	0	0	0	0	0	0
Aroclor 1260	0	0	0	0	0	0	0

3.2.4 PCB Congeners

Table 3-14 and **Table 3-15** show the number of PCB congeners detected above the MDL of the test for the 2003 and 2023 samples, respectively. The estimated concentration of PCB congeners detected in mussel tissue at each site for the 2003 study are shown in **Table 3-16** and the estimated concentrations for the 2023 study are shown in **Table 3-17**. Boxplots of the concentrations of PCB congeners in mussel tissues at all sites for the 2003 and 2023 studies are shown in Appendix C with MDL for the tests overlaid on the boxplots.

Considerably fewer PCB congeners were detected in the 2023 study than during the 2003 study. However, similar to the testing of Chlorinated Pesticides, this is likely to be because the MDLs for the laboratory testing in 2023 were generally above that of the 2003 study and detected values in 2003 were often lower than the 2023 MDLs.

Table 3-14. Number of samples with PCB detections above the MDL of the test for mussel tissue sampled in 2003. Colors indicate the percentage of replicates detected (see table notes for details).

PCB Congeners	BOT	SR	HI	HA	DR	HE	HO
PCB 008	0	0	0	0	0	0	0
PCB 018	1	0	0	0	0	0	0
PCB 028	1	0	0	0	0	0	0
PCB 044	1	0	0	0	0	0	0
PCB 049	1	0	0	0	0	1	0
PCB 052	1	0	0	0	0	0	0
PCB 066	3	3	3	2	3	3	2
PCB 087	2	0	2	0	1	0	0
PCB 101	3	3	3	2	3	3	2
PCB 105	3	3	3	2	3	3	2
PCB 110	3	3	3	2	3	3	2
PCB 118	3	3	3	2	3	3	2
PCB 128	2	3	3	2	3	3	2
PCB 138	3	2	3	2	3	3	2
PCB 153	3	3	3	2	3	3	2
PCB 170	1	0	0	0	0	0	0
PCB 180	0	0	0	0	0	0	0
PCB 183	2	3	3	2	3	3	2
PCB 184	0	0	0	0	0	0	0
PCB 187	3	3	2	2	3	3	2
PCB 195	0	0	0	0	0	0	0
PCB 206	0	0	0	0	0	0	0
PCB 209	1	0	0	0	0	0	0

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-15. Number of samples with PCB detections above the MDL of the test for mussel tissue sampled in 2003. Colors indicate the percentage of replicates detected (see table notes for details).

PCB Congeners	BOT	SR	HI	HA	DR	HE	HO
PCB 003	0	0	0	0	0	0	0
PCB 008	0	0	0	0	0	0	0
PCB 018	0	0	0	0	0	0	0
PCB 028	0	0	0	0	0	0	0
PCB 031	0	0	0	0	0	0	0
PCB 033	0	0	0	0	0	0	0
PCB 037	0	0	0	0	0	0	0
PCB 044	0	0	0	0	0	0	0

PCB Congeners	BOT	SR	HI	HA	DR	HE	HO
PCB 049	0	0	0	1	0	1	0
PCB 052	0	0	0	0	0	1	0
PCB 056/60	0	0	0	0	0	0	0
PCB 066	0	0	0	0	0	0	0
PCB 070	0	0	0	0	0	0	0
PCB 074	0	0	0	0	0	0	0
PCB 077	0	0	0	0	0	0	0
PCB 081	0	0	0	0	0	0	0
PCB 087	0	0	0	0	0	0	0
PCB 095	0	0	0	0	2	0	0
PCB 097	0	0	0	0	0	0	0
PCB 099	0	0	0	0	0	0	0
PCB 101	0	0	1	1	0	0	1
PCB 105	0	0	0	0	0	0	0
PCB 110	0	0	0	0	1	1	1
PCB 114	0	0	0	0	0	0	0
PCB 118	0	0	0	0	0	0	0
PCB 119	0	0	0	0	0	0	0
PCB 123	0	0	0	0	0	0	0
PCB 126	0	0	0	0	0	0	0
PCB 128	0	0	0	0	0	0	0
PCB 132/168	0	0	0	0	0	0	0
PCB 138	0	0	0	1	0	0	0
PCB 141	0	0	0	0	0	0	0
PCB 149	0	0	0	0	0	0	0
PCB 151	0	0	0	0	0	0	0
PCB 153	0	1	2	1	3	3	1
PCB 156	0	0	0	0	1	0	0
PCB 157	0	0	1	0	0	0	1
PCB 158	2	0	0	0	0	0	0
PCB 167	0	0	0	0	0	0	0
PCB 169	0	0	0	0	0	0	0
PCB 170	0	0	0	0	0	0	0
PCB 174	0	0	0	0	0	0	0
PCB 177	0	0	0	1	1	1	1
PCB 180	0	0	0	0	0	0	0
PCB 183	0	0	0	0	0	0	0
PCB 187	0	0	0	0	0	0	0
PCB 189	0	0	0	0	0	0	0
PCB 194	0	0	0	0	0	0	0
PCB 195	0	0	1	0	0	0	0

PCB Congeners	BOT	SR	HI	HA	DR	HE	HO
PCB 199	0	0	0	0	0	0	0
PCB 201	0	0	0	0	0	0	0
PCB 206	0	0	0	0	0	0	0
PCB 209	0	0	0	0	0	0	0

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-16. Mean concentration (ng/g wet weight) of PCBs in mussel tissue sampled in 2003.

PCB Congeners	BOT	SR	HI	HA	DR	HE	HO
PCB 008	0	0	0	0	0	0	0
PCB 018	0.0819	0	0	0	0	0	0
PCB 028	0.148	0	0	0	0	0	0
PCB 044	0.202	0	0	0	0	0	0
PCB 049	0.157	0	0	0	0	0.279	0
PCB 052	0.216	0	0	0	0	0	0
PCB 066	0.333	0.0499	0.0488	0.0469	0.0629	0.0596	0.0829
PCB 087	0.130	0	0.0846	0	0.0630	0	0
PCB 101	0.788	0.433	0.533	0.518	0.373	0.421	0.478
PCB 105	0.242	0.111	0.127	0.114	0.116	0.107	0.120
PCB 110	0.457	0.122	0.170	0.153	0.149	0.142	0.197
PCB 118	0.772	0.227	0.313	0.299	0.250	0.264	0.362
PCB 128	0.156	0.0386	0.064	0.0538	0.0648	0.0812	0.0841
PCB 138	1.09	0.271	0.501	0.446	0.458	0.538	0.550
PCB 153	1.48	0.565	0.629	0.627	0.639	0.623	0.795
PCB 170	0.0620	0	0	0	0	0	0
PCB 180	0	0	0	0	0	0	0
PCB 183	0.0841	0.0375	0.0471	0.0424	0.0763	0.0847	0.0805
PCB 184	0	0	0	0	0	0	0
PCB 187	0.383	0.203	0.167	0.191	0.199	0.236	0.265
PCB 195	0	0	0	0	0	0	0
PCB 206	0	0	0	0	0	0	0
PCB 209	0.196	0	0	0	0	0	0

Table 3-17. Mean concentration (ng/g wet weight) of PCBs in mussel tissue sampled in 2023.

PCB Congeners	BOT	SR	HI	HA	DR	HE	HO
PCB 003	0	0	0	0	0	0	0
PCB 008	0	0	0	0	0	0	0
PCB 018	0	0	0	0	0	0	0
PCB 028	0	0	0	0	0	0	0
PCB 031	0	0	0	0	0	0	0

PCB Congeners	BOT	SR	HI	HA	DR	HE	HO
PCB 033	0	0	0	0	0	0	0
PCB 037	0	0	0	0	0	0	0
PCB 044	0	0	0	0	0	0	0
PCB 049	0	0	0	0.176	0	0.287	0
PCB 052	0	0	0	0	0	0.227	0
PCB 056/60	0	0	0	0	0	0	0
PCB 066	0	0	0	0	0	0	0
PCB 070	0	0	0	0	0	0	0
PCB 074	0	0	0	0	0	0	0
PCB 077	0	0	0	0	0	0	0
PCB 081	0	0	0	0	0	0	0
PCB 087	0	0	0	0	0	0	0
PCB 095	0	0	0	0	0.413	0	0
PCB 097	0	0	0	0	0	0	0
PCB 099	0	0	0	0	0	0	0
PCB 101	0	0	0.267	0.327	0	0	0.193
PCB 105	0	0	0	0	0	0	0
PCB 110	0	0	0	0	0.139	0.215	0.206
PCB 114	0	0	0	0	0	0	0
PCB 118	0	0	0	0	0	0	0
PCB 119	0	0	0	0	0	0	0
PCB 123	0	0	0	0	0	0	0
PCB 126	0	0	0	0	0	0	0
PCB 128	0	0	0	0	0	0	0
PCB 132/168	0	0	0	0	0	0	0
PCB 138	0	0	0	0.285	0	0	0
PCB 141	0	0	0	0	0	0	0
PCB 149	0	0	0	0	0	0	0
PCB 151	0	0	0	0	0	0	0
PCB 153	0	0.180	0.337	0.184	0.491	0.450	0.225
PCB 156	0	0	0	0	0.139	0	0
PCB 157	0	0	0.157	0	0	0	0.120
PCB 158	0.155	0	0	0	0	0	0
PCB 167	0	0	0	0	0	0	0
PCB 169	0	0	0	0	0	0	0
PCB 170	0	0	0	0	0	0	0
PCB 174	0	0	0	0	0	0	0
PCB 177	0	0	0	0.232	0.279	0.174	0.238
PCB 180	0	0	0	0	0	0	0
PCB 183	0	0	0	0	0	0	0
PCB 187	0	0	0	0	0	0	0

PCB Congeners	BOT	SR	HI	HA	DR	HE	HO
PCB 189	0	0	0	0	0	0	0
PCB 194	0	0	0	0	0	0	0
PCB 195	0	0	0.159	0	0	0	0
PCB 199	0	0	0	0	0	0	0
PCB 201	0	0	0	0	0	0	0
PCB 206	0	0	0	0	0	0	0
PCB 209	0	0	0	0	0	0	0

3.2.5 Polycyclic Aromatic Hydrocarbons

Table 3-18 and **Table 3-19** show the number of PAHs detected above the MDL of the test for the 2003 and 2023 samples, respectively. The estimated concentration of PAHs detected in mussel tissue at each site for the 2003 study are shown in **Table 3-20** and the estimated concentrations for the 2023 study are shown in **Table 3-21**. Boxplots of the concentrations of PAHs in mussel tissues at all sites for the 2003 and 2023 studies are shown in Appendix C with MDL for the tests overlaid on the boxplots.

Considerably fewer PAHs were detected in the 2023 study than during the 2003 study. However, similar to the testing of PCB Congeners and Chlorinated Pesticides, this is likely to be because the MDLs for the laboratory testing in 2023 were generally above those of the 2003 study and detected values in 2003 were often lower than the 2023 MDLs.

Table 3-18. Number of samples with PAH detections above the MDL of the test for mussel tissue sampled in 2003. Colors indicate the percentage of replicates detected (see table notes for details).

PAHs	BOT	SR	HI	HA	DR	HE	HO
1-Methylnaphthalene	3	3	3	2	3	3	2
1-Methylphenanthrene	3	3	2	2	3	3	2
2-Methylnaphthalene	3	3	3	2	3	3	2
2,3,5-Trimethylnaphthalene	2	1	1	2	2	2	1
2,6-Dimethylnaphthalene	2	1	0	0	1	2	0
Acenaphthene	0	1	0	0	0	1	0
Acenaphthylene	0	1	0	0	0	1	0
Benz[a]anthracene	3	2	0	0	2	3	0
Benzo[a]pyrene	0	1	0	0	0	1	0
Benzo[b]fluoranthene	2	1	0	0	0	1	0
Benzo[e]pyrene	2	1	0	0	0	1	0
Benzo[g,h,i]perylene	0	1	0	0	0	1	0
Benzo[k]fluoranthene	2	1	0	0	0	1	0
Biphenyl	3	3	3	2	3	3	2
Chrysene	3	3	2	2	2	3	2
C1-Chrysenes	3	3	2	2	2	1	1

PAHs	BOT	SR	HI	HA	DR	HE	HO
C2-Chrysenes	2	1	0	0	0	1	0
C3-Chrysenes	0	1	0	0	0	1	0
C4-Chrysenes	0	1	0	0	0	1	0
Dibenzothiophene	3	3	2	2	3	3	2
C1-Dibenzothiophenes	3	1	0	0	3	3	2
C2-Dibenzothiophenes	3	3	2	2	3	3	2
C3-Dibenzothiophenes	3	3	2	2	3	3	2
Fluoranthene	3	3	3	2	2	3	2
Pyrene	2	3	3	2	2	3	2
C1-Fluoranthenes/Pyrenes	3	1	0	0	0	1	0
C2-Fluoranthenes/Pyrenes	3	2	2	1	0	2	2
C3-Fluoranthenes/Pyrenes	2	2	2	1	0	2	1
Fluorene	3	3	3	2	3	3	2
C1-Fluorenes	0	1	0	0	0	1	0
C2-Fluorenes	0	1	0	0	0	1	0
C3-Fluorenes	0	1	0	0	0	1	0
Naphthalene	3	3	3	2	3	3	2
C1-Naphthalenes	3	3	3	2	3	3	2
C2-Naphthalenes	2	1	0	0	1	2	0
C3-Naphthalenes	3	3	2	2	3	3	2
C4-Naphthalenes	2	1	0	0	1	1	0
Phenanthrene	3	3	3	2	2	3	2
Anthracene	3	1	0	0	0	1	0
C1-Phenanthrenes/Anthracenes	3	3	2	2	3	3	2
C2-Phenanthrenes/Anthracenes	3	3	2	2	3	3	2
C3-Phenanthrenes/Anthracenes	3	3	2	2	3	3	2
C4-Phenanthrenes/Anthracenes	2	2	1	2	2	3	0
Dibenz[a,h]anthracene	0	1	0	0	0	1	0
Indeno[1,2,3-cd]pyrene	0	1	0	0	0	1	0
Perylene	0	1	0	0	2	1	0

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-19. Number of samples with PAH detections above the MDL of the test for mussel tissue sampled in 2023. Colors indicate the percentage of replicates detected (see table notes for details).

PAHs	BOT	SR	HI	HA	DR	HE	HO
1-Methylnaphthalene	3	1	1	1	0	0	0
1-Methylphenanthrene	3	0	0	0	0	0	0
2-Methylnaphthalene	3	2	2	3	3	1	1
2,3,5-Trimethylnaphthalene	0	0	0	0	0	0	0
2,6-Dimethylnaphthalene	3	0	0	0	0	0	0
Acenaphthene	3	0	0	0	0	0	0
Acenaphthene-d10	3	2	3	3	3	3	3
Acenaphthylene	0	0	0	0	0	0	0
Anthracene	2	0	0	0	0	0	0
Benz[a]anthracene	3	0	0	0	0	0	0
Benzo[a]pyrene	0	0	0	0	0	0	0
Benzo[b]fluoranthene	0	0	0	0	0	0	0
Benzo[e]pyrene	0	0	0	0	0	0	0
Benzo[g,h,i]perylene	0	0	0	0	0	0	0
Benzo[k]fluoranthene	0	0	0	0	0	0	0
Biphenyl	0	2	0	0	0	1	1
Chrysene	3	1	0	0	0	0	0
Chrysene-d12	3	2	3	3	3	3	3
Dibenz[a,h]anthracene	0	0	0	0	0	0	0
Dibenzothiophene	0	0	0	0	0	0	0
Fluoranthene	3	0	0	1	1	0	0
Fluorene	3	0	0	0	0	0	0
Indeno[1,2,3-cd]pyrene	0	0	0	0	0	0	0
Naphthalene	3	0	2	2	0	0	0
Naphthalene-d8	3	2	3	3	3	3	3
Perylene	0	0	0	0	0	0	0
Perylene-d12	3	2	3	3	3	3	3

Table Note: Shading indicates percentage of samples with detections of parameters above the MDL of the laboratory test. Purple = 100%; Orange >=50%; Yellow < 50%; White = no samples.

Table 3-20. Mean concentration (ng/g wet weight) of PAHs in mussel tissue sampled in 2003.

PAHs	BOT	SR	HI	HA	DR	HE	HO
1-Methylnaphthalene	0.226	0.161	0.178	0.157	0.177	0.158	0.18
1-Methylphenanthrene	0.269	0.127	0.0921	0.080	0.190	0.117	0.228
2-Methylnaphthalene	0.414	0.255	0.288	0.252	0.303	0.272	0.317
2,3,5-Trimethylnaphthalene	0.203	0.0468	0.0521	0.0772	0.0824	0.0942	0.0762
2,6-Dimethylnaphthalene	0.196	0.0447	0	0	0.0843	0.0945	0
Acenaphthene	0	0.0457	0	0	0	0.0454	0

PAHs	BOT	SR	HI	HA	DR	HE	HO
Acenaphthylene	0	0.0262	0	0	0	0.0261	0
Benz[a]anthracene	0.306	0.0688	0	0	0.0668	0.0597	0
Benzo[a]pyrene	0	0.0749	0	0	0	0.0744	0
Benzo[b]fluoranthene	0.403	0.0843	0	0	0	0.0838	0
Benzo[e]pyrene	0.401	0.0867	0	0	0	0.0861	0
Benzo[g,h,i]perylene	0	0.0434	0	0	0	0.0431	0
Benzo[k]fluoranthene	0.276	0.0553	0	0	0	0.055	0
Biphenyl	0.169	0.241	0.286	0.182	0.261	0.205	0.228
Chrysene	1.59	0.337	0.269	0.393	0.197	0.248	0.291
C1-Chrysenes	0.862	0.245	0.338	0.449	0.220	0.0695	0.189
C2-Chrysenes	0.964	0.0699	0	0	0	0.0695	0
C3-Chrysenes	0	0.0699	0	0	0	0.0695	0
C4-Chrysenes	0	0.0699	0	0	0	0.0695	0
Dibenzothiophene	0.184	0.127	0.0777	0.0991	0.106	0.0871	0.135
C1-Dibenzothiophenes	0.318	0.0275	0	0	0.216	0.163	0.188
C2-Dibenzothiophenes	3.46	0.898	0.714	1.13	0.907	0.800	0.885
C3-Dibenzothiophenes	2.40	1.13	0.884	1.38	0.823	0.762	0.878
Fluoranthene	2.30	0.254	0.278	0.233	0.131	0.201	0.192
Pyrene	0.992	0.340	0.330	0.308	0.148	0.242	0.243
C1-Fluoranthenes/Pyrenes	1.63	0.0455	0	0	0	0.0452	0
C2-Fluoranthenes/Pyrenes	1.45	0.670	0.913	0.918	0	0.231	0.962
C3-Fluoranthenes/Pyrenes	0.916	0.924	1.64	0.970	0	0.391	0.620
Fluorene	0.593	0.632	0.625	0.510	0.505	0.557	0.559
C1-Fluorenes	0	0.0329	0	0	0	0.0327	0
C2-Fluorenes	0	0.0329	0	0	0	0.0327	0
C3-Fluorenes	0	0.0329	0	0	0	0.0327	0
Naphthalene	0.962	0.872	0.862	0.607	0.931	0.792	0.823
C1-Naphthalenes	0.389	0.302	0.303	0.313	0.290	0.255	0.359
C2-Naphthalenes	0.538	0.0495	0	0	0.273	0.330	0
C3-Naphthalenes	0.763	0.415	0.254	0.384	0.473	0.480	0.444
C4-Naphthalenes	0.625	0.0495	0	0	0.232	0.0492	0
Phenanthrene	1.01	0.391	0.385	0.327	0.281	0.402	0.392
Anthracene	0.342	0.0693	0	0	0	0.0689	0
C1-Phenanthrenes/Anthracenes	1.40	0.537	0.378	0.493	0.781	0.693	0.784
C2-Phenanthrenes/Anthracenes	4.32	2.55	1.72	2.42	2.40	2.31	2.52
C3-Phenanthrenes/Anthracenes	3.20	1.89	1.32	2.29	1.28	1.35	1.40
C4-Phenanthrenes/Anthracenes	1.27	0.784	0.618	1.76	0.654	0.790	0
Dibenz[a,h]anthracene	0	0.0477	0	0	0	0.0474	0
Indeno[1,2,3-cd]pyrene	0	0.0523	0	0	0	0.0520	0
Perylene	0	0.0644	0	0	0.337	0.0640	0

Table 3-21. Mean concentration (ng/g wet weight) of PAHs in mussel tissue sampled in 2023.

PAHs	BOT	SR	HI	HA	DR	HE	HO
1-Methylnaphthalene	1.86	1.15	1.01	1.14	0	0	0
1-Methylphenanthrene	1.15	0	0	0	0	0	0
2-Methylnaphthalene	2.88	1.43	1.32	1.50	1.28	1.18	1.03
2,3,5-Trimethylnaphthalene	0	0	0	0	0	0	0
2,6-Dimethylnaphthalene	1.23	0	0	0	0	0	0
Acenaphthene	4.46	0	0	0	0	0	0
Acenaphthylene	0	0	0	0	0	0	0
Anthracene	1.17	0	0	0	0	0	0
Benz[a]anthracene	4.62	0	0	0	0	0	0
Benzo[a]pyrene	0	0	0	0	0	0	0
Benzo[b]fluoranthene	0	0	0	0	0	0	0
Benzo[e]pyrene	0	0	0	0	0	0	0
Benzo[g,h,i]perylene	0	0	0	0	0	0	0
Benzo[k]fluoranthene	0	0	0	0	0	0	0
Biphenyl	0	1.07	0	0	0	1.05	1.02
Chrysene	12.6	1.23	0	0	0	0	0
Dibenz[a,h]anthracene	0	0	0	0	0	0	0
Dibenzothiophene	0	0	0	0	0	0	0
Fluoranthene	5.66	0	0	1.05	1.08	0	0
Fluorene	3.72	0	0	0	0	0	0
Indeno[1,2,3-cd]pyrene	0	0	0	0	0	0	0
Naphthalene	3.04	0	2.36	2.79	0	0	0
Perylene	0	0	0	0	0	0	0
Phenanthrene	9.80	0	0	0	0	0	0
Pyrene	2.71	1.05	0	1.09	0	0	0

3.3 Statistical Analysis

3.3.1 Differences between BOT and EOT for Both Years

The results of a t-test for differences between the beginning of test samples and the end of test samples were completed for both studies. Results of all parameters with sufficient sample detections to qualify for testing are compiled in Appendix D. The results include Levene tests of homoscedacity, the sites included in the tests, the t-test results and the mean concentrations in each year.

Significant differences between the start and end of the study were detected for twenty-five (25) parameters out of a possible ninety (90) parameters tested. Several parameters differed between the start and end of the study in both study years. In particular, metals were the group most frequently observed to have changed between the start of end of the test in both study years. Typically, metals increased in concentration during the course of the study. It is possible that mussels were accumulating higher concentrations of metals because they were closer to the sediments during the study than their pre-study growing conditions. The mussels were sourced from a rope-based aquaculture facility that grows the mussels suspended in open water. Metals often bind to fine sediments and so it is possible metals were ingested by the mussels over the course of the experiment because they were suspended relatively close to the seafloor.

The next most abundant group for which differences were most frequently detected between the start and end of the studies was PAHs. Unlike metals, the levels of PAHs generally decline in the majority of the parameters for which differences were detected. This indicates that the mussels may be less exposed to PAHs when deployed during the studies than when they were initially recovered from the aquaculture facility. Tests of the conventional parameters indicate that both lipids and solids decreased during the 2023 study, even though lipids were observed to increase during the 2003 study. Mean concentrations of lipids in the 2003 study were lower than those in the 2023 study at the beginning of the test.

Table 3-22. Parameters with significant differences between the beginning and end of each study based on a t-test. Mean values are shown, with purple cells showing the higher concentration and orange cells showing the lower concentration.

Parameter	Study Year	t-test p-value	BOT Mean Concentration	EOT Mean Concentration	Units
Metals					
Aluminum	2003	<0.0001	19.5667	33.3438	µg/g
	2023	<0.0001	13.1767	59.5000	µg/g
Arsenic	2003	0.0009	1.6333	1.9700	µg/g
Barium	2003	<0.0001	0.1580	0.3883	µg/g
	2023	0.0004	0.2163	0.9919	µg/g
Cadmium	2003	<0.0001	0.2333	1.3350	µg/g
	2023	0.0159	1.5633	1.0060	µg/g
Chromium	2003	<0.0001	0.3487	0.5850	µg/g
Cobalt	2003	<0.0001	0.0707	0.1180	µg/g
	2023	0.0225	0.1313	0.0909	µg/g
Copper	2023	0.0014	1.6067	1.0899	µg/g
Iron	2003	<0.0001	26.7000	39.9750	µg/g
	2023	<0.0001	26.3333	90.3059	µg/g
Mercury	2023	<0.0001	0.0028	0.0058	µg/g
Molybdenum	2003	<0.0001	0.2233	1.0062	µg/g
	2023	0.0007	0.2427	0.3955	µg/g
Nickel	2003	<0.0001	0.1927	0.3046	µg/g
Selenium	2003	0.0048	1.1533	1.4400	µg/g
Vanadium	2003	0.0008	0.1019	0.2260	µg/g

Parameter	Study Year	t-test p-value	BOT Mean Concentration	EOT Mean Concentration	Units
	2023	<0.0001	0.1180	0.3255	µg/g
PAHs					
1-Methylnaphthalene	2023	<0.0001	1.8567	0.5147	ng/g
1-Methylphenanthrene	2003	<0.0001	0.2694	0.1371	ng/g
2-Methylnaphthalene	2023	0.0006	2.8767	1.2812	ng/g
Benz[a]anthracene	2003	0.0103	0.3063	0.0366	ng/g
Chrysene	2003	<0.0001	1.5851	0.2824	ng/g
Dibenzothiophene	2003	0.0006	0.1842	0.1039	ng/g
Fluoranthene	2003	<0.0001	2.3024	0.2150	ng/g
Naphthalene	2023	<0.0001	3.0433	0.9076	ng/g
Phenanthrene	2003	<0.0001	1.0070	0.3635	ng/g
Chlorinated Pesticides					
4,4'-DDE	2023	<0.0001	1.8733	5.2353	ng/g
Conventionals					
Percent Lipids	2003	0.0072	1.2277	1.4431	%
	2023	<0.0001	1.8100	1.4308	%
Percent Solids	2003	0.0001	20.7838	18.1959	%

3.3.2 Differences between Studies (Years)

The following section discusses the results for parameters where a t-test detected a significant difference between studies for the mounds. Results for tests performed between study years are compiled in Appendix E. These results include test results of comparisons between mounds and, separately, results of the tests of comparisons between reference sites.

The objective of this analysis is to determine whether there is evidence that the mounds have changed in such a way that metals or chemicals may have begun leaching from the mounds. If a significant difference between years at the mounds is detected, a second t-test is performed to determine whether there was a similar difference between years at the reference sites. If a similar difference occurs at both the mounds and the reference sites, the difference between study years is not considered to be due to the mounds deteriorating and releasing more chemicals. Instead, this result would considered most likely due to a regional-scale change in the abundance of the parameter between the two study years.

Results of the tests where a significant difference was detected between years for a parameter at the mounds are shown in **Table 3-23**. Also shown in **Table 3-23** are parameters where the concentration of a parameter only one year was above the MDL. T-tests for parameters where no parameters were detected in one of the years are invalid. However, they are also unnecessary because the presence of a parameter at concentrations higher than the MDL for one year and not present in the remaining year indicates a difference between years that does not require statistical consideration.

Significant differences between years at the mounds were detected in eighteen (18) parameters out of a possible ninety (90) parameters tested. A further nine (9) parameters demonstrated detections above the MDL in one year and were not detected in the other year, indicating the concentration of these parameters in mussel tissues was likely to be different between years (**Table 3-23**).

The largest number of differences between years at the mounds were detected in the metals group. The mean concentrations in mussel tissues at the mounds of four parameters were significantly higher in 2023 than in 2003; these were Aluminum, Barium, Iron, and Vanadium. However, concentrations of these metals were also higher in tissue samples from the reference locations, suggesting the pattern may be regional and unrelated to the mounds. Nine parameters were lower in 2023 than in 2003. The concentration of eight of these nine parameters in tissue samples from the reference sites were also lower in 2023 than in 2003, suggesting this pattern may also have been a regional pattern unrelated to the mounds. The only exception was chromium. This parameter had a significantly lower concentration at the mounds in 2023 when compared to 2003 but had a higher concentration at the reference stations in 2023 when compared to 2003. However, this result would indicate that levels of chromium around the mounds may have declined in the intervening period. It should be noted that a Welch's test did not find the difference at the reference stations to be significantly different between years, with a p-value of 0.58.

The next largest number of differences between years at the mounds after metals were detected in the PCB Congeners group. The results of t-tests indicated that the mean concentrations in mussel tissues at the mounds of three parameters were significantly higher in 2003 than in 2023. Five other PCB congeners were detected in 2003 and were not detected in laboratory tests in 2023. Similar patterns were observed at the reference sites; seven PCB congeners were detected in 2003 in tissue samples from the reference sites and were not detected in 2023 in tissue samples from these locations. One PCB congener, PCB 153, was detected in both 2003 and 2023. A t-test determined a significant difference in the mean concentration of this parameter in mussel tissue between years and the concentration was lower in 2023. The consistently lower concentrations of PCB congeners at both the mounds and reference locations suggests this pattern may also, like the metals, have been a regional pattern unrelated to the mounds.

The remaining two groups; chlorinated pesticides and PAHs, showed a relatively small number of parameters that indicated any differences in concentration between years at the mounds. Three chlorinated pesticides were detected in tissue sample from the mounds in 2003 and were not detected in tissue samples from the mounds in 2023. Two of these parameters; 4, 4' DDT and BHC-alpha, showed the same pattern at the reference sites. The remaining chlorinated pesticide: Chlordane-gamma was detected in both studies in tissue samples from the reference sites, with a higher mean concentration in 2023 compared to 2003, but this difference was not significantly different based on the results of the t-test. Therefore, similar to the remaining parameters discussed, this indicates a pattern or regional decline in these parameters in the intervening period between tests.

Only two PAHs were determined to have different concentrations in mussel tissue between years at the mounds. 2- Methylnaphthalene was not detected in the 2003 study above the MDL, but was detected above the MDL in the 2023 study. Napthalene was detected in 2003 and 2023 and the results of a Welch's t-test indicate that the concentration in mussel tissue at the mounds is likely to be significantly higher in 2023 compared to 2003. Napthalene was not detected at the reference locations in 2023, however it was detected at the reference locations in 2003.This result represents the only parameter to show any evidence of having increased at the mounds in the intervening period.

Table 3-23. Parameters with significant differences between years for the mounds and the reference locations based on a t-test. Mean values are shown, with purple cells showing the higher concentration and orange cells showing the lower concentration.

Parameter	Mounds				References				MDL	Units
	Test	t-test p-value	2003 Conc	2023 Conc	Test	t-test p-value	2003 Conc	2023 Conc		
Metals										
Aluminum	Welch's	0.0003	30.3800	54.5917	Welch's	0.1154	38.2833	71.2800	1.0000	µg/g
Arsenic	Welch's	0.0000	1.9270	1.3225	Welch's	0.0000	2.0417	1.2340	0.0372	µg/g
Barium	Welch's	0.0024	0.3724	1.0802	Welch's	0.0214	0.4148	0.7800	0.0250	µg/g
Cadmium	Welch's	0.0000	1.3800	0.9536	Welch's	0.0988	1.2600	1.1318	0.0250	µg/g
Chromium	Welch's	0.0005	0.5879	0.2833	Welch's	0.5778	0.5803	1.0962	0.0250	µg/g
Cobalt	Welch's	0.0001	0.1169	0.0937	Welch's	0.0014	0.1197	0.0842	0.0250	µg/g
Iron	Welch's	0.0000	36.3900	86.4667	Welch's	0.0079	45.9500	99.5200	1.0000	µg/g
Lead	Welch's	0.0000	0.1035	0.0498	Welch's	0.0000	0.1201	0.0582	0.0250	µg/g
Mercury	Welch's	0.0000	0.0105	0.0059	Welch's	0.0000	0.0115	0.0056	0.0009	µg/g
Molybdenum	Welch's	0.0000	0.7444	0.3616	Welch's	0.0086	1.4427	0.4768	0.0250	µg/g
Selenium	Welch's	0.0000	1.4070	0.5913	Welch's	0.0000	1.4950	0.5654	0.0932	µg/g
Vanadium	Welch's	0.0000	0.1921	0.3259	Welch's	0.4365	0.2825	0.3244	0.0499	µg/g
Zinc	Welch's	0.0000	24.0700	13.9167	Welch's	0.0000	24.4667	14.7000	0.1752	µg/g
Chlorinated Pesticides										
4,4'-DDT	Not Tested	–	0.2457	0.1280	Not Tested	–	0.2062	0.1280	0.1280	ng/g
BHC-alpha	Not Tested	–	0.7440	0.2500	Not Tested	–	0.6255	0.2500	0.2500	ng/g
Chlordane-gamma	Not Tested	–	0.2699	0.1870	Welch's	0.6959	0.2518	0.3008	0.1870	ng/g
PAHs										
2-Methylnaphthalene	Not Tested	–	1.0000	1.2575	Not Tested	–	1.0000	1.3380	1.0000	ng/g
Naphthalene	Welch's	0.0438	1.0096	1.7858	Not Tested	–	1.0065	1.0000	1.0000	ng/g
PCB Congeners										
PCB 066	Not Tested	–	0.0585	0.0270	Not Tested	–	0.0564	0.0270	0.0270	ng/g
PCB 101	Welch's	0.0136	0.4856	0.2033	Not Tested	–	0.4029	0.0270	0.0270	ng/g
PCB 105	Not Tested	–	0.1169	0.0470	Not Tested	–	0.1135	0.0470	0.0470	ng/g
PCB 118	Not Tested	–	0.3055	0.0690	Not Tested	–	0.2386	0.0690	0.0690	ng/g
PCB 138	Welch's	0.0000	0.5110	0.1180	Not Tested	–	0.3645	0.0615	0.0615	ng/g
PCB 153	Welch's	0.0001	0.6597	0.2989	Welch's	0.0493	0.6021	0.3662	0.0650	ng/g
PCB 183	Not Tested	–	0.0707	0.0560	Not Tested	–	0.0661	0.0560	0.0560	ng/g
PCB 187	Not Tested	–	0.2256	0.1680	Not Tested	–	0.2035	0.1680	0.1680	ng/g

3.3.3 Differences between Mounds and Reference Sites

A one-way ANOVA was used to test for differences between sites within each study. Only sites where a parameter was detected in one or more samples during the study were included in the tests. Results of the Levene's test for equal variance alongside ANOVA results are included in Appendix F.

One hundred (100) tests were run out of a possible two hundred and fifty-three (253) unique parameter and year combinations. The null hypothesis that no differences occur between sites was rejected for twenty-one (21) parameter tests across the two studies, indicating significantly different mean concentrations between at least some sites tested. The parameters and study years where significant differences were detected are shown in **Table 3-24** along with the p-value from the ANOVA tests and the results of a post hoc analysis. Boxplots showing mean concentration by site and year are shown in Appendix C.

The post hoc analysis included in **Table 3-24** is a Tukey test. The Tukey test is a pairwise multiple comparison test that assigns the mean concentration for each site into groups. The groups are displayed in **Table 3-24** by means of colors, with matching colors corresponding to matching groups of sites. Tukey and SNK groups are shown in Appendix F.

Figure 3-1 illustrates the use of colors to show results of the post hoc test for different scenarios in **Table 3-24**. Under Scenario 1, both reference sites (SR = shallow reference; DR = deep reference) are grouped together by the color blue. All four mounds (HI = Hilda; HA = Hazel; HE = Heidi; HO = Hope) are grouped together by the color orange. This means the post hoc test indicates that the level of concentration of the parameter is not significantly different between the reference sites, and the concentration of the parameter is not significantly different between the mounds, but the mounds are different to the reference sites. Furthermore, blue indicates that the reference sites belong to the group of sites with the lowest mean concentrations detected in mussel tissue and orange indicates that the mound sites belong to the highest mean concentrations detected. This would represent the worst case scenario with respect to potentially leaching the parameter, because the mounds are all showing higher concentrations than the reference sites.

Scenario 2 indicates a situation where the reference sites are grouped into the lower mean concentrations group and two mounds (Heidi and Hope) are separated into a higher mean concentration group. However, the mean concentration of the parameter in mussel tissue at the remaining two mounds (Hilda and Hazel) are not different from either the reference sites or the other two mounds. This is indicated by the color purple. Furthermore, Heidi and Hope have significantly higher concentrations than the reference sites. This scenario would represent a situation where Heidi and Hope may be leaching the metal or chemical, but differences for Hilda and Hazel are most likely to be due to random chance.

Similar to Scenarios 1 and 2 described previously, Scenario 3 also shows post hoc results that indicate the concentrations of the parameter tested at the two reference locations are likely to be different from, and lower than, Heidi and Hope. Similar to Scenario 2, differences between Hilda and Hazel are most likely to be due to random chance. However, the concentration of the parameter in the mussel tissue at Hilda is not likely to be different from the reference locations. This is indicated by the lighter purple color. Similarly, the concentration of the parameter in the mussel tissue at Hazel is not likely to be different from Heidi and Hope. This is indicated by the darker purple color.

In Scenario 4, the concentration of the parameter in the mussel tissue at Heidi and Hope differ from the Reference locations, but Hilda and Hazel were not tested because the parameter was not detected at those sites. This is indicated by the white cells in the table for these sites.

Lastly, Scenario 5 represents a situation where all detected sites are in the same group according to the post hoc test. In this scenario, the ANOVA test has indicated that there is a difference between some of the sites, but the post hoc test cannot determine which sites are different. This is typically because insufficient data are available to determine which sites are different and is most likely to occur when minor differences between sites occur.

It is worth noting that Scenarios 1 through 4 presented in **Figure 3-1** represent hypothetical test results that may indicate some or all of the mound sites are leaching a parameter into the marine environment at a rate sufficient to accumulate in biological organisms. Scenarios like this should be carefully screened for when considering the results presented in **Table 3-24**.

Hypothetical Post Hoc Scenarios	SR	DR	HI	HA	HE	HO
Scenario 1						
Scenario 2						
Scenario 3						
Scenario 4						
Scenario 5						

Figure 3-1. Examples of potential scenarios for post hoc tests results shown in **Table 3-24**.

The majority of parameters where differences among sites were detected (**Table 3-24**) are metals. The only parameter detected in both studies was barium. However, no clear pattern of site groupings can be seen for barium when comparing the two studies. In 2003, the highest concentrations were identified in the Shallow Reference site. However, no barium was detected at the Shallow Reference site in 2023. In 2003 the lowest concentrations were detected at Hilda, which was significantly different to the Shallow Reference site. In 2023, Hazel had the highest concentration or barium and was statistically significant from the other sites where barium was detected.

Differences in percent lipids between sites were also detected in both studies by ANOVA. However, in 2023, post hoc analysis could not determine which sites differed. In 2003, lipids were highest at Hilda and lowest at the Deep Reference location and Heidi. The Shallow Reference location was not different from any of these sites in 2003. Tests could not be performed for lipids in 2003 at the Hazel and Hope mounds because only two samples were returned from these locations, which is an insufficient replicate number for statistical testing.

The reference stations occurred in the highest ranked and lowest ranked groups approximately an equal number of times; 10 times in the highest ranked groups and 11 times in the lowest ranked groups collectively. The mounds occurred in the lower ranked groups more often than the higher ranked groups; 12 times in the highest ranked groups and 21 times in the lowest ranked groups, respectively. In other words, while reference stations were equally likely to be in low or high ranked groups, mounds were more likely to be in a lower ranked group. Lower ranked groups are the groups of sites with lower concentrations than other sites. This is illustrated by the larger number of blue colors compared to orange colors for the mound sites in **Table 3-24**.

Based on the pattern of test results shown in **Table 3-24**, there is no indication that concentrations of parameters in mussel tissues are elevated at mounds compared to reference locations.

Table 3-24. Parameters with statistically significant differences between sites based on ANOVA testing. The results of post hoc analyses based on a Tukey test are also shown. See text and **Figure 3-1** for explanation of post hoc testing presentation.

Parameter	Year	ANOVA p-value	Sites Detected	SR	DR	HI	HA	HE	HO
Metals									
Aluminum	2003	0.004	SR HI DR HE						
Arsenic	2023	0.01	HI HA DR HE HO						
Barium	2003	0.02	SR HI DR HE						
	2023	0.0002	HI HA DR HE HO						
Cadmium	2023	0.00006	HI HA DR HE HO						
Cobalt	2023	0.0003	HI HA DR HE HO						
Copper	2023	0.005	HI HA DR HE HO						
Iron	2003	0.002	SR HI DR HE						
Lead	2003	0.0005	SR HI DR HE						
Mercury	2003	0.0005	SR HI DR HE						
Molybdenum	2003	0.00001	SR HI DR HE						
Selenium	2023	0.009	HI HA DR HE HO						
Thallium	2003	0.01	SR HI DR HE						
Zinc	2003	0.03	SR HI DR HE						
Chlorinated Pesticides									
4,4'-DDE	2023	0.05	HI HA DR HE HO						
PCB Congeners									
PCB 183	2003	0.04	SR HI DR HE						
PAH									
Fluoranthene	2003	0.03	SR HI DR HE						
Pyrene	2003	0.01	SR HI DR HE						
Mussel Growth									
Percent Lipids	2003	0.02	SR HI DR HE						
Percent Lipids	2023	0.04	HI HA DR HE HO						
Percent Solids	2023	0.004	HI HA DR HE HO						

4.0 Summary

The successful recovery of live mussels deployed at the mounds in both 2003 and 2023 is evidence of the resilience of these marine organisms to survive seemingly hostile conditions and warrants their use as bioaccumulation surrogates for a range of *in situ* experimental and monitoring applications. In both studies, live mussels were harvested from largely favorable environments for these organisms and placed in a seemingly hostile environment where they survived for 8 weeks and appeared to maintain good body condition, as evidenced by analyses of solids and lipids in tissue. The 2003 study harvested mussels from the jackets of the oil platform Emmy, where mussels and many other organisms were established largely in clear open water well above the sometimes turbid, sedimentary seafloor. Similarly, mussels for the 2023 study were harvested from strung rope aquaculture, also established in clear open water well above the seafloor. Based on diver-reported conditions in several of the reviewed studies, evidence from the ROV survey conducted in 2022, and a well-founded experience of outer shelf seafloor conditions in general, the environment these mussels were placed in during the study is likely to be considerably darker and more turbid than their natal growing habitat. Despite these conditions, the animals thrived.

The objective of the study was to determine whether the mounds, which contain numerous toxic substances based on core samples taken in prior studies, could be leaching these substances to the overlying water column such that organisms might accumulate them in their tissues. As in the 2003 study completed by SAIC, the results presented here did not identify any convincing evidence that the 4H Shell Mounds are leaching toxic substances into the environment sufficient to bioaccumulate in mussel tissues. Where significant differences between the start and end of the study were detected for PAHs, the tissue concentrations had actually declined over the course of both studies. In other words, less PAHs were found in mussel tissues after they were deployed at the mound and reference sites when compared to their condition in their open water natal habitat. Several metals increased in concentration; however, results were not consistent, with several metals showing declines and many showing no difference between the beginning and end of the study.

Comparisons between studies in the concentrations of parameters accumulating in mussel tissues provided an opportunity to determine whether the containment of the mound contaminants may have declined in the intervening 20 years between studies. The toxic contaminants within the mounds are encased in a layer of shell hash and sediment that has accumulated since the wells were first drilled and the contaminants were deposited on the seafloor with the drilling muds. Although a handful of parameters had increased concentrations in mussel tissues in 2023 compared to 2003, that majority of parameters tested were either not detected, not different between the years, or the results indicated that changes were similar at reference locations, indicating the changes were likely regional differences rather than a result of leaching from the mounds. Most promising for mound stability were the indications that, for certain groups like the PCB congeners, concentrations had declined in the 20 years between tests at both the mounds and the reference sites suggesting that maybe background levels of these contaminants may be declining throughout the region. However, this is a relatively small study and it would be improper to generalize these data to the broader region.

Just one parameter; the PAH Napthalene, showed an increase in concentration in 2023 compared to 2003. It is possible that the identification of this result is a consequence of testing a large number of parameters. The repeated use of statistical tests that essentially rely on an underlying probability distribution to determine if an estimate is ‘likely’ to be true increases the possibility that eventually the testing will detect a difference that may not be correct. This is more likely if sample sizes are not large, such as in this study. Furthermore, the low concentrations of many parameters detected relative to the MDL for the tests means that estimates may be further subject to large errors. Statistical testing done in this way can lead to Type I errors, where a significant difference is falsely determined when it may just be due to random chance. To counteract this inherent flaw, the assessment of results based on this study design must rely on a ‘weight of evidence approach’ (Phillips et al 2006), which views the repeated examination of many likely contaminants known to occur within the mounds. Therefore, one parameter out of many parameters tested showing a possible increase in concentration is a poor indication that the mounds are in some way deteriorating. The weight of evidence suggests the mounds have not changed with respect to their potential to leach metals and other contaminants in the intervening 20 years since the 2003 study was completed.

The final suite of tests considered whether the mounds differed from the reference locations during either study. Post-hoc testing of parameters where differences were found did not identify a consistent pattern indicating the mounds were consistently producing higher concentrations of contaminants than the reference locations. Very few parameters tested indicated differences between sites within the years, and those that did showed no consistent pattern. These two repeated studies are fundamentally concerned with detecting consistent patterns of increased toxic substances at the mounds that are not found at reference locations. This study has found no such evidence that parameters are elevated at the mounds in comparison to reference locations, nor that significant changes in contaminant release has occurred in the 20 years period since the initial testing was completed.

5.0 Literature Cited

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Appendix A

2003 Study Data

BATTELLE MARINE SCIENCES LABORATORY
1529 W. Sequim Bay Road
Sequim, WA 98382
(360) 681-4564

SAIC - CHEVRON 4H SHELL MOUNDS
METALS IN TISSUE SAMPLES
Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	COLLECTION DATE	Percent Solids	Ag	Al	As	Ba	Be
				Analytical Batch ID:	*050103-5000a*	*050103-5000a*	*050103-5000a*	*050103-5000a*	*050103-5000a*
				Instrument:	*ICP-MS*	*ICP-MS*	*ICP-MS*	*ICP-MS*	*ICP-MS*
2011-1	T1720	4H-HI-21	04/22/03	18.6	0.0445 U	115	9.93	1.43	0.0502 J
2011-2	T1721	4H-HI-07	04/22/03	18.2	0.0445 U	120	10.6	1.69	0.0506 J
2011-3 r1	T1722	4H-HA-10	04/22/03	19.1	0.0457 J	168	10.7	2.40	0.0362 J
2011-3 r2	T1722	4H-HA-10	04/22/03	19.1	0.0445 U	166	10.9	1.88	0.0289 J
2011-4	T1723	4H-HI-05	04/22/03	18.4	0.0445 U	125	10.8	1.56	0.0359 J
2011-5	T1724	4H-SR-18	04/22/03	18.8	0.0445 U	179	11.1	2.25	0.0489 J
2011-6	T1725	4H-SR-22	04/22/03	18.0	0.0445 U	209	10.7	2.58	0.0447 J
2011-7 r1	T1726	4H-SR-01	04/22/03	19.7	0.0445 U	165	11.8	2.33	0.0663
2011-7 r2	T1726	4H-SR-01	04/22/03	19.7	0.0445 U	165	11.1	2.28	0.0668
2011-8	T1727	4H-HA-13	04/22/03	18.5	0.0492 J	226	10.3	2.40	0.0267 J
2011-9	T1728	4H-HO-15	04/24/03	17.3	0.0445 U	183	10.5	1.78	0.0286 J
2011-10	T1729	4H-HO-11	04/24/03	18.4	0.0445 U	192	11.6	2.65	0.0402 J
2011-11	T1730	4H-DR-14	04/24/03	17.8	0.0445 U	225	11.1	2.16	0.0548 J
2011-12	T1731	4H-DR-23	04/24/03	17.5	0.0445 U	277	11.2	2.40	0.0326 J
2011-13	T1732	4H-HE-19	04/24/03	18.1	0.0445 U	147	10.4	1.79	0.0543 J
2011-14	T1733	4H-DR-08	04/24/03	18.1	0.0445 U	207	11.3	1.89	0.0488 J
2011-15	T1735	4H-HE-17	04/24/03	17.9	0.0445 U	219	10.8	2.69	0.0623
2011-16	T1736	4H-HE-06	04/24/03	16.8	0.0445 U	186	10.6	2.44	0.0432 J
2011-17	T1757	4H-TO-20	02/21/03	20.6	0.0445 U	97.9	8.00	0.794	0.0482 J
2011-18	T1758	4H-TO-03	02/21/03	21.2	0.0445 U	98.1	7.97	0.802	0.0320 J
2011-19	T1759	4H-TO-12	02/21/03	20.6	0.0445 U	86.5	7.57	0.683	0.0416 J
			Mean % Solids	*18.7*					
Target Detection Limits (WET Wt)					0.05	1	1	0.1	0.1
Target Detection Limits (DRY Wt) [(1)]					0.268	5.35	5.35	0.535	0.535
Achieved Detection Limits (Wet Wt) [(1)]					0.00831	0.0204	0.0372	0.00132	0.00351
Achieved Detection Limits (DRY Wt) [(2)]					**0.0445**	**0.109**	**0.199**	**0.00706**	**0.0188**
Reporting Limit (RL) [(3)]					**0.14**	**0.35**	**0.63**	**0.022**	**0.060**

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SAIC - CHEVRON 4H SHELL MOUNDS
METALS IN TISSUE SAMPLES
Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	COLLECTION DATE	Percent Solids	Ag	Al	As	Ba	Be
				Analytical Batch ID:	*050103-5000a*	*050103-5000a*	*050103-5000a*	*050103-5000a*	*050103-5000a*
				Instrument:	*ICP-MS*	*ICP-MS*	*ICP-MS*	*ICP-MS*	*ICP-MS*
Procedural Blanks									
Blank	Blank (1)				0.0445 U	0.122 J	0.199 U	0.0152 J	0.0666
Blank Spike Results									
Blank	Blank (1)				0.0445 U	0.122 J	0.199 U	0.0152 J	0.0666
BS	BS (1)				1.08	116	26.9	1.07	1.21
		Spiking Level			1	100	25	1	1
		% Recovery BS (1)			**108%**	**116%**	**108%**	**105%**	**114%**
Matrix Spike Results									
2011-17	T1757	4H-TO-20	02/21/03	20.6	0.0445 U	97.9	8.00	0.794	0.0482 J
2011-17 MS	T1757	4H-TO-20	02/21/03	79.4	0.975	181	30.6	1.81	1.10
2011-17 MSD	T1757	4H-TO-20	02/21/03	79.4	0.983	205	35	1.78	1.18
		MS Spiking Level			0.98	100	25	0.98	0.98
		MSD Spiking Level			0.98	100	25	0.98	0.98
		% Recovery MS			**99%**	**83%**	**91%**	**104%**	**107%**
		% Recovery MSD			**100%**	**107%**	**108%**	**101%**	**115%**
		RPD			**1%**	**25%**	**17%**	**3%**	**7%**
REPLICATE ANALYSIS RESULTS									
2011-3 r1	T1722	4H-HA-10	04/22/03	19.1	0.0457 J	168	10.7	2.40	0.0362 J
2011-3 r2	T1722	4H-HA-10	04/22/03	19.1	0.0445 U	166	10.9	1.88	0.0289 J
Mean	*T1722*	*4H-HA-10*	*04/22/03*	*19.1*	NA	167	10.8	2.14	0.0326
		RPD				**1%**	**2%**	**24%**	**22%**

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Samples Received: (04/26/03)
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MSL Code	BOS Code	Client Code	COLLECTION DATE	Percent Solids	Ag	Al	As	Ba	Be
				Analytical Batch ID:	*050103-5000a*	*050103-5000a*	*050103-5000a*	*050103-5000a*	*050103-5000a*
				Instrument:	*ICP-MS*	*ICP-MS*	*ICP-MS*	*ICP-MS*	*ICP-MS*
REPLICATE ANALYSIS RESULTS, Cont.									
2011-7 r1	T1726	4H-SR-01	04/22/03	19.7	0.0445 U	165	11.8	2.33	0.0663
2011-7 r2	T1726	4H-SR-01	04/22/03	19.7	0.0445 U	165	11.1	2.28	0.0668
Mean	*T1726*	*4H-SR-01*	*04/22/03*	*19.7*	NA	165	11.5	2.31	0.0666
		RPD				**0%**	**6%**	**2%**	**1%**
STANDARD REFERENCE MATERIAL									
DORM-2	SRM (1)					10.1	17.8		
		Certified Value			NR	10.9	18	NC	NC
		Range				±1.70	±1.10		
		PD DORM-2				**7%**	**1%**		
1566b	SRM (2)				0.637	162	7.61	7.81	
		Certified Value			0.666	197.2	7.65	*8.6*	NC
		Range			±0.01	±6.00	±0.65	±0.30	
		PD 1566b			**4%**	**18%**	**1%**	**9%**	
INSTRUMENT CHECK SAMPLE (µg/L)									
1640 Direct -1	SRM (3)				7.70	54.0	28.9	152	40.0
1640 Direct -2	SRM (4)				7.68	56.3	29.1	154	40.1
		Certified Value			7.62	52.0	26.67	148	34.94
		PD 1640 Direct -1			**1%**	**4%**	**8%**	**3%**	**14%**
		PD 1640 Direct -2			**1%**	**8%**	**9%**	**4%**	**15%**

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SAIC - CHEVRON 4H SHELL MOUNDS
METALS IN TISSUE SAMPLES
Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	COLLECTION DATE	Percent Solids	Ag	Al	As	Ba	Be
				Analytical Batch ID:	*050103-5000a*	*050103-5000a*	*050103-5000a*	*050103-5000a*	*050103-5000a*
				Instrument:	*ICP-MS*	*ICP-MS*	*ICP-MS*	*ICP-MS*	*ICP-MS*

(1) Target MDL converted to dry weight using the average percent solids
(2) Achieved detection limits reported from the 2003 Tissue MDL Study
(3) Reporting limit defined as 3.18 * MDL defines the upper limit of the J flag
U Analyte not detected at or above the achieved MDL, MDL reported
J Analyte detected above the achieved MDL, but below the RL
& QC value exceeds accuracy or precision criteria goal: spike accuracy ± 25% recovery; replicate precision ≤25% (RPD); SRM accuracy ≤20% (PD)
NC Analyte not certified in the SRM
NR SRM certified less than the RL, QC data not reported.
NA Not applicable

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SAIC - CHEVRON 4H SHELL MOUNDS
METALS IN TISSUE SAMPLES
Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	Cd	Co	Cr	Cu	Fe	Hg	Mo
			050103-5000a ICP-MS	*050103-5000a ICP-MS*	*T050503A GFAA*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050703HGB2 CVAA*	*050103-5000a ICP-MS*
2011-1	T1720	4H-HI-21	7.98	0.657	1.58	6.01	161	0.0486	3.21
2011-2	T1721	4H-HI-07	7.97	0.748	3.07	6.12	176	0.0533	4.51
2011-3 r1	T1722	4H-HA-10	7.63	0.623	2.43	6.21	195	0.0453	4.05
2011-3 r2	T1722	4H-HA-10	7.50	0.603	2.46	6.16	196	0.0478	3.93
2011-4	T1723	4H-HI-05	9.14	0.677	3.10	6.25	172	0.0554	3.56
2011-5	T1724	4H-SR-18	7.40	0.661	2.42	5.90	228	0.0556	10.7
2011-6	T1725	4H-SR-22	6.60	0.661	3.43	5.76	250	0.0556	9.60
2011-7 r1	T1726	4H-SR-01	7.21	0.669	1.99	6.18	216	0.0540	11.1
2011-7 r2	T1726	4H-SR-01	6.99	0.657	1.91	5.98	211	0.0547	10.9
2011-8	T1727	4H-HA-13	6.72	0.666	2.94	5.96	239	0.0579	3.66
2011-9	T1728	4H-HO-15	6.42	0.551	3.63	5.94	210	0.0662	4.02
2011-10	T1729	4H-HO-11	7.56	0.639	4.54	6.22	221	0.0700	4.28
2011-11	T1730	4H-DR-14	7.35	0.701	4.12	5.86	272	0.0739	5.54
2011-12	T1731	4H-DR-23	6.89	0.634	3.96	5.49	308	0.0741	5.26
2011-13	T1732	4H-HE-19	6.97	0.552	3.40	5.86	185	0.0612	4.07
2011-14	T1733	4H-DR-08	5.88	0.596	3.30	5.93	240	0.0664	4.68
2011-15	T1735	4H-HE-17	7.13	0.644	3.25	5.81	234	0.0576	4.61
2011-16	T1736	4H-HE-06	8.76	0.700	4.67	5.67	217	0.0644	5.29
2011-17	T1757	4H-TO-20	1.20	0.325	1.75	4.74	132	0.0499	1.00
2011-18	T1758	4H-TO-03	1.00	0.355	1.74	5.07	130	0.0520	1.19
2011-19	T1759	4H-TO-12	1.17	0.341	1.54	4.81	124	0.0496	1.03
Target Detection Limits (WET Wt)			0.1	0.1	1	0.5	1	0.02	0.1
Target Detection Limits (DRY Wt) (1)			0.535	0.535	5.35	2.68	5.35	0.107	0.535
Achieved Detection Limits (Wet Wt) (1)			0.00910	0.00424	0.00284	0.0176	0.211	0.000870	0.00362
Achieved Detection Limits (DRY Wt) (2)			**0.0487**	**0.0227**	**0.0152**	**0.0940**	**1.13**	**0.00466**	**0.0194**
Reporting Limit (RL) (3)			**0.15**	**0.072**	**0.048**	**0.30**	**3.6**	**0.015**	**0.062**

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METALS IN TISSUE SAMPLES
Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	Cd	Co	Cr	Cu	Fe	Hg	Mo
			050103-5000a ICP-MS	*050103-5000a ICP-MS*	*T050503A GFAA*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050703HGB2 CVAA*	*050103-5000a ICP-MS*
Procedural Blanks									
Blank	Blank (1)		0.0487 U	0.0227 U	0.0584	0.0940 U	2.22 J	0.00466 U	0.0194 U
Blank Spike Results									
Blank	Blank (1)		0.0487 U	0.0227 U	0.0584	0.0940 U	2.22 J	0.00466 U	0.0194 U
BS	BS (1)		1.05	1.18	1.14	27.9	112	1.03	1.14
		Spiking Level	1	1	1	25	100	1	1
		% Recovery BS (1)	**105%**	**118%**	**108%**	**112%**	**110%**	**103%**	**114%**
Matrix Spike Results									
2011-17	T1757	4H-TO-20	1.20	0.325	1.75	4.74	132	0.0499	1.00
2011-17 MS	T1757	4H-TO-20	2.08	1.41	2.83	26.4	204	1.04	2.07
2011-17 MSD	T1757	4H-TO-20	2.13	1.43	2.80	30.1	231	1.06	2.05
		MS Spiking Level	0.98	0.98	0.98	25	100	0.98	0.98
		MSD Spiking Level	0.98	0.98	0.98	25	100	1.0	0.98
		% Recovery MS	**90%**	**111%**	**110%**	**87%**	**72% &**	**101%**	**109%**
		% Recovery MSD	**95%**	**113%**	**107%**	**101%**	**99%**	**101%**	**107%**
		RPD	**6%**	**2%**	**2%**	**15%**	**32% &**	**1%**	**2%**
REPLICATE ANALYSIS RESULTS									
2011-3 r1	T1722	4H-HA-10	7.63	0.623	2.43	6.21	195	0.0453	4.05
2011-3 r2	T1722	4H-HA-10	7.50	0.603	2.46	6.16	196	0.0478	3.93
Mean	*T1722*	*4H-HA-10*	7.57	0.613	2.44	6.19	196	0.0465	3.99
		RPD	**2%**	**3%**	**1%**	**1%**	**1%**	**6%**	**3%**

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METALS IN TISSUE SAMPLES
Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	Cd	Co	Cr	Cu	Fe	Hg	Mo
			050103-5000a ICP-MS	*050103-5000a ICP-MS*	*T050503A GFAA*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050703HGB2 CVAA*	*050103-5000a ICP-MS*
REPLICATE ANALYSIS RESULTS, Cont.									
2011-7 r1	T1726	4H-SR-01	7.21	0.669	1.99	6.18	216	0.0540	11.1
2011-7 r2	T1726	4H-SR-01	6.99	0.657	1.91	5.98	211	0.0547	10.9
Mean	*T1726*	*4H-SR-01*	7.10	0.663	1.95	6.08	213.5	0.0543	11.0
		RPD	**3%**	**2%**	**4%**	**3%**	**2%**	**1%**	**2%**
STANDARD REFERENCE MATERIAL									
DORM-2	SRM (1)			0.203	35.2	2.23	155	4.35	
		Certified Value	NR	0.182	34.7	2.34	142	4.64	NC
		Range		±0.03	±5.50	±0.16	±10	±0.26	
		PD DORM-2		**12%**	**1%**	**5%**	**9%**	**6%**	
1566b	SRM (2)		2.37	0.359		66.1	192	0.0341	
		Certified Value	2.48	0.371	NC	71.6	205.8	0.0371	NC
		Range	±0.08	±0.01		±1.6	±6.80	±0.001	
		PD 1566b	**4%**	**3%**		**8%**	**7%**	**8%**	
INSTRUMENT CHECK SAMPLE (µg/L)									
1640 Direct -1	SRM (3)		24.3	21.6	NA	88.8	56.9		49.1
1640 Direct -2	SRM (4)		24.2	21.6	NA	88.5	51.7		49.1
		Certified Value	22.79	20.28		85.2	34.3	NC	46.75
		PD 1640 Direct -1	**7%**	**7%**		**4%**	**66% &**		**5%**
		PD 1640 Direct -2	**6%**	**7%**		**4%**	**51% &**		**5%**

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Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	Cd	Co	Cr	Cu	Fe	Hg	Mo
			050103-5000a ICP-MS	*050103-5000a ICP-MS*	*T050503A GFAA*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050703HGB2 CVAA*	*050103-5000a ICP-MS*

(1) Target MDL converted to dry weight using the average percent solids
(2) Achieved detection limits reported from the 2003 Tissue MDL Study
(3) Reporting limit defined as 3.18 * MDL defines the upper limit of the J flag
U Analyte not detected at or above the achieved MDL, MDL reported
J Analyte detected above the achieved MDL, but below the RL
& QC value exceeds accuracy or precision criteria goal: spike accuracy ± 25% recovery; replicate precision ≤25% (RPD); SRM accuracy ≤20% (PD)
NC Analyte not certified in the SRM
NR SRM certified less than the RL, QC data not reported.
NA Not applicable

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METALS IN TISSUE SAMPLES
Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	Ni	Pb	Sb	Se	Tl	V	Zn
			050103-5000a ICP-MS	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*
2011-1	T1720	4H-HI-21	1.57	0.494	0.0255 J	6.64	0.0438 J	0.849 J	118
2011-2	T1721	4H-HI-07	2.01	0.509	0.0272 J	7.96	0.0490 J	1.82	137
2011-3 r1	T1722	4H-HA-10	1.54	0.538	0.0221 J	6.83	0.0453 J	1.03	121
2011-3 r2	T1722	4H-HA-10	1.49	0.520	0.0203 J	7.05	0.0456 J	1.15	119
2011-4	T1723	4H-HI-05	1.61	0.492	0.0279 J	7.40	0.0470 J	0.897	128
2011-5	T1724	4H-SR-18	1.79	0.637	0.0254 J	7.83	0.0408 J	1.87	126
2011-6	T1725	4H-SR-22	1.77	0.605	0.0272 J	7.68	0.0384 J	1.55	126
2011-7 r1	T1726	4H-SR-01	1.77	0.594	0.0189 U	7.44	0.0451 J	1.55	116
2011-7 r2	T1726	4H-SR-01	1.70	0.588	0.0189 U	7.67	0.0421 J	1.58	115
2011-8	T1727	4H-HA-13	1.59	0.599	0.0236 J	7.18	0.0470 J	1.07	115
2011-9	T1728	4H-HO-15	1.45	0.671	0.0231 J	8.29	0.0334 J	0.778 J	148
2011-10	T1729	4H-HO-11	1.70	0.635	0.0265 J	8.58	0.0389 J	0.980	144
2011-11	T1730	4H-DR-14	1.89	0.755	0.0277 J	8.54	0.0380 J	1.33	147
2011-12	T1731	4H-DR-23	1.78	0.689	0.0468 J	9.20	0.0419 J	1.72	147
2011-13	T1732	4H-HE-19	1.30	0.580	0.0266 J	7.58	0.0396 J	0.847 J	130
2011-14	T1733	4H-DR-08	1.62	0.660	0.0261 J	8.27	0.0362 J	1.21	142
2011-15	T1735	4H-HE-17	1.77	0.616	0.0229 J	8.49	0.0369 J	1.08	143
2011-16	T1736	4H-HE-06	1.68	0.590	0.0234 J	8.79	0.0415 J	1.19	148
2011-17	T1757	4H-TO-20	0.895	0.848	0.0241 J	5.31	0.0177 U	0.367 J	121
2011-18	T1758	4H-TO-03	0.968	1.29	0.0235 J	5.82	0.0241 J	0.468 J	119
2011-19	T1759	4H-TO-12	0.919	0.816	0.0212 J	5.55	0.0177 U	0.636 J	120
Target Detection Limits (WET Wt)			0.5	0.5	0.1	0.5	0.1	0.5	0.5
Target Detection Limits (DRY Wt) (1)			2.68	2.68	0.535	2.68	0.535	2.68	2.68
Achieved Detection Limits (Wet Wt) (1)			0.00835	0.00631	0.00353	0.0932	0.00331	0.0499	0.175
Achieved Detection Limits (DRY Wt) (2)			**0.0447**	**0.0338**	**0.0189**	**0.499**	**0.0177**	**0.267**	**0.938**
Reporting Limit (RL) (3)			**0.14**	**0.11**	**0.060**	**1.6**	**0.056**	**0.85**	**3.0**

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METALS IN TISSUE SAMPLES
Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	Ni	Pb	Sb	Se	Tl	V	Zn
			050103-5000a ICP-MS	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*
Procedural Blanks									
Blank	Blank (1)		0.0447 U	0.0338 U	0.0211 J	0.907 J	0.0177 U	0.267 U	0.938 U
Blank Spike Results									
Blank	Blank (1)		0.0447 U	0.0338 U	0.0211 J	0.907 J	0.0177 U	0.267 U	0.938 U
BS	BS (1)		1.20	1.05	1.04	25.7	1.01	27.8	106
		Spiking Level	1	1	1	25	1	25	100
		% Recovery BS (1)	**120%**	**105%**	**102%**	**99%**	**101%**	**111%**	**106%**
Matrix Spike Results									
2011-17	T1757	4H-TO-20	0.895	0.848	0.0241 J	5.31	0.0177 U	0.367 J	121
2011-17 MS	T1757	4H-TO-20	1.92	1.78	0.988	26.8	1.00	24.6	190
2011-17 MSD	T1757	4H-TO-20	1.92	1.76	0.993	31.7	0.996	28.4	219
		MS Spiking Level	0.98	0.98	0.98	25	0.98	25	100
		MSD Spiking Level	0.98	0.98	0.98	25	0.98	25	100
		% Recovery MS	**105%**	**95%**	**98%**	**86%**	**102%**	**97%**	**69% &**
		% Recovery MSD	**105%**	**93%**	**99%**	**106%**	**102%**	**112%**	**98%**
		RPD	**0%**	**2%**	**1%**	**20%**	**0%**	**15%**	**35% &**
REPLICATE ANALYSIS RESULTS									
2011-3 r1	T1722	4H-HA-10	1.54	0.538	0.0221 J	6.83	0.0453 J	1.03	121
2011-3 r2	T1722	4H-HA-10	1.49	0.520	0.0203 J	7.05	0.0456 J	1.15	119
Mean	*T1722*	*4H-HA-10*	1.52	0.529	0.0212	6.94	0.04545	1.09	120
		RPD	**3%**	**3%**	**8%**	**3%**	**1%**	**11%**	**2%**

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METALS IN TISSUE SAMPLES
Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	Ni	Pb	Sb	Se	Tl	V	Zn
			050103-5000a ICP-MS	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*
REPLICATE ANALYSIS RESULTS, Cont.									
2011-7 r1	T1726	4H-SR-01	1.77	0.594	0.0189 U	7.44	0.0451 J	1.55	116
2011-7 r2	T1726	4H-SR-01	1.70	0.588	0.0189 U	7.67	0.0421 J	1.58	115
Mean	*T1726*	*4H-SR-01*	1.74	0.591	NA	7.56	0.0436	1.565	116
		RPD	**4%**	**1%**		**3%**	**7%**	**2%**	**1%**
STANDARD REFERENCE MATERIAL									
DORM-2	SRM (1)		18.8	0.0616		1.30			23.6
		Certified Value	19.4	0.065	NC	1.4	NC	NC	25.6
		Range	±3.10	±0.007		±0.09			±2.30
		PD DORM-2	**3%**	**5%**		**7%**			**8%**
1566b	SRM (2)		0.981	0.283		1.99			1280
		Certified Value	1.04	0.308	NC	2.06	NC	NR	1424
		Range	±0.09	±0.009		±0.15			±46
		PD 1566b	**6%**	**8%**		**3%**			**10%**
INSTRUMENT CHECK SAMPLE (µg/L)									
1640 Direct -1	SRM (3)		28.3	27.8	14.3	26.4		13.8	60.4
1640 Direct -2	SRM (4)		28.4	29.2	14.0	25.4		14.1	59.8
		Certified Value	27.4	27.89	13.79	21.96	NC	12.99	53.2
		PD 1640 Direct -1	**3%**	**0%**	**4%**	**20%**		**6%**	**14%**
		PD 1640 Direct -2	**4%**	**5%**	**2%**	**16%**		**9%**	**12%**

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Samples Received: (04/26/03)
(concentrations in µg/g DRY WT - not blank corrected)

MSL Code	BOS Code	Client Code	Ni	Pb	Sb	Se	Tl	V	Zn
			050103-5000a ICP-MS	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*	*050103-5000a ICP-MS*

(1) Target MDL converted to dry weight using the average percent solids
(2) Achieved detection limits reported from the 2003 Tissue MDL Study
(3) Reporting limit defined as 3.18 * MDL defines the upper limit of the J flag
U Analyte not detected at or above the achieved MDL, MDL reported
J Analyte detected above the achieved MDL, but below the RL
& QC value exceeds accuracy or precision criteria goal: spike accuracy ± 25% recovery; replicate precision ≤25% (RPD); SRM accuracy ≤20% (PD)
NC Analyte not certified in the SRM
NR SRM certified less than the RL, QC data not reported.
NA Not applicable

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Project Name: California State Land Commission Chevron 4H Shell Mounds Project
Project Number: N005537

Client Sample ID	Procedural Blank	Laboratory Control Sample	SRM 1974a	SRM 1974a	4H-HI-21
Battelle Sample ID	BC253PB-ECD	BC254LCS-ECD	BC255SRM-ECD	BC255SRMD-ECD	T1720-ECD
Battelle Batch ID	03-0377	03-0377	03-0377	03-0377	03-0377
Data File	K1082B.D	K1082C.D	K1044.D	K1045.D	K1046.D
Extraction Date	04/29/03	04/29/03	04/29/03	04/29/03	04/29/03
Acquired Date	05/14/03	05/14/03	05/09/03	05/09/03	05/09/03
Matrix	Tissue	Tissue	Tissue	Tissue	Tissue
Sample Size (wet) (g)	30	1	3.27	3.95	32.58
Dilution Factor	1.667	1.667	1.667	1.667	1.724
PIV (mL)	0.25	0.25	0.25	0.25	0.25
Min Reporting Limit	0.07	2.08	0.64	0.53	0.07
Lipid weight(wet)(g/g)	NA	NA	NA	NA	0.02
Amount Units	ng/g	ng/g	ng/g	ng/g	ng/g
Naphthalene	0.91 B	579.10	6.16	5.12	0.74 B
C1-Naphthalenes	0.22	1.43 U	0.44 U	0.36 U	0.22 B
C2-Naphthalenes	0.05 U	1.43 U	0.44 U	0.36 U	0.05 U
C3-Naphthalenes	0.05 U	1.43 U	0.44 U	0.36 U	0.05 U
C4-Naphthalenes	0.05 U	1.43 U	0.44 U	0.36 U	0.05 U
2-Methylnaphthalene	0.26 B	667.03	1.57	1.35	0.29 B
1-Methylnaphthalene	0.17 B	604.10	0.83 B	0.61 B	0.21 B
2,6-Dimethylnaphthalene	0.04 U	659.23	0.86	0.68	0.04 U
2,3,5-Trimethylnaphthalene	0.03 U	714.44	0.48 J	0.41 J	0.03 U
Biphenyl	0.24 B	660.18	1.62	1.36	0.23 B
Acenaphthylene	0.03 U	742.82	1.04	0.80	0.02 U
Acenaphthene	0.04 U	644.90	2.79	2.75	0.04 U
Fluorene	0.03 U	726.00	0.60 J	0.46 J	0.68
C1-Fluorenes	0.03 U	0.95 U	0.29 U	0.24 U	0.03 U
C2-Fluorenes	0.03 U	0.95 U	0.29 U	0.24 U	0.03 U
C3-Fluorenes	0.03 U	0.95 U	0.29 U	0.24 U	0.03 U
Phenanthrene	0.09	791.46	2.20	1.81	0.38 B
Anthracene	0.07 U	825.28	1.43	1.26	0.06 U
C1-Phenanthrenes/Anthracenes	0.04 U	1.05 U	0.32 U	0.27 U	0.03 U
C2-Phenanthrenes/Anthracenes	0.04 U	1.05 U	0.32 U	0.27 U	0.03 U
C3-Phenanthrenes/Anthracenes	0.04 U	1.05 U	0.32 U	0.27 U	0.03 U
C4-Phenanthrenes/Anthracenes	0.04 U	1.05 U	0.32 U	0.27 U	0.03 U
1-Methylphenanthrene	0.04 U	890.08	0.86	0.70	0.04 U
Dibenzothiophene	0.12	0.80 U	0.39 JB	0.38 JB	0.03 U
C1-Dibenzothiophenes	0.03 U	0.80 U	0.24 U	0.20 U	0.03 U
C2-Dibenzothiophenes	0.03 U	0.80 U	0.24 U	0.20 U	0.03 U
C3-Dibenzothiophenes	0.03 U	0.80 U	0.24 U	0.20 U	0.03 U
Fluoranthene	0.04 U	961.34	18.25	18.53	0.34
Pyrene	0.03 U	963.68	17.30	17.64	0.37
C1-Fluoranthenes/Pyrenes	0.04 U	1.32 U	0.40 U	0.33 U	0.04 U
C2-Fluoranthenes/Pyrenes	0.04 U	1.32 U	0.40 U	0.33 U	0.04 U
C3-Fluoranthenes/Pyrenes	0.04 U	1.32 U	0.40 U	0.33 U	0.04 U
Benzo(a)anthracene	0.07 U	963.13	3.04	2.87	0.06 U
Chrysene	0.07 U	899.31	8.53	8.35	0.06 U
C1-Chrysenes	0.07 U	2.02 U	0.62 U	0.51 U	0.06 U
C2-Chrysenes	0.07 U	2.02 U	0.62 U	0.51 U	0.06 U
C3-Chrysenes	0.07 U	2.02 U	0.62 U	0.51 U	0.06 U
C4-Chrysenes	0.07 U	2.02 U	0.62 U	0.51 U	0.06 U
Benzo(b)fluoranthene	0.08 U	970.71	4.00	4.01	0.08 U
Benzo(k)fluoranthene	0.05 U	936.42	3.62	3.10	0.05 U
Benzo(e)pyrene	0.08 U	834.98	7.59	7.18	0.08 U
Benzo(a)pyrene	0.07 U	904.06	1.42	1.11	0.07 U
Perylene	0.06 U	780.09	0.85	0.68	0.06 U
Indeno(1,2,3-cd)pyrene	0.05 U	1077.65	0.89	0.84	0.05 U
Dibenz(a,h)anthracene	0.05 U	1050.86	0.32 J	0.29 J	0.04 U
Benzo(g,h,i)perylene	0.04 U	696.34	1.62	1.69	0.04 U
Naphthalene-d8	57	63	51	54	64
Phenanthrene-d10	82	70	77	81	77
Chrysene-d12	105	85	85	90	84

U = Analyte not detected, the sample specific Method Detection Limit (MDL) reported.
J = Analyte detected below the sample specific Reporting Limit (RL).
NA = Not applicable.
n = QC value outside the accuracy or precision data quality objective, but meets contingency criteria.
N = QC value outside the accuracy or precision data quality objective.
B = Analyte concentration found in the sample at a concentration <5x the level found in the procedure blank.

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Project Name California State Land Commission Chevron 4H Shell Mounds Project
Project Number N005537

Client Sample ID	4H-HI-07	4H-HA-10	4H-HI-05	4H-SR-18	4H-SR-22
Battelle Sample ID	T1721-ECD	T1722-ECD	T1723-ECD	T1724-ECD	T1725-ECD
Battelle Batch ID	03-0377	03-0377	03-0377	03-0377	03-0377
Data File	K1047.D	K1048.D	K1050.D	K1051.D	K1052.D
Extraction Date	04/29/03	04/29/03	04/29/03	04/29/03	04/29/03
Acquired Date	05/10/03	05/10/03	05/10/03	05/10/03	05/10/03
Matrix	Tissue	Tissue	Tissue	Tissue	Tissue
Sample Size (wet) (g)	30.05	31.37	31.54	29.19	29.65
Dilution Factor	1.724	1.724	1.724	1.724	1.724
PIV (mL)	0.25	0.25	0.25	0.25	0.25
Min Reporting Limit	0.07	0.07	0.07	0.07	0.07
Lipid weight(wet)(g/g)	0.02	0.02	0.02	0.02	0.01
Amount Units	ng/g	ng/g	ng/g	ng/g	ng/g
Naphthalene	0.75 B	0.62 B	1.10 B	0.86 B	0.73 B
C1-Naphthalenes	0.33 B	0.29 B	0.36 B	0.38 B	0.27 B
C2-Naphthalenes	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
C3-Naphthalenes	0.34	0.36	0.38	0.44	0.37
C4-Naphthalenes	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2-Methylnaphthalene	0.29 B	0.25 B	0.29 B	0.25 B	0.23 B
1-Methylnaphthalene	0.16 B	0.16 B	0.17 B	0.17 B	0.12 B
2,6-Dimethylnaphthalene	0.04 U	0.04 U	0.04 U	0.05 U	0.05 U
2,3,5-Trimethylnaphthalene	0.09	0.07	0.03 U	0.04 U	0.06 J
Biphenyl	0.26 B	0.21 B	0.37 B	0.24 B	0.21 B
Acenaphthylene	0.03 U	0.03 U	0.02 U	0.03 U	0.03 U
Acenaphthene	0.05 U	0.04 U	0.04 U	0.05 U	0.05 U
Fluorene	0.54	0.48	0.66	0.76	0.53
C1-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
C2-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
C3-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Phenanthrene	0.39 B	0.35 B	0.38 B	0.46 B	0.30 B
Anthracene	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
C1-Phenanthrenes/Anthracenes	0.58	0.46	0.52	0.51	0.47
C2-Phenanthrenes/Anthracenes	2.54	2.26	2.57	2.71	2.29
C3-Phenanthrenes/Anthracenes	1.98	2.08	1.93	1.69	1.49
C4-Phenanthrenes/Anthracenes	1.79	2.00	0.03 U	0.04 U	0.78
1-Methylphenanthrene	0.14	0.07	0.10	0.18	0.11
Dibenzothiophene	0.12 B	0.10 B	0.09 B	0.18 B	0.09 B
C1-Dibenzothiophenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
C2-Dibenzothiophenes	1.13	1.04	0.99	0.86	0.66
C3-Dibenzothiophenes	1.77	1.23	0.85	1.20	0.80
Fluoranthene	0.25	0.23	0.24	0.27	0.20
Pyrene	0.32	0.28	0.30	0.33	0.27
C1-Fluoranthenes/Pyrenes	0.05 U	0.04 U	0.04 U	0.05 U	0.05 U
C2-Fluoranthenes/Pyrenes	1.44	0.04 U	1.26	0.05 U	0.86
C3-Fluoranthenes/Pyrenes	2.16	0.04 U	2.73	0.05 U	1.48
Benzo(a)anthracene	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Chrysene	0.39	0.38	0.36	0.34	0.27
C1-Chrysenes	0.46	0.41	0.49	0.30	0.07 U
C2-Chrysenes	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
C3-Chrysenes	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
C4-Chrysenes	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Benzo(b)fluoranthene	0.08 U	0.08 U	0.08 U	0.09 U	0.09 U
Benzo(k)fluoranthene	0.06 U	0.05 U	0.05 U	0.06 U	0.06 U
Benzo(e)pyrene	0.09 U	0.08 U	0.08 U	0.09 U	0.09 U
Benzo(a)pyrene	0.07 U	0.07 U	0.07 U	0.08 U	0.08 U
Perylene	0.06 U	0.06 U	0.06 U	0.07 U	0.07 U
Indeno(1,2,3-cd)pyrene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dibenz(a,h)anthracene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Benzo(g,h,i)perylene	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U

Naphthalene-d8	54	49	56	57	47
Phenanthrene-d10	74	63	71	78	66
Chrysene-d12	81	70	78	84	72

U = Ana U = Analyte not detected, the sample specific Method Detection Limit (MDL) reported.
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NA = N NA = Not applicable.
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N = QC N = QC value outside the accuracy or precision data quality objective.
B = Ana B = Analyte concentration found in the sample at a concentration <5x the level found in the procedure blank.

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Project Name California State Land Commission Chevron 4H Shell Mounds Project
Project Number N005537

Client Sample ID	4H-SR-22	4H-HA-13	4H-SR-01	4H-HO-15	4H-HO-11
Battelle Sample ID	T1725DUP-ECD	T1727-ECD	T1726-ECD	T1728-ECD	T1729-ECD
Battelle Batch ID	03-0377	03-0377	03-0377	03-0377	03-0377
Data File	K1053.D	K1056.D	K1056A.D	K1057.D	K1059A.D
Extraction Date	04/29/03	04/29/03	04/29/03	04/29/03	04/29/03
Acquired Date	05/10/03	05/10/03	05/10/03	05/10/03	05/10/03
Matrix	Tissue	Tissue	Tissue	Tissue	Tissue
Sample Size (wet) (g)	29.76	31.46	30.45	28.65	29.56
Dilution Factor	1.667	1.724	1.724	1.724	1.724
PIV (mL)	0.25	0.25	0.25	0.25	0.25
Min Reporting Limit	0.07	0.07	0.07	0.08	0.07
Lipid weight(wet)(g/g)	0.01	0.02	0.02	0.01	0.02
Amount Units	ng/g	ng/g	ng/g	ng/g	ng/g
Naphthalene	1.32 B	0.59 B	0.73 B	1.00 B	0.65 B
C1-Naphthalenes	0.32 B	0.34 B	0.23 B	0.46 B	0.26 B
C2-Naphthalenes	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
C3-Naphthalenes	0.41	0.41	0.41	0.45	0.43
C4-Naphthalenes	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2-Methylnaphthalene	0.31 B	0.26 B	0.25 B	0.37 B	0.27 B
1-Methylnaphthalene	0.19 B	0.15 B	0.15 B	0.21 B	0.15 B
2,6-Dimethylnaphthalene	0.04 U	0.04 U	0.04 U	0.05 U	0.05 U
2,3,5-Trimethylnaphthalene	0.08	0.08	0.03 U	0.04 U	0.12
Biphenyl	0.39 B	0.15 B	0.19 B	0.31 B	0.15 B
Acenaphthylene	0.03 U	0.02 U	0.03 U	0.03 U	0.03 U
Acenaphthene	0.04 U	0.04 U	0.04 U	0.05 U	0.05 U
Fluorene	0.66	0.54	0.54	0.66	0.46
C1-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
C2-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
C3-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Phenanthrene	0.38 B	0.30 B	0.37 B	0.46 B	0.32 B
Anthracene	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
C1-Phenanthrenes/Anthracenes	0.57	0.52	0.58	0.84	0.73
C2-Phenanthrenes/Anthracenes	2.21	2.58	2.69	2.55	2.50
C3-Phenanthrenes/Anthracenes	1.64	2.51	2.42	1.30	1.50
C4-Phenanthrenes/Anthracenes	0.86	1.51	1.49	0.04 U	0.04 U
1-Methylphenanthrene	0.11	0.09	0.09	0.25	0.21
Dibenzothiophene	0.09 B	0.10 B	0.11 B	0.14 B	0.13 B
C1-Dibenzothiophenes	0.03 U	0.03 U	0.03 U	0.16	0.22
C2-Dibenzothiophenes	0.88	1.22	1.06	0.80	0.97
C3-Dibenzothiophenes	1.03	1.52	1.28	0.85	0.91
Fluoranthene	0.23	0.23	0.28	0.21	0.18
Pyrene	0.34	0.33	0.38	0.24	0.24
C1-Fluoranthenes/Pyrenes	0.04 U	0.04 U	0.04 U	0.05 U	0.05 U
C2-Fluoranthenes/Pyrenes	0.80	1.79	1.13	0.89	1.03
C3-Fluoranthenes/Pyrenes	1.28	1.90	1.34	1.19	0.05 U
Benzo(a)anthracene	0.07 U	0.07 U	0.07 J	0.07 U	0.07 U
Chrysene	0.32	0.41	0.38	0.30	0.29
C1-Chrysenes	0.07 U	0.49	0.37	0.07 U	0.30
C2-Chrysenes	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
C3-Chrysenes	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
C4-Chrysenes	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Benzo(b)fluoranthene	0.08 U	0.08 U	0.08 U	0.09 U	0.09 U
Benzo(k)fluoranthene	0.05 U	0.05 U	0.05 U	0.06 U	0.06 U
Benzo(e)pyrene	0.08 U	0.08 U	0.09 U	0.09 U	0.09 U
Benzo(a)pyrene	0.07 U	0.07 U	0.07 U	0.08 U	0.08 U
Perylene	0.06 U	0.06 U	0.06 U	0.07 U	0.07 U
Indeno(1,2,3-cd)pyrene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dibenz(a,h)anthracene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Benzo(g,h,i)perylene	0.04 U	0.04 U	0.04 U	0.05 U	0.04 U
Naphthalene-d8	66	58	58	46	52
Phenanthrene-d10	75	71	75	73	67
Chrysene-d12	80	76	82	79	73

U = Ana U = Analyte not detected, the sample specific Method Detection Limit (MDL) reported.
J = Ana J = Analyte detected below the sample specific Reporting Limit (RL).
NA = N NA = Not applicable.
n = QC n = QC value outside the accuracy or precision data quality objective, but meets contingency criteria.
N = QC N = QC value outside the accuracy or precision data quality objective.
B = Ana B = Analyte concentration found in the sample at a concentration <5x the level found in the procedure blank.

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Project Name California State Land Commission Chevron 4H Shell Mounds Project
Project Number N005537

Client Sample ID	4H-DR-14	4H-DR-23	4H-HE-19	4H-DR-08	4H-HE-17
Battelle Sample ID	T1730-ECD	T1731-ECD	T1732-ECD	T1733-ECD	T1735-ECD
Battelle Batch ID	03-0377	03-0377	03-0377	03-0377	03-0377
Data File	K1059.D	K1008.D	K1009.D	K1010.D	K1011.D
Extraction Date	04/29/03	04/29/03	04/29/03	04/29/03	04/29/03
Acquired Date	05/11/03	05/06/03	05/06/03	05/06/03	05/06/03
Matrix	Tissue	Tissue	Tissue	Tissue	Tissue
Sample Size (wet) (g)	28.7	29.15	30.97	29.26	28.45
Dilution Factor	1.724	1.724	1.724	1.724	1.724
PIV (mL)	0.25	0.25	0.25	0.25	0.25
Min Reporting Limit	0.08	0.07	0.07	0.07	0.08
Lipid weight(wet)(g/g)	0.01	0.01	0.01	0.01	0.01
Amount Units	ng/g	ng/g	ng/g	ng/g	ng/g
Naphthalene	0.84 B	0.94 B	0.71 B	1.01 B	1.00 B
C1-Naphthalenes	0.26 B	0.33 B	0.20 B	0.28 B	0.35 B
C2-Naphthalenes	0.05 U	0.72	0.60	0.05 U	0.05 U
C3-Naphthalenes	0.38	0.52	0.49	0.53	0.49
C4-Naphthalenes	0.05 U	0.59	0.05 U	0.05 U	0.05 U
2-Methylnaphthalene	0.26 B	0.34 B	0.28 B	0.31 B	0.32 B
1-Methylnaphthalene	0.14 B	0.20 B	0.15 B	0.18 B	0.19 B
2,6-Dimethylnaphthalene	0.05 U	0.16	0.14	0.05 U	0.05 U
2,3,5-Trimethylnaphthalene	0.09	0.12	0.11	0.04 U	0.04 U
Biphenyl	0.23 B	0.27 B	0.17 B	0.28 B	0.25 B
Acenaphthylene	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Acenaphthene	0.05 U	0.05 U	0.04 U	0.05 U	0.05 U
Fluorene	0.46	0.52	0.54	0.53	0.56
C1-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
C2-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
C3-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Phenanthrene	0.38 B	0.43 B	0.31 B	0.04 U	0.51
Anthracene	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
C1-Phenanthrenes/Anthracenes	0.73	0.82	0.67	0.79	0.76
C2-Phenanthrenes/Anthracenes	2.47	2.45	2.14	2.28	2.51
C3-Phenanthrenes/Anthracenes	1.14	1.21	1.41	1.49	1.52
C4-Phenanthrenes/Anthracenes	0.04 U	1.06	0.73	0.87	0.99
1-Methylphenanthrene	0.22	0.19	0.12	0.15	0.11
Dibenzothiophene	0.11 B	0.10 B	0.08 B	0.11 B	0.09 B
C1-Dibenzothiophenes	0.15	0.28	0.15	0.22	0.17
C2-Dibenzothiophenes	0.70	0.97	0.78	1.06	0.86
C3-Dibenzothiophenes	0.49	1.05	0.73	0.93	0.78
Fluoranthene	0.16	0.18	0.19	0.05 U	0.20
Pyrene	0.19	0.22	0.25	0.03 U	0.24
C1-Fluoranthenes/Pyrenes	0.05 U	0.05 U	0.04 U	0.05 U	0.05 U
C2-Fluoranthenes/Pyrenes	0.05 U	0.05 U	0.60	0.05 U	0.05 U
C3-Fluoranthenes/Pyrenes	0.05 U	0.05 U	1.08	0.05 U	0.05 U
Benzo(a)anthracene	0.07 U	0.06 J	0.04 J	0.07 J	0.07 J
Chrysene	0.26	0.26	0.23	0.07 U	0.29
C1-Chrysenes	0.07 U	0.29	0.07 U	0.30	0.07 U
C2-Chrysenes	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
C3-Chrysenes	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
C4-Chrysenes	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Benzo(b)fluoranthene	0.09 U	0.09 U	0.08 U	0.09 U	0.09 U
Benzo(k)fluoranthene	0.06 U	0.06 U	0.05 U	0.06 U	0.06 U
Benzo(e)pyrene	0.09 U	0.09 U	0.08 U	0.09 U	0.09 U
Benzo(a)pyrene	0.08 U	0.08 U	0.07 U	0.08 U	0.08 U
Perylene	0.07 U	0.47	0.06 U	0.48	0.07 U
Indeno(1,2,3-cd)pyrene	0.05 U	0.05 U	0.05 U	0.05 U	0.06 U
Dibenz(a,h)anthracene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Benzo(g,h,i)perylene	0.05 U	0.04 U	0.04 U	0.04 U	0.05 U

Naphthalene-d8	37 N	51	61	53	59
Phenanthrene-d10	57	64	67	67	71
Chrysene-d12	61	72	75	75	80

U = Ana U = Analyte not detected, the sample specific Method Detection Limit (MDL) reported.
J = Ana J = Analyte detected below the sample specific Reporting Limit (RL).
NA = N NA = Not applicable.
n = QC n = QC value outside the accuracy or precision data quality objective, but meets contingency criteria.
N = QC N = QC value outside the accuracy or precision data quality objective.
B = Ana B = Analyte concentration found in the sample at a concentration <5x the level found in the procedure blank.

Battelle
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Project Name California State Land Commission Chevron 4H Shell Mounds Project
Project Number N005537

Client Sample ID	4H-HE-06	4H-T0-20	4H-T0-03	4H-T0-12	Procedural Blank
Battelle Sample ID	T1736-ECD	U7057-ECD	U7058-ECD	U7059-ECD	BC253PB
Battelle Batch ID	03-0377	03-0377	03-0377	03-0377	03-0377
Data File	K1012.D	K1037.D	K1038.D	K1041.D	K0999.D
Extraction Date	04/29/03	04/29/03	04/29/03	04/29/03	04/29/03
Acquired Date	05/07/03	05/09/03	05/09/03	05/09/03	05/06/03
Matrix	Tissue	Tissue	Tissue	Tissue	Tissue
Sample Size (wet) (g)	30.44	30.36	29.13	31.29	30.00
Dilution Factor	1.724	1.724	1.724	1.724	1.667
PIV (mL)	0.25	0.25	0.25	0.25	0.5
Min Reporting Limit	0.07	0.07	0.07	0.07	0.14
Lipid weight(wet)(g/g)	0.01	0.01	0.01	0.01	NA
Amount Units	ng/g	ng/g	ng/g	ng/g	ng/g
Naphthalene	0.83 B	0.82 B	1.49 B	0.58 B	0.11 J
C1-Naphthalenes	0.24 B	0.40 B	0.48 B	0.29 B	0.04 J
C2-Naphthalenes	0.62	0.05 U	0.83	0.73	0.05 U
C3-Naphthalenes	0.52	0.66	0.89	0.74	0.05 U
C4-Naphthalenes	0.05 U	0.05 U	0.85	0.98	0.05 U
2-Methylnaphthalene	0.24 B	0.37 B	0.54 B	0.33 B	0.03 J
1-Methylnaphthalene	0.15 B	0.23 B	0.27 B	0.17 B	0.03 J
2,6-Dimethylnaphthalene	0.15	0.04 U	0.31	0.24	0.04 U
2,3,5-Trimethylnaphthalene	0.13	0.03 U	0.30	0.27	0.03 U
Biphenyl	0.22 B	0.18 B	0.21 B	0.12 B	0.03 U
Acenaphthylene	0.03 U	0.03 U	0.03 U	0.02 U	0.03 U
Acenaphthene	0.04 U	0.05 U	0.05 U	0.04 U	0.04 U
Fluorene	0.61	0.46	0.69	0.64	0.03 U
C1-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
C2-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
C3-Fluorenes	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Phenanthrene	0.43 B	1.02	1.03	0.96	0.04 U
Anthracene	0.07 U	0.31	0.34	0.38	0.07 U
C1-Phenanthrenes/Anthracenes	0.68	1.51	1.38	1.32	0.04 U
C2-Phenanthrenes/Anthracenes	2.32	4.45	4.26	4.25	0.04 U
C3-Phenanthrenes/Anthracenes	1.12	3.23	3.14	3.23	0.04 U
C4-Phenanthrenes/Anthracenes	0.61	0.04 U	1.93	1.85	0.04 U
1-Methylphenanthrene	0.12	0.27	0.26	0.28	0.04 U
Dibenzothiophene	0.10 B	0.20 B	0.17 B	0.18 B	0.03 U
C1-Dibenzothiophenes	0.16	0.33	0.33	0.29	0.03 U
C2-Dibenzothiophenes	0.81	2.97	3.26	4.16	0.03 U
C3-Dibenzothiophenes	0.76	2.14	2.64	2.44	0.03 U
Fluoranthene	0.23	2.34	2.35	2.22	0.04 U
Pyrene	0.25	0.03 U	1.49	1.46	0.03 U
C1-Fluoranthenes/Pyrenes	0.04 U	1.66	1.56	1.66	0.04 U
C2-Fluoranthenes/Pyrenes	0.04 U	1.36	1.65	1.34	0.04 U
C3-Fluoranthenes/Pyrenes	0.04 U	1.23	1.47	0.04 U	0.04 U
Benzo(a)anthracene	0.07 U	0.24	0.35	0.32	0.07 U
Chrysene	0.22	1.54	1.63	1.59	0.07 U
C1-Chrysenes	0.07 U	0.79	0.86	0.94	0.07 U
C2-Chrysenes	0.07 U	0.07 U	1.22	1.60	0.07 U
C3-Chrysenes	0.07 U	0.07 U	0.07 U	0.06 U	0.07 U
C4-Chrysenes	0.07 U	0.07 U	0.07 U	0.06 U	0.07 U
Benzo(b)fluoranthene	0.08 U	0.08 U	0.55	0.57	0.08 U
Benzo(k)fluoranthene	0.05 U	0.05 U	0.39	0.39	0.05 U
Benzo(e)pyrene	0.09 U	0.09 U	0.47	0.65	0.08 U
Benzo(a)pyrene	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Perylene	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U
Indeno(1,2,3-cd)pyrene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dibenz(a,h)anthracene	0.05 U	0.05 U	0.05 U	0.04 U	0.05 U
Benzo(g,h,i)perylene	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Naphthalene-d8	48	55	89	49	76
Phenanthrene-d10	64	73	67	73	66
Chrysene-d12	72	79	73	81	73

U = Ana U = Analyte not detected, the sample specific Method Detection Limit (MDL) reported.
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NA = N NA = Not applicable.
n = QC n = QC value outside the accuracy or precision data quality objective, but meets contingency criteria.
N = QC N = QC value outside the accuracy or precision data quality objective.
B = Ana B = Analyte concentration found in the sample at a concentration <5x the level found in the procedure blank.

Field Sample Data

Battelle
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Project Name: California State Lands Commission Chevron 4H Shell Mounds Project
Project Number: N005537

Client Sample ID:	4H-SR-22	4H-HI-21	4H-HI-07	4H-HA-10
Battelle Sample ID:	T1725	T1720	T1721	T1722
Percent Moisture (%)	82.67	82.03	81.90	81.27
Battelle Batch ID:	03-0377	03-0377	03-0377	03-0377
Lipid Weight (g/g):	0.01	0.02	0.02	0.02
Sample Wet Weight (g):	29.65	32.58	30.05	31.37
Units:	ng/g Wet Wt.	ng/g Wet Wt.	ng/g Wet Wt.	ng/g Wet Wt.
4,4 DDD	0.465	0.544	0.500	0.475
2,4 DDD	0.181	0.218	0.186	0.173
4,4 DDE	2.735 D	4.609 D	3.601 D	3.481 D
2,4 DDE	0.409	0.763	0.648	0.613
4,4 DDT	0.189	0.274	0.208	0.218
2,4 DDT	0.120	0.061	0.102	0.064
a-Chlordane	0.212	0.320	0.245	0.268
g-Chlordane	0.118	0.139	0.106	0.121
cis-nonachlor	0.072	0.079	0.072	0.074
trans-nonachlor	0.146	0.151	0.144	0.154
a-BHC	0.716	1.062	0.733	0.757
b-BHC	0.054 U	0.049 U	0.053 U	0.051 U
d-BHC	0.050 U	0.045 U	0.049 U	0.047 U
g-BHC	0.043 U	0.039 U	0.043 U	0.041 U
Dieldrin	0.054	0.035 U	0.070	0.064
Aldrin	0.038 U	0.035 U	0.038 U	0.036 U
Endosulfan I	0.056 U	0.051 U	0.055 U	0.053 U
Endosulfan II	0.045 U	0.041 U	0.044 U	0.043 U
Endosulfan sulfate	0.064 U	0.059 U	0.053	0.058
Endrin Aldehyde	0.065 U	0.059 U	0.064 U	0.062 U
Endrin	0.039 U	0.036 U	0.039 U	0.037 U
Heptachlor	0.054 U	0.049 U	0.053 U	0.051 U
Heptachlor epoxide	0.038 U	0.034 U	0.037 U	0.036 U
Methoxychlor	0.077 U	0.070 U	0.076 U	0.073 U
Toxaphene	2.907 U	2.646 U	2.869 U	2.748 U
Cl2 08	0.088 U	0.080 U	0.087 U	0.083 U
Cl3 18	0.047 U	0.043 U	0.047 U	0.045 U
Cl3 28	0.063 U	0.058 U	0.063 U	0.060 U
Cl4 44	0.051 U	0.047 U	0.051 U	0.049 U
Cl4 49	0.053 U	0.048 U	0.052 U	0.050 U
Cl4 52	0.044 U	0.040 U	0.044 U	0.042 U
Cl4 66	0.045	0.062	0.043	0.049
Cl5 87	0.034 U	0.031 U	0.116	0.032 U
Cl5 101	0.332	0.606	0.463	0.469
Cl5 105	0.083	0.129	0.117	0.106
Cl5 110	0.094	0.180	0.164	0.138
Cl5 118	0.177	0.345	0.302	0.255
Cl6 128	0.032	0.089	0.056	0.051
Cl6 138	0.345	0.614	0.515	0.293
Cl6 153	0.445	0.655	0.671	0.550
Cl7 170	0.039 U	0.036 U	0.039 U	0.037 U
Cl7 180	0.046 U	0.042 U	0.045 U	0.043 U
Cl7 183	0.032	0.068	0.053	0.048
Cl7 184	0.041 U	0.038 U	0.041 U	0.039 U
Cl7 187	0.165	0.262	0.034 U	0.180
Cl8 195	0.036 U	0.033 U	0.036 U	0.034 U
Cl9 206	0.043 U	0.039 U	0.043 U	0.041 U
Cl10 209	0.045 U	0.041 U	0.044 U	0.042 U
Aroclor 1016	1.454 U	1.323 U	1.434 U	1.374 U
Aroclor 1221	1.454 U	1.323 U	1.434 U	1.374 U
Aroclor 1232	1.454 U	1.323 U	1.434 U	1.374 U
Aroclor 1242	1.454 U	1.323 U	1.434 U	1.374 U
Aroclor 1248	1.454 U	1.323 U	1.434 U	1.374 U
Aroclor 1254	6.242	8.447	6.754	6.669
Aroclor 1260	1.454 U	1.323 U	1.434 U	1.374 U
Surrogate Recoveries:				
Cl3(34)	71	69	73	70
Cl5(112)	58	86	64	62

U - Analyte not detected, ssMDL value inserted.
J - Analyte detected below the ssRL value.
N - QC value outside the accuracy or precision DQO.
D - Result determined from dilution.

Field Sample Data

Battelle
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Project Name: California State Lands Com
Project Number: N005537

Client Sample ID:	4H-HI-05	4H-SR-18	4H-SR-01	4H-HA-13
Battelle Sample ID:	T1723	T1724	T1726	T1727
Percent Moisture (%)	81.85	81.17	80.77	81.43
Battelle Batch ID:	03-0377	03-0377	03-0377	03-0377
Lipid Weight (g/g):	0.02	0.02	0.02	0.02
Sample Wet Weight (g):	31.54	29.19	30.45	31.46
Units:	ng/g Wet Wt.	ng/g Wet Wt.	ng/g Wet Wt.	ng/g Wet Wt.
4,4 DDD	0.504	0.632	0.731	0.558
2,4 DDD	0.202	0.258	0.285	0.195
4,4 DDE	7.017	7.299	3.885 D	4.218 D
2,4 DDE	0.627	0.562	0.769	0.740
4,4 DDT	0.227	0.060 U	0.375	0.322
2,4 DDT	0.072	0.106	0.181	0.094
a-Chlordane	0.294	0.296	0.370	0.329
g-Chlordane	0.095	0.141	0.162	0.129
cis-nonachlor	0.083	0.090	0.086	0.087
trans-nonachlor	0.126	0.178	0.208	0.154
a-BHC	0.788	0.710	0.760	0.692
b-BHC	0.050 U	0.054 U	0.052 U	0.051 U
d-BHC	0.047 U	0.050 U	0.048 U	0.047 U
g-BHC	0.041 U	0.044 U	0.042 U	0.041 U
Dieldrin	0.066	0.074	0.085	0.065
Aldrin	0.036 U	0.039 U	0.037 U	0.036 U
Endosulfan I	0.053 U	0.057 U	0.054 U	0.053 U
Endosulfan II	0.042 U	0.046 U	0.044 U	0.042 U
Endosulfan sulfate	0.076	0.066 U	0.086	0.051
Endrin Aldehyde	0.061 U	0.066 U	0.064 U	0.062 U
Endrin	0.037 U	0.040 U	0.038 U	0.037 U
Heptachlor	0.050 U	0.054 U	0.052 U	0.050 U
Heptachlor epoxide	0.036 U	0.038 U	0.037 U	0.036 U
Methoxychlor	0.072 U	0.078 U	0.075 U	0.073 U
Toxaphene	2.733 U	2.953 U	2.831 U	2.740 U
Cl2 08	0.083 U	0.090 U	0.086 U	0.083 U
Cl3 18	0.045 U	0.048 U	0.046 U	0.045 U
Cl3 28	0.060 U	0.064 U	0.062 U	0.060 U
Cl4 44	0.048 U	0.052 U	0.050 U	0.048 U
Cl4 49	0.050 U	0.054 U	0.051 U	0.050 U
Cl4 52	0.042 U	0.045 U	0.043 U	0.042 U
Cl4 66	0.041	0.052	0.053	0.045
Cl5 87	0.107	0.034 U	0.033 U	0.032 U
Cl5 101	0.530	0.426	0.542	0.567
Cl5 105	0.135	0.122	0.129	0.122
Cl5 110	0.167	0.126	0.144	0.168
Cl5 118	0.293	0.239	0.266	0.344
Cl6 128	0.047	0.037	0.046	0.056
Cl6 138	0.375	0.406	0.061 U	0.600
Cl6 153	0.559	0.609	0.641	0.704
Cl7 170	0.037 U	0.040 U	0.038 U	0.037 U
Cl7 180	0.043 U	0.046 U	0.045 U	0.043 U
Cl7 183	0.020	0.039	0.042	0.037
Cl7 184	0.039 U	0.042 U	0.040 U	0.039 U
Cl7 187	0.206	0.205	0.237	0.201
Cl8 195	0.034 U	0.037 U	0.035 U	0.034 U
Cl9 206	0.041 U	0.044 U	0.042 U	0.041 U
Cl10 209	0.042 U	0.045 U	0.043 U	0.042 U
Aroclor 1016	1.367 U	1.477 U	1.415 U	1.370 U
Aroclor 1221	1.367 U	1.477 U	1.415 U	1.370 U
Aroclor 1232	1.367 U	1.477 U	1.415 U	1.370 U
Aroclor 1242	1.367 U	1.477 U	1.415 U	1.370 U
Aroclor 1248	1.367 U	1.477 U	1.415 U	1.370 U
Aroclor 1254	7.977	7.646	9.286	8.860
Aroclor 1260	1.367 U	1.477 U	1.415 U	1.370 U
Surrogate Recoveries:				
Cl3(34)	69	77	73	66
Cl5(112)	69	72	68	66

U - Analyte not detected, ssMDL value inserted.
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N - QC value outside the accuracy or precision D
D - Result determined from dilution.

Field Sample Data

Battelle
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Project Name: California State Lands Com
Project Number: N005537

Client Sample ID:	4H-HO-15	4H-HO-11	4H-DR-14	4H-DR-23
Battelle Sample ID:	T1728	T1729	T1730	T1731
Percent Moisture (%)	82.73	81.57	82.27	82.36
Battelle Batch ID:	03-0377	03-0377	03-0377	03-0377
Lipid Weight (g/g):	0.01	0.02	0.01	0.01
Sample Wet Weight (g):	28.65	29.56	28.70	29.15
Units:	ng/g Wet Wt.	ng/g Wet Wt.	ng/g Wet Wt.	ng/g Wet Wt.
4,4 DDD	0.550	0.600	0.451	0.464
2,4 DDD	0.163	0.198	0.155	0.168
4,4 DDE	2.717 D	4.182 D	2.680 D	3.089 D
2,4 DDE	0.839	0.863	0.470	0.514
4,4 DDT	0.252	0.234	0.100	0.170
2,4 DDT	0.156	0.116	0.072	0.077
a-Chlordane	0.260	0.255	0.169	0.173
g-Chlordane	0.103	0.125	0.078	0.080
cis-nonachlor	0.084	0.077	0.036	0.037
trans-nonachlor	0.170	0.180	0.115	0.121
a-BHC	0.642	0.608	0.376	0.587
b-BHC	0.055 U	0.054 U	0.055 U	0.055 U
d-BHC	0.051 U	0.050 U	0.051 U	0.050 U
g-BHC	0.045 U	0.043 U	0.045 U	0.044 U
Dieldrin	0.076	0.072	0.059	0.049
Aldrin	0.039 U	0.038 U	0.039 U	0.039 U
Endosulfan I	0.058 U	0.056 U	0.058 U	0.057 U
Endosulfan II	0.047 U	0.045 U	0.047 U	0.046 U
Endosulfan sulfate	0.067 U	0.065 U	0.067 U	0.066 U
Endrin Aldehyde	0.068 U	0.065 U	0.067 U	0.066 U
Endrin	0.041 U	0.039 U	0.041 U	0.040 U
Heptachlor	0.055 U	0.054 U	0.055 U	0.054 U
Heptachlor epoxide	0.039 U	0.038 U	0.039 U	0.039 U
Methoxychlor	0.080 U	0.077 U	0.080 U	0.078 U
Toxaphene	3.009 U	2.916 U	3.003 U	2.957 U
Cl2 08	0.091 U	0.089 U	0.091 U	0.090 U
Cl3 18	0.049 U	0.048 U	0.049 U	0.048 U
Cl3 28	0.066 U	0.064 U	0.066 U	0.065 U
Cl4 44	0.053 U	0.052 U	0.053 U	0.052 U
Cl4 49	0.055 U	0.053 U	0.055 U	0.054 U
Cl4 52	0.046 U	0.044 U	0.046 U	0.045 U
Cl4 66	0.084	0.082	0.053	0.059
Cl5 87	0.035 U	0.034 U	0.035 U	0.034 U
Cl5 101	0.465	0.492	0.296	0.322
Cl5 105	0.099	0.141	0.106	0.102
Cl5 110	0.184	0.209	0.125	0.135
Cl5 118	0.347	0.377	0.206	0.221
Cl6 128	0.081	0.087	0.048	0.059
Cl6 138	0.509	0.591	0.335	0.436
Cl6 153	0.813	0.777	0.515	0.594
Cl7 170	0.041 U	0.039 U	0.041 U	0.040 U
Cl7 180	0.047 U	0.046 U	0.047 U	0.047 U
Cl7 183	0.058	0.102	0.062	0.063
Cl7 184	0.043 U	0.041 U	0.043 U	0.042 U
Cl7 187	0.269	0.261	0.154	0.199
Cl8 195	0.037 U	0.036 U	0.037 U	0.037 U
Cl9 206	0.045 U	0.043 U	0.045 U	0.044 U
Cl10 209	0.046 U	0.045 U	0.046 U	0.045 U
Aroclor 1016	1.504 U	1.458 U	1.502 U	1.479 U
Aroclor 1221	1.504 U	1.458 U	1.502 U	1.479 U
Aroclor 1232	1.504 U	1.458 U	1.502 U	1.479 U
Aroclor 1242	1.504 U	1.458 U	1.502 U	1.479 U
Aroclor 1248	1.504 U	1.458 U	1.502 U	1.479 U
Aroclor 1254	8.608	7.847	6.120	6.323
Aroclor 1260	1.504 U	1.458 U	1.502 U	1.479 U
Surrogate Recoveries:				
Cl3(34)	74	71	54	68
Cl5(112)	65	63	52	60

U - Analyte not detected, ssMDL value inserted.
J - Analyte detected below the ssRL value.
N - QC value outside the accuracy or precision D
D - Result determined from dilution.

Field Sample Data

Battelle
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Project Name: California State Lands Com
Project Number: N005537

Client Sample ID:	4H-HE-19	4H-DR-08	4H-HE-17	4H-T0-20
Battelle Sample ID:	T1732	T1733	T1735	U7057
Percent Moisture (%)	82.48	82.27	82.00	80.30
Battelle Batch ID:	03-0377	03-0377	03-0377	03-0377
Lipid Weight (g/g):	0.01	0.01	0.01	0.01
Sample Wet Weight (g):	30.97	29.26	28.45	30.36
Units:	ng/g Wet Wt.	ng/g Wet Wt.	ng/g Wet Wt.	ng/g Wet Wt.
4,4 DDD	0.569	0.677	0.603	0.518
2,4 DDD	0.216	0.215	0.194	0.187
4,4 DDE	4.073 D	4.149 D	3.468 D	12.089 D
2,4 DDE	0.799	0.871	0.815	0.558
4,4 DDT	0.362	0.247	0.232	0.203
2,4 DDT	0.157	0.139	0.118	0.090
a-Chlordane	0.237	0.259	0.304	0.228
g-Chlordane	0.123	0.134	0.121	0.100
cis-nonachlor	0.096	0.076	0.060	0.116
trans-nonachlor	0.162	0.191	0.164	0.134
a-BHC	0.822	0.604	0.779	0.676
b-BHC	0.051 U	0.054 U	0.056 U	0.051 U
d-BHC	0.047 U	0.050 U	0.052 U	0.047 U
g-BHC	0.041 U	0.044 U	0.045 U	0.104
Dieldrin	0.066	0.063	0.069	0.064
Aldrin	0.036 U	0.039 U	0.040 U	0.036 U
Endosulfan I	0.054 U	0.057 U	0.058 U	0.053 U
Endosulfan II	0.043 U	0.046 U	0.047 U	0.043 U
Endosulfan sulfate	0.062 U	0.065 U	0.067 U	0.061 U
Endrin Aldehyde	0.063 U	0.066 U	0.068 U	0.062 U
Endrin	0.038 U	0.040 U	0.041 U	0.055
Heptachlor	0.051 U	0.054 U	0.056 U	0.051 U
Heptachlor epoxide	0.036 U	0.038 U	0.039 U	0.036 U
Methoxychlor	0.074 U	0.078 U	0.080 U	0.073 U
Toxaphene	2.783 U	2.946 U	3.030 U	2.839 U
Cl2 08	0.085 U	0.089 U	0.092 U	0.083 U
Cl3 18	0.045 U	0.048 U	0.050 U	0.045 U
Cl3 28	0.061 U	0.064 U	0.066 U	0.060 U
Cl4 44	0.049 U	0.052 U	0.054 U	0.049 U
Cl4 49	0.051 U	0.053 U	0.735	0.050 U
Cl4 52	0.042 U	0.045 U	0.046 U	0.042 U
Cl4 66	0.059	0.077	0.071	0.063
Cl5 87	0.032 U	0.120	0.035 U	0.080
Cl5 101	0.435	0.500	0.491	0.315
Cl5 105	0.128	0.140	0.123	0.098
Cl5 110	0.169	0.188	0.153	0.121
Cl5 118	0.340	0.322	0.268	0.230
Cl6 128	0.098	0.088	0.080	0.115
Cl6 138	0.636	0.604	0.423	0.371
Cl6 153	0.705	0.808	0.720	0.505
Cl7 170	0.038 U	0.040 U	0.041 U	0.037 U
Cl7 180	0.044 U	0.046 U	0.048 U	0.043 U
Cl7 183	0.097	0.104	0.083	0.073
Cl7 184	0.039 U	0.042 U	0.043 U	0.039 U
Cl7 187	0.280	0.244	0.242	0.197
Cl8 195	0.034 U	0.036 U	0.038 U	0.034 U
Cl9 206	0.041 U	0.044 U	0.045 U	0.041 U
Cl10 209	0.043 U	0.045 U	0.047 U	0.042 U
Aroclor 1016	1.392 U	1.473 U	1.515 U	1.420 U
Aroclor 1221	1.392 U	1.473 U	1.515 U	1.420 U
Aroclor 1232	1.392 U	1.473 U	1.515 U	1.420 U
Aroclor 1242	1.392 U	1.473 U	1.515 U	1.420 U
Aroclor 1248	1.392 U	1.473 U	1.515 U	1.420 U
Aroclor 1254	7.890	8.689	8.647	6.460
Aroclor 1260	1.392 U	1.473 U	1.515 U	1.420 U
Surrogate Recoveries:				
Cl3(34)	77	66	71	71
Cl5(112)	63	65	67	61

U - Analyte not detected, ssMDL value inserted.
J - Analyte detected below the ssRL value.
N - QC value outside the accuracy or precision D
D - Result determined from dilution.

Field Sample Data

Battelle
. . . Putting Technology To Work

Project Name: California State Lands Com
Project Number: N005537

Client Sample ID:	4H-T0-12	4H-T0-03	4H-HE-06
Battelle Sample ID:	U7059	U7058	T1736
Percent Moisture (%)	80.07	78.80	83.59
Battelle Batch ID:	03-0377	03-0377	03-0377
Lipid Weight (g/g):	0.01	0.01	0.01
Sample Wet Weight (g):	31.29	29.13	30.44
Units:	ng/g Wet Wt.	ng/g Wet Wt.	ng/g Wet Wt.
4,4 DDD	1.188	1.255	0.451
2,4 DDD	0.376	0.411	0.171
4,4 DDE	10.564 D	5.609 D	2.917 D
2,4 DDE	1.793	1.944	0.508
4,4 DDT	0.522	0.382	0.123
2,4 DDT	0.259	0.052 U	0.068
a-Chlordane	0.555	0.574	0.186
g-Chlordane	0.500	0.437	0.085
cis-nonachlor	0.324	0.258	0.041 U
trans-nonachlor	0.538	0.513	0.103
a-BHC	0.648	0.423	0.557
b-BHC	0.210	0.055 U	0.052 U
d-BHC	0.045 U	0.050 U	0.048 U
g-BHC	0.053	0.044 U	0.042 U
Dieldrin	0.231	0.216	0.055
Aldrin	0.035 U	0.039 U	0.037 U
Endosulfan I	0.051 U	0.057 U	0.054 U
Endosulfan II	0.282	0.046 U	0.044 U
Endosulfan sulfate	0.234	0.066 U	0.063 U
Endrin Aldehyde	0.060 U	0.066 U	0.064 U
Endrin	0.155	0.040 U	0.038 U
Heptachlor	0.017	0.054 U	0.052 U
Heptachlor epoxide	0.035 U	0.039 U	0.037 U
Methoxychlor	0.071 U	0.078 U	0.075 U
Toxaphene	2.755 U	2.959 U	2.832 U
Cl2 08	0.081 U	0.090 U	0.086 U
Cl3 18	0.153	0.048 U	0.046 U
Cl3 28	0.320	0.065 U	0.062 U
Cl4 44	0.506	0.052 U	0.050 U
Cl4 49	0.368	0.054 U	0.051 U
Cl4 52	0.562	0.045 U	0.043 U
Cl4 66	0.404	0.533	0.049
Cl5 87	0.276	0.034 U	0.033 U
Cl5 101	0.890	1.159	0.336
Cl5 105	0.325	0.303	0.070
Cl5 110	0.567	0.681	0.103
Cl5 118	0.929	1.158	0.184
Cl6 128	0.289	0.066 U	0.065
Cl6 138	1.286	1.605	0.555
Cl6 153	1.698	2.242	0.442
Cl7 170	0.109	0.040 U	0.038 U
Cl7 180	0.042 U	0.047 U	0.045 U
Cl7 183	0.148	0.032 U	0.074
Cl7 184	0.038 U	0.042 U	0.040 U
Cl7 187	0.474	0.479	0.188
Cl8 195	0.033 U	0.037 U	0.035 U
Cl9 206	0.040 U	0.044 U	0.042 U
Cl10 209	0.500	0.045 U	0.043 U
Aroclor 1016	1.377 U	1.480 U	1.416 U
Aroclor 1221	1.377 U	1.480 U	1.416 U
Aroclor 1232	1.377 U	1.480 U	1.416 U
Aroclor 1242	1.377 U	1.480 U	1.416 U
Aroclor 1248	1.377 U	1.480 U	1.416 U
Aroclor 1254	13.253	25.174	5.649
Aroclor 1260	1.377 U	1.480 U	1.416 U
Surrogate Recoveries:			
Cl3(34)	76	74	65
Cl5(112)	57	67	58

U - Analyte not detected, ssMDL value inserted.
J - Analyte detected below the ssRL value.
N - QC value outside the accuracy or precision D
D - Result determined from dilution.

Appendix B

2023 Study Data

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

November 22, 2023

Kaitlin Johnson
Tenera Environmental, Inc.
141 Suburban Rd SPC A2
San Luis Obispo, CA 93401-

Project Name: Santa Barbara Channel PO # 22238101
Physis Project ID: 2309005-001

Dear Kaitlin,

Enclosed are the analytical results for samples submitted to PHYSIS Environmental Laboratories, Inc. (PHYSIS) on 9/14/2023. A total of 3 samples were received for analysis in accordance with the attached chain of custody (COC). Per the COC, the samples were analyzed for:

Elements
Trace Metals by EPA 6020
Trace Mercury by EPA 245.7
Organics
Polynuclear Aromatic Hydrocarbons by EPA 8270E
Percent Solids by SM 2540 B
Percent Lipids by Gravimetric
Organochlorine Pesticides & PCB Congeners/Aroclors by EPA 8270E

Analytical results in this report apply only to samples submitted to PHYSIS in accordance with the COC and are intended to be considered in their entirety.

Please feel free to contact me at any time with any questions. PHYSIS appreciates the opportunity to provide you with our analytical and support services.

Regards,

Rachel Hansen
714 602-5320
Extension 203
rachelhansen@physislabs.com

ENVIRONMENTAL LABORATORIES, INC.

Innovative Solutions for Nature

PROJECT SAMPLE LIST

Tenera Environmental, Inc. PHYSIS Project ID: 2309005-001

Santa Barbara Channel PO # 22238101 Total Samples: 3

PHYSIS ID	Sample ID	Description	Date	Time	Matrix	Sample Type
111083	BOT-1		9/13/2023	7:30	Tissue	Not Specified
112324	BOT-2		9/13/2023	7:30	Tissue	Not Specified
112325	BOT-3		9/13/2023	7:30	Tissue	Not Specified

1904 E. Wright Circle Anaheim, CA 92806 (714) 602-5320 fax (714) 602-5321 www.physislabs.com CA ELAP #2769

ABBREVIATIONS and ACRONYMS

QM	Quality Manual
QA	Quality Assurance
QC	Quality Control
MDL	method detection limit
RL	reporting limit
R1	project sample
R2	project sample replicate
MS1	matrix spike
MS2	matrix spike replicate
B1	procedural blank
B2	procedural blank replicate
BS1	blank spike
BS2	blank spike replicate
LCS1	laboratory control spike
LCS2	laboratory control spike replicate
LCM1	laboratory control material
LCM2	laboratory control material replicate
CRM1	certified reference material
CRM2	certified reference material replicate
RPD	relative percent difference
LMW	low molecular weight
HMW	high molecular weight

QUALITY ASSURANCE SUMMARY

LABORATORY BATCH: Physis' QM defines a laboratory batch as a group of 20 or fewer project samples of similar matrix, processed together under the same conditions and with the same reagents. QC samples are associated with each batch and were used to assess the validity of the sample analyses.

PROCEDURAL BLANK: Laboratory contamination introduced during method use is assessed through the preparation and analysis of procedural blanks is provided at a minimum frequency of one per batch.

ACCURACY: Accuracy of analytical measurements is the degree of closeness based on percent recovery calculations between measured values and the actual or true value and includes a combination of reproducibility error and systematic bias due to sampling and analytical operations. Accuracy of the project data was indicated by analysis of MS, BS, LCS, LCM, CRM, and/or surrogate spikes on a minimum frequency of one per batch. Physis' QM requires that 95% of the target compounds greater than 10 times the MDL be within the specified acceptance limits.

PRECISION: Precision is the agreement among a set of replicate measurements without assumption of knowledge of the true value and is based on RPD calculations between repeated values. Precision of the project data was determined by analysis of replicate MS1/MS2, BS1/BS2, LCS1/LCS2, LCM1/LCM2, CRM1/CRM2, surrogate spikes and/or replicate project sample analysis (R1/R2) on a minimum frequency of one per batch. Physis' QM requires that for 95% of the compounds greater than 10 times the MDL, the percent RPD should be within the specified acceptance range.

BLANK SPIKES: BS is the introduction of a known concentration of analyte into the procedural blank. BS demonstrates performance of the preparation and analytical methods on a clean matrix void of potential matrix related interferences. The BS is performed in laboratory deionized water, making these recoveries a better indicator of the efficiency of the laboratory method per se.

MATRIX SPIKES: MS is the introduction of a known concentration of analyte into a sample. MS samples demonstrate the effect a particular project sample matrix has on the accuracy of a measurement. Individually, MS samples also indicate the bias of analytical measurements due to chemical interferences inherent in the in the specific project sample spiked. Intrinsic target analyte concentration in the specific project sample can also significantly impact MS recovery.

CERTIFIED REFERENCE MATERIALS: CRMs are materials of various matrices for which analytical information has been determined and certified by a recognized authority. These are used to provide a quantitative assessment of the accuracy of an analytical method. CRMs provide evidence that the laboratory preparation and analysis produces results that are comparable to those obtained by an independent organization.

LABORATORY CONTROL MATERIAL: LCM is provided because a suitable natural seawater CRM is not available and can be used to indicate accuracy of the method. Physis' internal LCM is seawater collected at ~800 meters in the Southern California San Pedro Basin and can be used as a reference for background concentrations in clean, natural seawater for comparison to project samples.

LABORATORY CONTROL SPIKES: LCS is the introduction of a known concentration of analyte into Physis' LCM. LCS samples were employed to assess the effect the seawater matrix has on the accuracy of a measurement. LCS also indicate the bias of this method due to chemical interferences inherent in the in the seawater matrix. Intrinsic LCM concentration can also significantly impact LCS recovery.

SURROGATES: A surrogate is a pure analyte unlikely to be found in any project sample, behaves similarly to the target analyte and most often used with organic analytical procedures. Surrogates are added in known concentration to all samples and are measured to indicate overall efficiency of the method including processing and analyses.

HOLDING TIME: Method recommended holding times are the length of time a project sample can be stored under specific conditions after collection and prior to analysis without significantly affecting the analyte's concentration. Holding times can be extended if preservation techniques are employed to reduce biodegradation, volatilization, oxidation, sorption, precipitation, and other physical and chemical processes.

SAMPLE STORAGE/RETENTION: In order to maintain chemical integrity prior to analysis, all samples submitted to Physis are refrigerated (liquids) or frozen (solids) upon receipt unless otherwise recommended by applicable methods. Solid samples are retained for 1 year from collection while liquid samples are retained until method recommended holding times elapse.

TOTAL/DISSOLVED FRACTION: In some instances, the results for the dissolved fraction may be higher than the total fraction for a particular analyte (e.g. trace metals). This is typically caused by the analytical variation for each result and indicates that the target analyte is primarily in the dissolved phase, within the sample.

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PHYSIS QUALIFIER CODES

CODE	DEFINITION
#	see Case Narrative
ND	analyte not detected at or above the MDL
B	analyte was detected in the procedural blank greater than 10 times the MDL
E	analyte concentration exceeds the upper limit of the linear calibration range, reported value is estimated
H	sample received and/or analyzed past the recommended holding time
J	analyte was detected at a concentration below the RL and above the MDL, reported value is estimated
N	insufficient sample, analysis could not be performed
M	analyte was outside the specified accuracy and/or precision acceptance limits due to matrix interference. The associated B/BS were within limits, therefore the sample data was reported without further clarification
SH	analyte concentration in the project sample exceeded the spike concentration, therefore accuracy and/or precision acceptance limits do not apply
SL	analyte results were lower than 10 times the MDL, therefore accuracy and/or precision acceptance limits do not apply
NH	project sample was heterogeneous and sample homogeneity could not be readily achieved using routine laboratory practices, therefore accuracy and/or precision acceptance limits do not apply
Q	analyte was outside the specified QAPP acceptance limits for precision and/or accuracy but within Physis derived acceptance limits, therefore the sample data was reported without further clarification
R	Physis' QM allows for 5% of the target compounds greater than 10 times the MDL to be outside the specified acceptance limits for precision and/or accuracy. This is often due to random error and does not indicate any significant problems with the analysis of these project samples

ANALYTICAL REPORT

PHYSIS

TERRA AQUA AURA

ENVIRONMENTAL LABORATORIES, INC.

Innovative Solutions for Nature

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Aroclor PCBs

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 111083-R1 BOT-1			**Matrix: Tissue**				**Sampled: 13-Sep-23 7:30**			**Received: 14-Sep-23**	
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Sample ID: 112324-R1 BOT-2			**Matrix: Tissue**				**Sampled: 13-Sep-23 7:30**			**Received: 14-Sep-23**	
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Sample ID: 112325-R1 BOT-3			**Matrix: Tissue**				**Sampled: 13-Sep-23 7:30**			**Received: 14-Sep-23**	
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43054	14-Nov-23	20-Nov-23

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 111083-R1 BOT-1		**Matrix: Tissue**					**Sampled: 13-Sep-23 7:30**			**Received: 14-Sep-23**	
(PCB030)	EPA 8270E	% Recovery	120	1			Total		O-43054	14-Nov-23	20-Nov-23
(PCB112)	EPA 8270E	% Recovery	120	1			Total		O-43054	14-Nov-23	20-Nov-23
(PCB198)	EPA 8270E	% Recovery	66	1			Total		O-43054	14-Nov-23	20-Nov-23
(TCMX)	EPA 8270E	% Recovery	110	1			Total		O-43054	14-Nov-23	20-Nov-23
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43054	14-Nov-23	20-Nov-23
2,4'-DDE	EPA 8270E	ng/wet g	ND	1	0.2	0.5	Total		O-43054	14-Nov-23	20-Nov-23
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43054	14-Nov-23	20-Nov-23
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43054	14-Nov-23	20-Nov-23
4,4'-DDE	EPA 8270E	ng/wet g	1.85	1	0.193	0.5	Total		O-43054	14-Nov-23	20-Nov-23
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43054	14-Nov-23	20-Nov-23
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43054	14-Nov-23	20-Nov-23
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43054	14-Nov-23	20-Nov-23
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43054	14-Nov-23	20-Nov-23
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

Sample ID: 112324-R1 BOT-2 | Matrix: Tissue | Sampled: 13-Sep-23 7:30 | Received: 14-Sep-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	121	1			Total		O-43054	14-Nov-23	20-Nov-23
(PCB112)	EPA 8270E	% Recovery	126	1			Total		O-43054	14-Nov-23	20-Nov-23
(PCB198)	EPA 8270E	% Recovery	69	1			Total		O-43054	14-Nov-23	20-Nov-23
(TCMX)	EPA 8270E	% Recovery	118	1			Total		O-43054	14-Nov-23	20-Nov-23
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43054	14-Nov-23	20-Nov-23
2,4'-DDE	EPA 8270E	ng/wet g	ND	1	0.2	0.5	Total		O-43054	14-Nov-23	20-Nov-23
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43054	14-Nov-23	20-Nov-23
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43054	14-Nov-23	20-Nov-23
4,4'-DDE	EPA 8270E	ng/wet g	2.14	1	0.193	0.5	Total		O-43054	14-Nov-23	20-Nov-23
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43054	14-Nov-23	20-Nov-23
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43054	14-Nov-23	20-Nov-23
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43054	14-Nov-23	20-Nov-23
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43054	14-Nov-23	20-Nov-23
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

Sample ID: 112325-R1 BOT-3 Matrix: Tissue Sampled: 13-Sep-23 7:30 Received: 14-Sep-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	116	1			Total		O-43054	14-Nov-23	20-Nov-23
(PCB112)	EPA 8270E	% Recovery	126	1			Total		O-43054	14-Nov-23	20-Nov-23
(PCB198)	EPA 8270E	% Recovery	65	1			Total		O-43054	14-Nov-23	20-Nov-23
(TCMX)	EPA 8270E	% Recovery	119	1			Total		O-43054	14-Nov-23	20-Nov-23
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43054	14-Nov-23	20-Nov-23
2,4'-DDE	EPA 8270E	ng/wet g	ND	1	0.2	0.5	Total		O-43054	14-Nov-23	20-Nov-23
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43054	14-Nov-23	20-Nov-23
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43054	14-Nov-23	20-Nov-23
4,4'-DDE	EPA 8270E	ng/wet g	1.63	1	0.193	0.5	Total		O-43054	14-Nov-23	20-Nov-23
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43054	14-Nov-23	20-Nov-23
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43054	14-Nov-23	20-Nov-23
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43054	14-Nov-23	20-Nov-23
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43054	14-Nov-23	20-Nov-23
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Conventionals

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 111083-R1 BOT-1			**Matrix: Tissue**				**Sampled: 13-Sep-23 7:30**			**Received: 14-Sep-23**	
Percent Solids	SM 2540 B	%	15.5	1	0.1	0.1	NA		C-78004	14-Nov-23	16-Nov-23
Sample ID: 112324-R1 BOT-2			**Matrix: Tissue**				**Sampled: 13-Sep-23 7:30**			**Received: 14-Sep-23**	
Percent Solids	SM 2540 B	%	17.7	1	0.1	0.1	NA		C-78004	14-Nov-23	16-Nov-23
Sample ID: 112325-R1 BOT-3			**Matrix: Tissue**				**Sampled: 13-Sep-23 7:30**			**Received: 14-Sep-23**	
Percent Solids	SM 2540 B	%	16.3	1	0.1	0.1	NA		C-78004	14-Nov-23	16-Nov-23

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 111083-R1 BOT-1		**Matrix: Tissue**					**Sampled:**	**13-Sep-23 7:30**		**Received:**	**14-Sep-23**
Aluminum (Al)	EPA 6020	µg/wet g	18.1	1	1	5	NA		E-29047	31-Oct-23	01-Nov-23
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Arsenic (As)	EPA 6020	µg/wet g	1.01	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Barium (Ba)	EPA 6020	µg/wet g	0.391	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Cadmium (Cd)	EPA 6020	µg/wet g	1.4	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Chromium (Cr)	EPA 6020	µg/wet g	0.119	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Cobalt (Co)	EPA 6020	µg/wet g	0.116	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Copper (Cu)	EPA 6020	µg/wet g	1.46	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Iron (Fe)	EPA 6020	µg/wet g	25.3	1	1	5	NA		E-29047	31-Oct-23	01-Nov-23
Lead (Pb)	EPA 6020	µg/wet g	0.051	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Mercury (Hg)	EPA 245.7	µg/wet g	0.00275	1	0.00001	0.00002	NA		E-27147	30-Oct-23	31-Oct-23
Molybdenum (Mo)	EPA 6020	µg/wet g	0.233	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Nickel (Ni)	EPA 6020	µg/wet g	0.225	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Selenium (Se)	EPA 6020	µg/wet g	0.481	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Silver (Ag)	EPA 6020	µg/wet g	0.054	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Vanadium (V)	EPA 6020	µg/wet g	0.122	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Zinc (Zn)	EPA 6020	µg/wet g	11.4	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112324-R1 BOT-2			**Matrix: Tissue**				**Sampled:**	**13-Sep-23 7:30**		**Received:**	**14-Sep-23**
Aluminum (Al)	EPA 6020	µg/wet g	9.63	1	1	5	NA		E-29047	31-Oct-23	01-Nov-23
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Arsenic (As)	EPA 6020	µg/wet g	1.23	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Barium (Ba)	EPA 6020	µg/wet g	0.091	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Cadmium (Cd)	EPA 6020	µg/wet g	1.72	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Chromium (Cr)	EPA 6020	µg/wet g	0.059	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Cobalt (Co)	EPA 6020	µg/wet g	0.14	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Copper (Cu)	EPA 6020	µg/wet g	1.67	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Iron (Fe)	EPA 6020	µg/wet g	24.1	1	1	5	NA		E-29047	31-Oct-23	01-Nov-23
Lead (Pb)	EPA 6020	µg/wet g	0.04	1	0.025	0.05	NA	J	E-29047	31-Oct-23	01-Nov-23
Mercury (Hg)	EPA 245.7	µg/wet g	0.00273	1	0.00001	0.00002	NA		E-27147	30-Oct-23	31-Oct-23
Molybdenum (Mo)	EPA 6020	µg/wet g	0.233	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Nickel (Ni)	EPA 6020	µg/wet g	0.213	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Selenium (Se)	EPA 6020	µg/wet g	0.551	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Silver (Ag)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Vanadium (V)	EPA 6020	µg/wet g	0.107	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Zinc (Zn)	EPA 6020	µg/wet g	14.1	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

Sample ID: 112325-R1 BOT-3 Matrix: Tissue Sampled: 13-Sep-23 7:30 Received: 14-Sep-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Aluminum (Al)	EPA 6020	µg/wet g	11.8	1	1	5	NA		E-29047	31-Oct-23	01-Nov-23
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Arsenic (As)	EPA 6020	µg/wet g	1.27	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Barium (Ba)	EPA 6020	µg/wet g	0.167	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Cadmium (Cd)	EPA 6020	µg/wet g	1.57	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Chromium (Cr)	EPA 6020	µg/wet g	0.059	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Cobalt (Co)	EPA 6020	µg/wet g	0.138	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Copper (Cu)	EPA 6020	µg/wet g	1.69	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Iron (Fe)	EPA 6020	µg/wet g	29.6	1	1	5	NA		E-29047	31-Oct-23	01-Nov-23
Lead (Pb)	EPA 6020	µg/wet g	0.049	1	0.025	0.05	NA	J	E-29047	31-Oct-23	01-Nov-23
Mercury (Hg)	EPA 245.7	µg/wet g	0.00297	1	0.00001	0.00002	NA		E-27147	30-Oct-23	31-Oct-23
Molybdenum (Mo)	EPA 6020	µg/wet g	0.262	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Nickel (Ni)	EPA 6020	µg/wet g	0.181	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Selenium (Se)	EPA 6020	µg/wet g	0.537	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Silver (Ag)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Vanadium (V)	EPA 6020	µg/wet g	0.125	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23
Zinc (Zn)	EPA 6020	µg/wet g	14.7	1	0.025	0.05	NA		E-29047	31-Oct-23	01-Nov-23

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

Sample ID: 111083-R1 BOT-1 Matrix: Tissue Sampled: 13-Sep-23 7:30 Received: 14-Sep-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 153	EPA 8270E	ng/wet g	ND	1	0.065	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 158	EPA 8270E	ng/wet g	0.193	1	0.074	0.5	Total	J	O-43054	14-Nov-23	20-Nov-23
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112324-R1 BOT-2			**Matrix: Tissue**				**Sampled:**	**13-Sep-23 7:30**		**Received:**	**14-Sep-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 153	EPA 8270E	ng/wet g	ND	1	0.065	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 158	EPA 8270E	ng/wet g	0.198	1	0.074	0.5	Total	J	O-43054	14-Nov-23	20-Nov-23
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PCB Congeners

Sample ID: 112325-R1 BOT-3 Matrix: Tissue Sampled: 13-Sep-23 7:30 Received: 14-Sep-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 153	EPA 8270E	ng/wet g	ND	1	0.065	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43054	14-Nov-23	20-Nov-23

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43054	14-Nov-23	20-Nov-23
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43054	14-Nov-23	20-Nov-23

Polynuclear Aromatic Hydrocarbons

Sample ID: 111083-R1 BOT-1 Matrix: Tissue Sampled: 13-Sep-23 7:30 Received: 14-Sep-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	121	1			Total		O-43054	14-Nov-23	20-Nov-23
(d10-Phenanthrene)	EPA 8270E	% Recovery	104	1			Total		O-43054	14-Nov-23	20-Nov-23
(d12-Chrysene)	EPA 8270E	% Recovery	132	1			Total		O-43054	14-Nov-23	20-Nov-23
(d12-Perylene)	EPA 8270E	% Recovery	86	1			Total		O-43054	14-Nov-23	20-Nov-23
(d8-Naphthalene)	EPA 8270E	% Recovery	114	1			Total		O-43054	14-Nov-23	20-Nov-23
1-Methylnaphthalene	EPA 8270E	ng/wet g	1.96	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
1-Methylphenanthrene	EPA 8270E	ng/wet g	1.13	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	1.19	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
2-Methylnaphthalene	EPA 8270E	ng/wet g	2.69	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Acenaphthene	EPA 8270E	ng/wet g	4.28	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Anthracene	EPA 8270E	ng/wet g	1.03	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Benz[a]anthracene	EPA 8270E	ng/wet g	4.74	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Chrysene	EPA 8270E	ng/wet g	13.7	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Fluoranthene	EPA 8270E	ng/wet g	5.85	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	3.54	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Naphthalene	EPA 8270E	ng/wet g	2.7	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Phenanthrene	EPA 8270E	ng/wet g	9.63	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Pyrene	EPA 8270E	ng/wet g	2.79	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23

Polynuclear Aromatic Hydrocarbons

Sample ID: 112324-R1 BOT-2 | Matrix: Tissue | Sampled: 13-Sep-23 7:30 | Received: 14-Sep-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	125	1			Total		O-43054	14-Nov-23	20-Nov-23
(d10-Phenanthrene)	EPA 8270E	% Recovery	104	1			Total		O-43054	14-Nov-23	20-Nov-23
(d12-Chrysene)	EPA 8270E	% Recovery	138	1			Total		O-43054	14-Nov-23	20-Nov-23
(d12-Perylene)	EPA 8270E	% Recovery	93	1			Total		O-43054	14-Nov-23	20-Nov-23
(d8-Naphthalene)	EPA 8270E	% Recovery	119	1			Total		O-43054	14-Nov-23	20-Nov-23
1-Methylnaphthalene	EPA 8270E	ng/wet g	1.93	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
1-Methylphenanthrene	EPA 8270E	ng/wet g	1.08	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	1.19	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
2-Methylnaphthalene	EPA 8270E	ng/wet g	3.08	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Acenaphthene	EPA 8270E	ng/wet g	4.37	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benz[a]anthracene	EPA 8270E	ng/wet g	3.78	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Chrysene	EPA 8270E	ng/wet g	12.6	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Fluoranthene	EPA 8270E	ng/wet g	5.01	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	3.69	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Naphthalene	EPA 8270E	ng/wet g	3.14	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Phenanthrene	EPA 8270E	ng/wet g	9.26	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Pyrene	EPA 8270E	ng/wet g	2.4	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23

Polynuclear Aromatic Hydrocarbons

Sample ID: 112325-R1 BOT-3 — Matrix: Tissue — Sampled: 13-Sep-23 7:30 — Received: 14-Sep-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	100	1			Total		O-43054	14-Nov-23	20-Nov-23
(d10-Phenanthrene)	EPA 8270E	% Recovery	81	1			Total		O-43054	14-Nov-23	20-Nov-23
(d12-Chrysene)	EPA 8270E	% Recovery	138	1			Total		O-43054	14-Nov-23	20-Nov-23
(d12-Perylene)	EPA 8270E	% Recovery	62	1			Total		O-43054	14-Nov-23	20-Nov-23
(d8-Naphthalene)	EPA 8270E	% Recovery	93	1			Total		O-43054	14-Nov-23	20-Nov-23
1-Methylnaphthalene	EPA 8270E	ng/wet g	1.68	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
1-Methylphenanthrene	EPA 8270E	ng/wet g	1.24	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	1.31	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
2-Methylnaphthalene	EPA 8270E	ng/wet g	2.86	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Acenaphthene	EPA 8270E	ng/wet g	4.72	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Anthracene	EPA 8270E	ng/wet g	1.49	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Benz[a]anthracene	EPA 8270E	ng/wet g	5.33	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Chrysene	EPA 8270E	ng/wet g	11.4	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Fluoranthene	EPA 8270E	ng/wet g	6.11	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	3.93	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Naphthalene	EPA 8270E	ng/wet g	3.29	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Phenanthrene	EPA 8270E	ng/wet g	10.5	1	1	5	Total		O-43054	14-Nov-23	20-Nov-23
Pyrene	EPA 8270E	ng/wet g	2.94	1	1	5	Total	J	O-43054	14-Nov-23	20-Nov-23

Total Extractable Organics

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 111083-R1 BOT-1		**Matrix: Tissue**					**Sampled:**	**13-Sep-23 7:30**		**Received:**	**14-Sep-23**
Percent Lipids	Gravimetric	% wet weight	1.82	1	0.01	0.05	NA		C-54129	16-Nov-23	17-Nov-23
Sample ID: 112324-R1 BOT-2		**Matrix: Tissue**					**Sampled:**	**13-Sep-23 7:30**		**Received:**	**14-Sep-23**
Percent Lipids	Gravimetric	% wet weight	1.83	1	0.01	0.05	NA		C-54129	16-Nov-23	17-Nov-23
Sample ID: 112325-R1 BOT-3		**Matrix: Tissue**					**Sampled:**	**13-Sep-23 7:30**		**Received:**	**14-Sep-23**
Percent Lipids	Gravimetric	% wet weight	1.78	1	0.01	0.05	NA		C-54129	16-Nov-23	17-Nov-23

QUALITY CONTROL REPORT

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Aroclor PCBs

QUALITY CONTROL REPORT

Sample ID: 111080-B1 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Aroclor 1016	Total	ND	1	10	20	ng/wet g							
Aroclor 1221	Total	ND	1	10	20	ng/wet g							
Aroclor 1232	Total	ND	1	10	20	ng/wet g							
Aroclor 1242	Total	ND	1	10	20	ng/wet g							
Aroclor 1248	Total	ND	1	10	20	ng/wet g							
Aroclor 1254	Total	ND	1	10	20	ng/wet g							
Aroclor 1260	Total	ND	1	10	20	ng/wet g							

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

QUALITY CONTROL REPORT

Sample ID: 111080-B1 **QAQC Procedural Blank** **Matrix:** BlankMatrix **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(PCB030)	Total	89	1			% Recovery	100		89	52 - 124% PASS			
(PCB112)	Total	86	1			% Recovery	100		86	49 - 133% PASS			
(PCB198)	Total	99	1			% Recovery	100		99	60 - 129% PASS			
(TCMX)	Total	88	1			% Recovery	100		88	6 - 124% PASS			
2,4'-DDD	Total	ND	1	0.267	0.5	ng/wet g							
2,4'-DDE	Total	ND	1	0.2	0.5	ng/wet g							
2,4'-DDT	Total	ND	1	0.194	0.5	ng/wet g							
4,4'-DDD	Total	ND	1	0.198	0.5	ng/wet g							
4,4'-DDE	Total	ND	1	0.193	0.5	ng/wet g							
4,4'-DDT	Total	ND	1	0.128	0.5	ng/wet g							
BHC-alpha	Total	ND	1	0.25	0.5	ng/wet g							
BHC-beta	Total	ND	1	0.25	0.5	ng/wet g							
BHC-delta	Total	ND	1	0.25	0.5	ng/wet g							
BHC-gamma	Total	ND	1	0.25	0.5	ng/wet g							
Chlordane-alpha	Total	ND	1	0.187	0.5	ng/wet g							
Chlordane-gamma	Total	ND	1	0.179	0.5	ng/wet g							
cis-Nonachlor	Total	ND	1	0.192	0.5	ng/wet g							
Dieldrin	Total	ND	1	0.1	0.2	ng/wet g							
Oxychlordane	Total	ND	1	0.25	0.5	ng/wet g							
trans-Nonachlor	Total	ND	1	0.186	0.5	ng/wet g							

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

QUALITY CONTROL REPORT

Sample ID: 111080-BS1 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(PCB030)	Total	85	1			% Recovery	100	0	85	52 - 124% PASS			
(PCB112)	Total	81	1			% Recovery	100	0	81	49 - 133% PASS			
(PCB198)	Total	86	1			% Recovery	100	0	86	60 - 129% PASS			
(TCMX)	Total	85	1			% Recovery	100	0	85	6 - 124% PASS			
2,4'-DDD	Total	429	1	0.267	0.5	ng/wet g	500	0	86	61 - 134% PASS			
2,4'-DDE	Total	434	1	0.2	0.5	ng/wet g	500	0	87	66 - 140% PASS			
2,4'-DDT	Total	539	1	0.194	0.5	ng/wet g	500	0	108	61 - 138% PASS			
4,4'-DDD	Total	523	1	0.198	0.5	ng/wet g	500	0	105	63 - 143% PASS			
4,4'-DDE	Total	474	1	0.193	0.5	ng/wet g	500	0	95	70 - 113% PASS			
4,4'-DDT	Total	586	1	0.128	0.5	ng/wet g	500	0	117	59 - 162% PASS			
BHC-alpha	Total	440	1	0.25	0.5	ng/wet g	500	0	88	49 - 124% PASS			
BHC-beta	Total	276	1	0.25	0.5	ng/wet g	500	0	55	55 - 127% PASS			
BHC-delta	Total	470	1	0.25	0.5	ng/wet g	500	0	94	58 - 121% PASS			
BHC-gamma	Total	536	1	0.25	0.5	ng/wet g	500	0	107	54 - 122% PASS			
Chlordane-alpha	Total	372	1	0.187	0.5	ng/wet g	500	0	74	61 - 114% PASS			
Chlordane-gamma	Total	396	1	0.179	0.5	ng/wet g	500	0	79	63 - 120% PASS			
cis-Nonachlor	Total	379	1	0.192	0.5	ng/wet g	500	0	76	64 - 112% PASS			
Dieldrin	Total	474	1	0.1	0.2	ng/wet g	500	0	95	56 - 123% PASS			
Oxychlordane	Total	639	1	0.25	0.5	ng/wet g	500	0	128	57 - 131% PASS			
trans-Nonachlor	Total	354	1	0.186	0.5	ng/wet g	500	0	71	62 - 114% PASS			

Chlorinated Pesticides

QUALITY CONTROL REPORT

Sample ID: 111080-BS2 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
(PCB030)	Total	83	1			% Recovery	100	0	83	52 - 124%	PASS	2	30	PASS
(PCB112)	Total	76	1			% Recovery	100	0	76	49 - 133%	PASS	6	30	PASS
(PCB198)	Total	89	1			% Recovery	100	0	89	60 - 129%	PASS	3	30	PASS
(TCMX)	Total	84	1			% Recovery	100	0	84	6 - 124%	PASS	1	30	PASS
2,4'-DDD	Total	453	1	0.267	0.5	ng/wet g	500	0	91	61 - 134%	PASS	6	30	PASS
2,4'-DDE	Total	466	1	0.2	0.5	ng/wet g	500	0	93	66 - 140%	PASS	7	30	PASS
2,4'-DDT	Total	575	1	0.194	0.5	ng/wet g	500	0	115	61 - 138%	PASS	6	30	PASS
4,4'-DDD	Total	559	1	0.198	0.5	ng/wet g	500	0	112	63 - 143%	PASS	6	30	PASS
4,4'-DDE	Total	521	1	0.193	0.5	ng/wet g	500	0	104	70 - 113%	PASS	9	30	PASS
4,4'-DDT	Total	647	1	0.128	0.5	ng/wet g	500	0	129	59 - 162%	PASS	10	30	PASS
BHC-alpha	Total	491	1	0.25	0.5	ng/wet g	500	0	98	49 - 124%	PASS	11	30	PASS
BHC-beta	Total	302	1	0.25	0.5	ng/wet g	500	0	60	55 - 127%	PASS	9	30	PASS
BHC-delta	Total	509	1	0.25	0.5	ng/wet g	500	0	102	58 - 121%	PASS	8	30	PASS
BHC-gamma	Total	545	1	0.25	0.5	ng/wet g	500	0	109	54 - 122%	PASS	2	30	PASS
Chlordane-alpha	Total	397	1	0.187	0.5	ng/wet g	500	0	79	61 - 114%	PASS	7	30	PASS
Chlordane-gamma	Total	423	1	0.179	0.5	ng/wet g	500	0	85	63 - 120%	PASS	7	30	PASS
cis-Nonachlor	Total	395	1	0.192	0.5	ng/wet g	500	0	79	64 - 112%	PASS	4	30	PASS
Dieldrin	Total	507	1	0.1	0.2	ng/wet g	500	0	101	56 - 123%	PASS	6	30	PASS
Oxychlordane	Total	646	1	0.25	0.5	ng/wet g	500	0	129	57 - 131%	PASS	1	30	PASS
trans-Nonachlor	Total	383	1	0.186	0.5	ng/wet g	500	0	77	62 - 114%	PASS	8	30	PASS

Chlorinated Pesticides

QUALITY CONTROL REPORT

Sample ID: 111082-CRM1 **QAQC CRM - SRM 1946** **Matrix:** Tissue **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(PCB030)	Total	133	1			% Recovery	100		133	60 - 140% PASS			
(PCB112)	Total	138	1			% Recovery	100		138	60 - 140% PASS			
(PCB198)	Total	83	1			% Recovery	100		83	60 - 140% PASS			
(TCMX)	Total	138	1			% Recovery	100		138	60 - 140% PASS			
2,4'-DDD	Total	2.04	1	0.267	0.5	ng/wet g	2.2		93	60 - 140% PASS			
2,4'-DDE	Total	0.79	1	0.2	0.5	ng/wet g	1.04		76	60 - 140% PASS			
2,4'-DDT	Total	26.4	1	0.194	0.5	ng/wet g	22.3		118	60 - 140% PASS			
4,4'-DDD	Total	16.5	1	0.198	0.5	ng/wet g	17.7		93	60 - 140% PASS			
4,4'-DDE	Total	351	1	0.193	0.5	ng/wet g	373		94	60 - 140% PASS			
4,4'-DDT	Total	45	1	0.128	0.5	ng/wet g	37.2		121	60 - 140% PASS			
BHC-alpha	Total	7.8	1	0.25	0.5	ng/wet g	5.72		136	60 - 140% PASS			
Chlordane-alpha	Total	30	1	0.187	0.5	ng/wet g	32.5		92	60 - 140% PASS			
Chlordane-gamma	Total	9.2	1	0.179	0.5	ng/wet g	8.36		110	60 - 140% PASS			
cis-Nonachlor	Total	60.2	1	0.192	0.5	ng/wet g	59.1		102	60 - 140% PASS			
Dieldrin	Total	38	1	0.1	0.2	ng/wet g	32.5		117	60 - 140% PASS			
Oxychlordane	Total	22.1	1	0.25	0.5	ng/wet g	18.9		117	60 - 140% PASS			
trans-Nonachlor	Total	101	1	0.186	0.5	ng/wet g	99.6		101	60 - 140% PASS			

Elements

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 111080-B1	**QAQC Procedural Blank**					**Matrix: BlankMatrix**	**Sampled:**				**Received:**		
	Method: EPA 245.7					Batch ID: E-27147	Prepared: 30-Oct-23				Analyzed: 31-Oct-23		
Mercury (Hg)	NA	ND	1	0.00001	0.00002	µg/wet g							
	Method: EPA 6020					Batch ID: E-29047	Prepared: 31-Oct-23				Analyzed: 01-Nov-23		
Aluminum (Al)	NA	ND	1	1	5	µg/wet g							
Antimony (Sb)	NA	ND	1	0.025	0.05	µg/wet g							
Arsenic (As)	NA	ND	1	0.025	0.05	µg/wet g							
Barium (Ba)	NA	ND	1	0.025	0.05	µg/wet g							
Beryllium (Be)	NA	ND	1	0.025	0.05	µg/wet g							
Cadmium (Cd)	NA	ND	1	0.025	0.05	µg/wet g							
Chromium (Cr)	NA	ND	1	0.025	0.05	µg/wet g							
Cobalt (Co)	NA	ND	1	0.025	0.05	µg/wet g							
Copper (Cu)	NA	ND	1	0.025	0.05	µg/wet g							
Iron (Fe)	NA	ND	1	1	5	µg/wet g							
Lead (Pb)	NA	ND	1	0.025	0.05	µg/wet g							
Molybdenum (Mo)	NA	ND	1	0.025	0.05	µg/wet g							
Nickel (Ni)	NA	ND	1	0.025	0.05	µg/wet g							
Selenium (Se)	NA	ND	1	0.025	0.05	µg/wet g							
Silver (Ag)	NA	ND	1	0.025	0.05	µg/wet g							
Thallium (Tl)	NA	ND	1	0.025	0.05	µg/wet g							
Vanadium (V)	NA	ND	1	0.025	0.05	µg/wet g							
Zinc (Zn)	NA	ND	1	0.025	0.05	µg/wet g							

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 111080-BS1	**QAQC Procedural Blank**					**Matrix: BlankMatrix**		**Sampled:**				**Received:**		
	Method: EPA 245.7					Batch ID: E-27147		Prepared: 30-Oct-23				Analyzed: 31-Oct-23		
Mercury (Hg)	NA	0.001	1	0.00001	0.00002	µg/wet g	0.001	0	100	82 - 119%	PASS			
	Method: EPA 6020					Batch ID: E-29047		Prepared: 31-Oct-23				Analyzed: 01-Nov-23		
Aluminum (Al)	NA	2.05	1	1	5	µg/wet g	2	0	102	89 - 119%	PASS			
Antimony (Sb)	NA	2	1	0.025	0.05	µg/wet g	2	0	100	87 - 117%	PASS			
Arsenic (As)	NA	1.99	1	0.025	0.05	µg/wet g	2	0	100	89 - 119%	PASS			
Barium (Ba)	NA	1.99	1	0.025	0.05	µg/wet g	2	0	100	88 - 118%	PASS			
Beryllium (Be)	NA	1.94	1	0.025	0.05	µg/wet g	2	0	97	73 - 120%	PASS			
Cadmium (Cd)	NA	1.97	1	0.025	0.05	µg/wet g	2	0	99	86 - 116%	PASS			
Chromium (Cr)	NA	1.95	1	0.025	0.05	µg/wet g	2	0	98	86 - 116%	PASS			
Cobalt (Co)	NA	1.95	1	0.025	0.05	µg/wet g	2	0	98	86 - 116%	PASS			
Copper (Cu)	NA	1.96	1	0.025	0.05	µg/wet g	2	0	98	83 - 116%	PASS			
Iron (Fe)	NA	1.95	1	1	5	µg/wet g	2	0	98	85 - 115%	PASS			
Lead (Pb)	NA	1.93	1	0.025	0.05	µg/wet g	2	0	96	89 - 119%	PASS			
Molybdenum (Mo)	NA	1.95	1	0.025	0.05	µg/wet g	2	0	98	85 - 115%	PASS			
Nickel (Ni)	NA	1.95	1	0.025	0.05	µg/wet g	2	0	98	81 - 119%	PASS			
Selenium (Se)	NA	2.05	1	0.025	0.05	µg/wet g	2	0	102	87 - 122%	PASS			
Silver (Ag)	NA	0.182	1	0.025	0.05	µg/wet g	0.2	0	91	75 - 123%	PASS			
Thallium (Tl)	NA	1.94	1	0.025	0.05	µg/wet g	2	0	97	75 - 125%	PASS			
Vanadium (V)	NA	1.97	1	0.025	0.05	µg/wet g	2	0	99	78 - 118%	PASS			
Zinc (Zn)	NA	1.97	1	0.025	0.05	µg/wet g	2	0	99	85 - 115%	PASS			

Elements

QUALITY CONTROL REPORT

Sample ID: 111080-BS2 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Method: EPA 245.7						Batch ID: E-27147		Prepared: 30-Oct-23				Analyzed: 31-Oct-23		
Mercury (Hg)	NA	0.00103	1	0.00001	0.00002	µg/wet g	0.001	0	103	82 - 119%	PASS	3	30 PASS	
Method: EPA 6020						Batch ID: E-29047		Prepared: 31-Oct-23				Analyzed: 01-Nov-23		
Aluminum (Al)	NA	1.97	1	1	5	µg/wet g	2	0	99	89 - 119%	PASS	4	30 PASS	
Antimony (Sb)	NA	1.96	1	0.025	0.05	µg/wet g	2	0	98	87 - 117%	PASS	2	30 PASS	
Arsenic (As)	NA	1.98	1	0.025	0.05	µg/wet g	2	0	99	89 - 119%	PASS	1	30 PASS	
Barium (Ba)	NA	1.95	1	0.025	0.05	µg/wet g	2	0	98	88 - 118%	PASS	2	30 PASS	
Beryllium (Be)	NA	1.94	1	0.025	0.05	µg/wet g	2	0	97	73 - 120%	PASS	0	30 PASS	
Cadmium (Cd)	NA	1.95	1	0.025	0.05	µg/wet g	2	0	98	86 - 116%	PASS	0	30 PASS	
Chromium (Cr)	NA	1.9	1	0.025	0.05	µg/wet g	2	0	95	86 - 116%	PASS	3	30 PASS	
Cobalt (Co)	NA	1.92	1	0.025	0.05	µg/wet g	2	0	96	86 - 116%	PASS	2	30 PASS	
Copper (Cu)	NA	1.92	1	0.025	0.05	µg/wet g	2	0	96	83 - 116%	PASS	2	30 PASS	
Iron (Fe)	NA	1.92	1	1	5	µg/wet g	2	0	96	85 - 115%	PASS	2	30 PASS	
Lead (Pb)	NA	1.93	1	0.025	0.05	µg/wet g	2	0	96	89 - 119%	PASS	0	30 PASS	
Molybdenum (Mo)	NA	1.94	1	0.025	0.05	µg/wet g	2	0	97	85 - 115%	PASS	1	30 PASS	
Nickel (Ni)	NA	1.91	1	0.025	0.05	µg/wet g	2	0	95	81 - 119%	PASS	2	30 PASS	
Selenium (Se)	NA	1.99	1	0.025	0.05	µg/wet g	2	0	100	87 - 122%	PASS	2	30 PASS	
Silver (Ag)	NA	0.197	1	0.025	0.05	µg/wet g	0.2	0	98	75 - 123%	PASS	7	30 PASS	
Thallium (Tl)	NA	1.95	1	0.025	0.05	µg/wet g	2	0	98	75 - 125%	PASS	1	30 PASS	
Vanadium (V)	NA	1.9	1	0.025	0.05	µg/wet g	2	0	95	78 - 118%	PASS	3	30 PASS	
Zinc (Zn)	NA	1.94	1	0.025	0.05	µg/wet g	2	0	97	85 - 115%	PASS	1	30 PASS	

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 111081-CRM1	**QAQC CRM - SRM 1566b**					**Matrix: Tissue**		**Sampled:**				**Received:**		
	Method: EPA 245.7					Batch ID: E-27147		Prepared: 30-Oct-23				Analyzed: 31-Oct-23		
Mercury (Hg)	NA	0.03	1	0.00001	0.00002	µg/wet g	0.0371		81	80 - 120%	PASS			
	Method: EPA 6020					Batch ID: E-29047		Prepared: 31-Oct-23				Analyzed: 01-Nov-23		
Aluminum (Al)	NA	157	1	1	5	µg/wet g	197		80	80 - 120%	PASS			
Antimony (Sb)	NA	0.013	1	0.025	0.05	µg/wet g	0.11		118	80 - 120%	PASS			
Arsenic (As)	NA	6.79	1	0.025	0.05	µg/wet g	7.65		89	80 - 120%	PASS			
Cadmium (Cd)	NA	2.49	1	0.025	0.05	µg/wet g	2.48		100	80 - 120%	PASS			
Cobalt (Co)	NA	0.365	1	0.025	0.05	µg/wet g	0.371		98	80 - 120%	PASS			
Copper (Cu)	NA	70.3	1	0.025	0.05	µg/wet g	71.6		98	80 - 120%	PASS			
Iron (Fe)	NA	184	1	1	5	µg/wet g	206		89	80 - 120%	PASS			
Lead (Pb)	NA	0.292	1	0.025	0.05	µg/wet g	0.308		95	80 - 120%	PASS			
Selenium (Se)	NA	2.41	1	0.025	0.05	µg/wet g	2.06		117	80 - 120%	PASS			
Silver (Ag)	NA	0.56	1	0.025	0.05	µg/wet g	0.666		84	80 - 120%	PASS			
Vanadium (V)	NA	0.502	1	0.025	0.05	µg/wet g	0.577		87	80 - 120%	PASS			
Zinc (Zn)	NA	1460	1	0.025	0.05	µg/wet g	1420		103	80 - 120%	PASS			

Elements

QUALITY CONTROL REPORT

Sample ID: 111083-MS1 BOT-1 | **Matrix: Tissue** | **Sampled: 13-Sep-23 7:30** | **Received: 14-Sep-23**

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Method: EPA 245.7	Batch ID: E-27147	Prepared: 30-Oct-23	Analyzed: 31-Oct-23											
Mercury (Hg)	NA	0.183	1	0.00001	0.00002	µg/wet g	0.184	0.00275	98	74 - 131%	PASS			
Method: EPA 6020	Batch ID: E-29047	Prepared: 31-Oct-23	Analyzed: 01-Nov-23											
Aluminum (Al)	NA	32.9	1	1	5	µg/wet g	14.8	18.1	100	63 - 142%	PASS			
Antimony (Sb)	NA	14.6	1	0.025	0.05	µg/wet g	14.8	0	99	87 - 117%	PASS			
Arsenic (As)	NA	16.4	1	0.025	0.05	µg/wet g	14.8	1.01	104	84 - 122%	PASS			
Barium (Ba)	NA	15.2	1	0.025	0.05	µg/wet g	14.8	0.391	100	74 - 137%	PASS			
Beryllium (Be)	NA	14.1	1	0.025	0.05	µg/wet g	14.8	0	95	83 - 119%	PASS			
Cadmium (Cd)	NA	16	1	0.025	0.05	µg/wet g	14.8	1.4	99	82 - 121%	PASS			
Chromium (Cr)	NA	14.6	1	0.025	0.05	µg/wet g	14.8	0.119	98	89 - 119%	PASS			
Cobalt (Co)	NA	14.7	1	0.025	0.05	µg/wet g	14.8	0.116	99	86 - 116%	PASS			
Copper (Cu)	NA	15.6	1	0.025	0.05	µg/wet g	14.8	1.46	96	83 - 113%	PASS			
Iron (Fe)	NA	39.6	1	1	5	µg/wet g	14.8	25.3	97	79 - 136%	PASS			
Lead (Pb)	NA	13.7	1	0.025	0.05	µg/wet g	14.8	0.051	92	79 - 118%	PASS			
Molybdenum (Mo)	NA	15.4	1	0.025	0.05	µg/wet g	14.8	0.233	102	83 - 140%	PASS			
Nickel (Ni)	NA	14.5	1	0.025	0.05	µg/wet g	14.8	0.225	96	85 - 115%	PASS			
Selenium (Se)	NA	15.8	1	0.025	0.05	µg/wet g	14.8	0.481	104	83 - 129%	PASS			
Silver (Ag)	NA	1.42	1	0.025	0.05	µg/wet g	1.48	0.054	92	67 - 127%	PASS			
Thallium (Tl)	NA	13.8	1	0.025	0.05	µg/wet g	14.8	0	93	75 - 125%	PASS			
Vanadium (V)	NA	15.1	1	0.025	0.05	µg/wet g	14.8	0.122	101	92 - 126%	PASS			
Zinc (Zn)	NA	25.6	1	0.025	0.05	µg/wet g	14.8	11.4	96	76 - 113%	PASS			

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

QUALITY CONTROL REPORT

Sample ID: 111083-MS2 BOT-1 | Matrix: Tissue | Sampled: 13-Sep-23 7:30 | Received: 14-Sep-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
	Method: EPA 245.7					Batch ID: E-27147		Prepared: 30-Oct-23				Analyzed: 31-Oct-23			
Mercury (Hg)	NA	0.18	1	0.00001	0.00002	µg/wet g	0.184	0.00275	96	74 - 131%	PASS	2	30	PASS	
	Method: EPA 6020					Batch ID: E-29047		Prepared: 31-Oct-23				Analyzed: 01-Nov-23			
Aluminum (Al)	NA	32.2	1	1	5	µg/wet g	14.8	18.1	95	63 - 142%	PASS	5	30	PASS	
Antimony (Sb)	NA	15	1	0.025	0.05	µg/wet g	14.8	0	101	87 - 117%	PASS	2	30	PASS	
Arsenic (As)	NA	16.6	1	0.025	0.05	µg/wet g	14.8	1.01	105	84 - 122%	PASS	1	30	PASS	
Barium (Ba)	NA	15.4	1	0.025	0.05	µg/wet g	14.8	0.391	101	74 - 137%	PASS	1	30	PASS	
Beryllium (Be)	NA	14.4	1	0.025	0.05	µg/wet g	14.8	0	97	83 - 119%	PASS	2	30	PASS	
Cadmium (Cd)	NA	16.3	1	0.025	0.05	µg/wet g	14.8	1.4	101	82 - 121%	PASS	2	30	PASS	
Chromium (Cr)	NA	14.7	1	0.025	0.05	µg/wet g	14.8	0.119	99	89 - 119%	PASS	1	30	PASS	
Cobalt (Co)	NA	14.8	1	0.025	0.05	µg/wet g	14.8	0.116	99	86 - 116%	PASS	0	30	PASS	
Copper (Cu)	NA	15.8	1	0.025	0.05	µg/wet g	14.8	1.46	97	83 - 113%	PASS	1	30	PASS	
Iron (Fe)	NA	40.3	1	1	5	µg/wet g	14.8	25.3	101	79 - 136%	PASS	4	30	PASS	
Lead (Pb)	NA	14	1	0.025	0.05	µg/wet g	14.8	0.051	94	79 - 118%	PASS	2	30	PASS	
Molybdenum (Mo)	NA	15.6	1	0.025	0.05	µg/wet g	14.8	0.233	104	83 - 140%	PASS	2	30	PASS	
Nickel (Ni)	NA	14.7	1	0.025	0.05	µg/wet g	14.8	0.225	98	85 - 115%	PASS	2	30	PASS	
Selenium (Se)	NA	16.2	1	0.025	0.05	µg/wet g	14.8	0.481	106	83 - 129%	PASS	2	30	PASS	
Silver (Ag)	NA	1.65	1	0.025	0.05	µg/wet g	1.48	0.054	108	67 - 127%	PASS	16	30	PASS	
Thallium (Tl)	NA	14.2	1	0.025	0.05	µg/wet g	14.8	0	96	75 - 125%	PASS	3	30	PASS	
Vanadium (V)	NA	15.2	1	0.025	0.05	µg/wet g	14.8	0.122	102	92 - 126%	PASS	1	30	PASS	
Zinc (Zn)	NA	26.3	1	0.025	0.05	µg/wet g	14.8	11.4	101	76 - 113%	PASS	5	30	PASS	

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

QUALITY CONTROL REPORT

Sample ID: 111083-R2 BOT-1 | Matrix: Tissue | Sampled: 13-Sep-23 7:30 | Received: 14-Sep-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
Method: EPA 245.7						Batch ID: E-27147		Prepared: 30-Oct-23				Analyzed: 31-Oct-23			
Mercury (Hg)	NA	0.00217	1	0.00001	0.00002	µg/wet g					PASS	24	30	PASS	
Method: EPA 6020						Batch ID: E-29047		Prepared: 31-Oct-23				Analyzed: 01-Nov-23			
Aluminum (Al)	NA	16.4	1	1	5	µg/wet g						10	30	PASS	
Antimony (Sb)	NA	ND	1	0.025	0.05	µg/wet g						0	30	PASS	
Arsenic (As)	NA	1.02	1	0.025	0.05	µg/wet g						1	30	PASS	
Barium (Ba)	NA	0.212	1	0.025	0.05	µg/wet g						59	30	FAIL	SL
Beryllium (Be)	NA	ND	1	0.025	0.05	µg/wet g						0	30	PASS	
Cadmium (Cd)	NA	1.47	1	0.025	0.05	µg/wet g						5	30	PASS	
Chromium (Cr)	NA	0.078	1	0.025	0.05	µg/wet g						42	30	FAIL	SL
Cobalt (Co)	NA	0.118	1	0.025	0.05	µg/wet g						2	30	PASS	
Copper (Cu)	NA	1.45	1	0.025	0.05	µg/wet g						1	30	PASS	
Iron (Fe)	NA	24.7	1	1	5	µg/wet g						2	30	PASS	
Lead (Pb)	NA	0.039	1	0.025	0.05	µg/wet g						27	30	PASS	J
Molybdenum (Mo)	NA	0.207	1	0.025	0.05	µg/wet g						12	30	PASS	
Nickel (Ni)	NA	0.188	1	0.025	0.05	µg/wet g						18	30	PASS	
Selenium (Se)	NA	0.458	1	0.025	0.05	µg/wet g						5	30	PASS	
Silver (Ag)	NA	ND	1	0.025	0.05	µg/wet g						73	30	FAIL	SL
Thallium (Tl)	NA	ND	1	0.025	0.05	µg/wet g						0	30	PASS	
Vanadium (V)	NA	0.115	1	0.025	0.05	µg/wet g						6	30	PASS	
Zinc (Zn)	NA	11.6	1	0.025	0.05	µg/wet g						2	30	PASS	

PCB Congeners

QUALITY CONTROL REPORT

Sample ID: 111080-B1 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 003	Total	ND	1	0.25	0.5	ng/wet g							
PCB 008	Total	ND	1	0.017	0.5	ng/wet g							
PCB 018	Total	ND	1	0.029	0.5	ng/wet g							
PCB 028	Total	ND	1	0.023	0.5	ng/wet g							
PCB 031	Total	ND	1	0.25	0.5	ng/wet g							
PCB 033	Total	ND	1	0.25	0.5	ng/wet g							
PCB 037	Total	ND	1	0.06	0.5	ng/wet g							
PCB 044	Total	ND	1	0.028	0.5	ng/wet g							
PCB 049	Total	ND	1	0.036	0.5	ng/wet g							
PCB 052	Total	ND	1	0.012	0.5	ng/wet g							
PCB 056/60	Total	ND	1	0.25	0.5	ng/wet g							
PCB 066	Total	ND	1	0.027	0.5	ng/wet g							
PCB 070	Total	ND	1	0.023	0.5	ng/wet g							
PCB 074	Total	ND	1	0.021	0.5	ng/wet g							
PCB 077	Total	ND	1	0.018	0.5	ng/wet g							
PCB 081	Total	ND	1	0.084	0.5	ng/wet g							
PCB 087	Total	ND	1	0.081	0.5	ng/wet g							
PCB 095	Total	ND	1	0.25	0.5	ng/wet g							
PCB 097	Total	ND	1	0.25	0.5	ng/wet g							
PCB 099	Total	ND	1	0.028	0.5	ng/wet g							
PCB 101	Total	ND	1	0.027	0.5	ng/wet g							
PCB 105	Total	ND	1	0.047	0.5	ng/wet g							
PCB 110	Total	ND	1	0.074	0.5	ng/wet g							

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 114	Total	ND	1	0.072	0.5	ng/wet g							
PCB 118	Total	ND	1	0.069	0.5	ng/wet g							
PCB 119	Total	ND	1	0.071	0.5	ng/wet g							
PCB 123	Total	ND	1	0.018	0.5	ng/wet g							
PCB 126	Total	ND	1	0.086	0.5	ng/wet g							
PCB 128	Total	ND	1	0.081	0.5	ng/wet g							
PCB 132/168	Total	ND	1	0.094	0.5	ng/wet g							
PCB 138	Total	ND	1	0.057	0.5	ng/wet g							
PCB 141	Total	ND	1	0.25	0.5	ng/wet g							
PCB 149	Total	ND	1	0.092	0.5	ng/wet g							
PCB 151	Total	ND	1	0.073	0.5	ng/wet g							
PCB 153	Total	ND	1	0.065	0.5	ng/wet g							
PCB 156	Total	ND	1	0.089	0.5	ng/wet g							
PCB 157	Total	ND	1	0.103	0.5	ng/wet g							
PCB 158	Total	ND	1	0.074	0.5	ng/wet g							
PCB 167	Total	ND	1	0.049	0.5	ng/wet g							
PCB 169	Total	ND	1	0.116	0.5	ng/wet g							
PCB 170	Total	ND	1	0.118	0.5	ng/wet g							
PCB 174	Total	ND	1	0.25	0.5	ng/wet g							
PCB 177	Total	ND	1	0.085	0.5	ng/wet g							
PCB 180	Total	ND	1	0.154	0.5	ng/wet g							
PCB 183	Total	ND	1	0.056	0.5	ng/wet g							
PCB 187	Total	ND	1	0.168	0.5	ng/wet g							
PCB 189	Total	ND	1	0.109	0.5	ng/wet g							
PCB 194	Total	ND	1	0.164	0.5	ng/wet g							
PCB 195	Total	ND	1	0.093	0.5	ng/wet g							

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 199	Total	ND	1	0.25	0.5	ng/wet g							
PCB 201	Total	ND	1	0.104	0.5	ng/wet g							
PCB 206	Total	ND	1	0.155	0.5	ng/wet g							
PCB 209	Total	ND	1	0.25	0.5	ng/wet g							

PCB Congeners

QUALITY CONTROL REPORT

Sample ID: 111080-BS1 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 003	Total	42.9	1	0.25	0.5	ng/wet g	50	0	86	41 - 122%	PASS			
PCB 008	Total	41.7	1	0.017	0.5	ng/wet g	50	0	83	47 - 123%	PASS			
PCB 018	Total	41.5	1	0.029	0.5	ng/wet g	50	0	83	48 - 123%	PASS			
PCB 028	Total	42.1	1	0.023	0.5	ng/wet g	50	0	84	53 - 121%	PASS			
PCB 031	Total	42.1	1	0.25	0.5	ng/wet g	50	0	84	60 - 118%	PASS			
PCB 033	Total	44.2	1	0.25	0.5	ng/wet g	50	0	88	58 - 120%	PASS			
PCB 037	Total	57.1	1	0.06	0.5	ng/wet g	50	0	114	59 - 121%	PASS			
PCB 044	Total	42.5	1	0.028	0.5	ng/wet g	50	0	85	57 - 126%	PASS			
PCB 049	Total	42.6	1	0.036	0.5	ng/wet g	50	0	85	60 - 124%	PASS			
PCB 052	Total	42.1	1	0.012	0.5	ng/wet g	50	0	84	56 - 130%	PASS			
PCB 056/60	Total	92.8	1	0.25	0.5	ng/wet g	100	0	93	65 - 124%	PASS			
PCB 066	Total	43.6	1	0.027	0.5	ng/wet g	50	0	87	62 - 128%	PASS			
PCB 070	Total	44.8	1	0.023	0.5	ng/wet g	50	0	90	60 - 129%	PASS			
PCB 074	Total	42.9	1	0.021	0.5	ng/wet g	50	0	86	62 - 126%	PASS			
PCB 077	Total	48.7	1	0.018	0.5	ng/wet g	50	0	97	69 - 132%	PASS			
PCB 081	Total	44.8	1	0.084	0.5	ng/wet g	50	0	90	64 - 131%	PASS			
PCB 087	Total	45.4	1	0.081	0.5	ng/wet g	50	0	91	60 - 134%	PASS			
PCB 095	Total	38.2	1	0.25	0.5	ng/wet g	50	0	76	59 - 126%	PASS			
PCB 097	Total	48.1	1	0.25	0.5	ng/wet g	50	0	96	63 - 134%	PASS			
PCB 099	Total	44.4	1	0.028	0.5	ng/wet g	50	0	89	62 - 130%	PASS			
PCB 101	Total	41.8	1	0.027	0.5	ng/wet g	50	0	84	61 - 132%	PASS			
PCB 105	Total	41.1	1	0.047	0.5	ng/wet g	50	0	82	69 - 117%	PASS			
PCB 110	Total	44.1	1	0.074	0.5	ng/wet g	50	0	88	61 - 132%	PASS			

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 114	Total	47.4	1	0.072	0.5	ng/wet g	50	0	95	59 - 141%	PASS			
PCB 118	Total	41.1	1	0.069	0.5	ng/wet g	50	0	82	60 - 139%	PASS			
PCB 119	Total	38.2	1	0.071	0.5	ng/wet g	50	0	76	62 - 130%	PASS			
PCB 123	Total	41.5	1	0.018	0.5	ng/wet g	50	0	83	61 - 139%	PASS			
PCB 126	Total	47.5	1	0.086	0.5	ng/wet g	50	0	95	63 - 148%	PASS			
PCB 128	Total	45.2	1	0.081	0.5	ng/wet g	50	0	90	64 - 140%	PASS			
PCB 132/168	Total	85.4	1	0.094	0.5	ng/wet g	100	0	85	60 - 127%	PASS			
PCB 138	Total	45.4	1	0.057	0.5	ng/wet g	50	0	91	69 - 132%	PASS			
PCB 141	Total	44.5	1	0.25	0.5	ng/wet g	50	0	89	64 - 122%	PASS			
PCB 149	Total	43.5	1	0.092	0.5	ng/wet g	50	0	87	54 - 137%	PASS			
PCB 151	Total	40.8	1	0.073	0.5	ng/wet g	50	0	82	59 - 146%	PASS			
PCB 153	Total	44.7	1	0.065	0.5	ng/wet g	50	0	89	69 - 132%	PASS			
PCB 156	Total	43.9	1	0.089	0.5	ng/wet g	50	0	88	59 - 156%	PASS			
PCB 157	Total	41.6	1	0.103	0.5	ng/wet g	50	0	83	59 - 136%	PASS			
PCB 158	Total	46.8	1	0.074	0.5	ng/wet g	50	0	94	72 - 127%	PASS			
PCB 167	Total	46.4	1	0.049	0.5	ng/wet g	50	0	93	67 - 139%	PASS			
PCB 169	Total	48.4	1	0.116	0.5	ng/wet g	50	0	97	51 - 173%	PASS			
PCB 170	Total	46.5	1	0.118	0.5	ng/wet g	50	0	93	55 - 157%	PASS			
PCB 174	Total	47.4	1	0.25	0.5	ng/wet g	50	0	95	67 - 129%	PASS			
PCB 177	Total	49.5	1	0.085	0.5	ng/wet g	50	0	99	62 - 142%	PASS			
PCB 180	Total	41.5	1	0.154	0.5	ng/wet g	50	0	83	60 - 152%	PASS			
PCB 183	Total	44.2	1	0.056	0.5	ng/wet g	50	0	88	60 - 145%	PASS			
PCB 187	Total	41.9	1	0.168	0.5	ng/wet g	50	0	84	66 - 140%	PASS			
PCB 189	Total	46.9	1	0.109	0.5	ng/wet g	50	0	94	43 - 173%	PASS			
PCB 194	Total	50.6	1	0.164	0.5	ng/wet g	50	0	101	45 - 168%	PASS			
PCB 195	Total	49.6	1	0.093	0.5	ng/wet g	50	0	99	57 - 158%	PASS			

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 199	Total	42.6	1	0.25	0.5	ng/wet g	50	0	85	52 - 137%	PASS			
PCB 201	Total	45	1	0.104	0.5	ng/wet g	50	0	90	59 - 143%	PASS			
PCB 206	Total	47.9	1	0.155	0.5	ng/wet g	50	0	96	46 - 172%	PASS			
PCB 209	Total	44.7	1	0.25	0.5	ng/wet g	50	0	89	50 - 163%	PASS			

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

QUALITY CONTROL REPORT

Sample ID: 111080-BS2 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
PCB 003	Total	39.5	1	0.25	0.5	ng/wet g	50	0	79	41 - 122%	PASS	8	30	PASS	
PCB 008	Total	41.5	1	0.017	0.5	ng/wet g	50	0	83	47 - 123%	PASS	0	30	PASS	
PCB 018	Total	38.6	1	0.029	0.5	ng/wet g	50	0	77	48 - 123%	PASS	8	30	PASS	
PCB 028	Total	40.8	1	0.023	0.5	ng/wet g	50	0	82	53 - 121%	PASS	2	30	PASS	
PCB 031	Total	41.7	1	0.25	0.5	ng/wet g	50	0	83	60 - 118%	PASS	1	30	PASS	
PCB 033	Total	40.1	1	0.25	0.5	ng/wet g	50	0	80	58 - 120%	PASS	10	30	PASS	
PCB 037	Total	53.4	1	0.06	0.5	ng/wet g	50	0	107	59 - 121%	PASS	6	30	PASS	
PCB 044	Total	40.8	1	0.028	0.5	ng/wet g	50	0	82	57 - 126%	PASS	4	30	PASS	
PCB 049	Total	40.7	1	0.036	0.5	ng/wet g	50	0	81	60 - 124%	PASS	5	30	PASS	
PCB 052	Total	39.7	1	0.012	0.5	ng/wet g	50	0	79	56 - 130%	PASS	6	30	PASS	
PCB 056/60	Total	83.5	1	0.25	0.5	ng/wet g	100	0	83	65 - 124%	PASS	10	30	PASS	
PCB 066	Total	39.1	1	0.027	0.5	ng/wet g	50	0	78	62 - 128%	PASS	11	30	PASS	
PCB 070	Total	40.9	1	0.023	0.5	ng/wet g	50	0	82	60 - 129%	PASS	9	30	PASS	
PCB 074	Total	43.6	1	0.021	0.5	ng/wet g	50	0	87	62 - 126%	PASS	1	30	PASS	
PCB 077	Total	56.7	1	0.018	0.5	ng/wet g	50	0	113	69 - 132%	PASS	15	30	PASS	
PCB 081	Total	43.2	1	0.084	0.5	ng/wet g	50	0	86	64 - 131%	PASS	5	30	PASS	
PCB 087	Total	47.5	1	0.081	0.5	ng/wet g	50	0	95	60 - 134%	PASS	4	30	PASS	
PCB 095	Total	37.6	1	0.25	0.5	ng/wet g	50	0	75	59 - 126%	PASS	1	30	PASS	
PCB 097	Total	41.2	1	0.25	0.5	ng/wet g	50	0	82	63 - 134%	PASS	16	30	PASS	
PCB 099	Total	41.3	1	0.028	0.5	ng/wet g	50	0	83	62 - 130%	PASS	7	30	PASS	
PCB 101	Total	37.7	1	0.027	0.5	ng/wet g	50	0	75	61 - 132%	PASS	11	30	PASS	
PCB 105	Total	39.2	1	0.047	0.5	ng/wet g	50	0	78	69 - 117%	PASS	5	30	PASS	
PCB 110	Total	43.2	1	0.074	0.5	ng/wet g	50	0	86	61 - 132%	PASS	2	30	PASS	

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
PCB 114	Total	44.6	1	0.072	0.5	ng/wet g	50	0	89	59 - 141%	PASS	7	30	PASS	
PCB 118	Total	44	1	0.069	0.5	ng/wet g	50	0	88	60 - 139%	PASS	7	30	PASS	
PCB 119	Total	39.8	1	0.071	0.5	ng/wet g	50	0	80	62 - 130%	PASS	5	30	PASS	
PCB 123	Total	41	1	0.018	0.5	ng/wet g	50	0	82	61 - 139%	PASS	1	30	PASS	
PCB 126	Total	42.3	1	0.086	0.5	ng/wet g	50	0	85	63 - 148%	PASS	11	30	PASS	
PCB 128	Total	44.2	1	0.081	0.5	ng/wet g	50	0	88	64 - 140%	PASS	2	30	PASS	
PCB 132/168	Total	79.1	1	0.094	0.5	ng/wet g	100	0	79	60 - 127%	PASS	7	30	PASS	
PCB 138	Total	41.5	1	0.057	0.5	ng/wet g	50	0	83	69 - 132%	PASS	9	30	PASS	
PCB 141	Total	37.4	1	0.25	0.5	ng/wet g	50	0	75	64 - 122%	PASS	17	30	PASS	
PCB 149	Total	38.9	1	0.092	0.5	ng/wet g	50	0	78	54 - 137%	PASS	11	30	PASS	
PCB 151	Total	44.2	1	0.073	0.5	ng/wet g	50	0	88	59 - 146%	PASS	7	30	PASS	
PCB 153	Total	41.3	1	0.065	0.5	ng/wet g	50	0	83	69 - 132%	PASS	7	30	PASS	
PCB 156	Total	44.1	1	0.089	0.5	ng/wet g	50	0	88	59 - 156%	PASS	0	30	PASS	
PCB 157	Total	39	1	0.103	0.5	ng/wet g	50	0	78	59 - 136%	PASS	6	30	PASS	
PCB 158	Total	38.6	1	0.074	0.5	ng/wet g	50	0	77	72 - 127%	PASS	20	30	PASS	
PCB 167	Total	40.5	1	0.049	0.5	ng/wet g	50	0	81	67 - 139%	PASS	14	30	PASS	
PCB 169	Total	44.3	1	0.116	0.5	ng/wet g	50	0	89	51 - 173%	PASS	9	30	PASS	
PCB 170	Total	47.2	1	0.118	0.5	ng/wet g	50	0	94	55 - 157%	PASS	1	30	PASS	
PCB 174	Total	44	1	0.25	0.5	ng/wet g	50	0	88	67 - 129%	PASS	8	30	PASS	
PCB 177	Total	42.9	1	0.085	0.5	ng/wet g	50	0	86	62 - 142%	PASS	14	30	PASS	
PCB 180	Total	42	1	0.154	0.5	ng/wet g	50	0	84	60 - 152%	PASS	1	30	PASS	
PCB 183	Total	40.7	1	0.056	0.5	ng/wet g	50	0	81	60 - 145%	PASS	8	30	PASS	
PCB 187	Total	39.2	1	0.168	0.5	ng/wet g	50	0	78	66 - 140%	PASS	7	30	PASS	
PCB 189	Total	40.3	1	0.109	0.5	ng/wet g	50	0	81	43 - 173%	PASS	15	30	PASS	
PCB 194	Total	40.4	1	0.164	0.5	ng/wet g	50	0	81	45 - 168%	PASS	22	30	PASS	
PCB 195	Total	43.2	1	0.093	0.5	ng/wet g	50	0	86	57 - 158%	PASS	14	30	PASS	

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
PCB 199	Total	36.4	1	0.25	0.5	ng/wet g	50	0	73	52 - 137%	PASS	15	30	PASS	
PCB 201	Total	39.4	1	0.104	0.5	ng/wet g	50	0	79	59 - 143%	PASS	13	30	PASS	
PCB 206	Total	46.1	1	0.155	0.5	ng/wet g	50	0	92	46 - 172%	PASS	4	30	PASS	
PCB 209	Total	58.3	1	0.25	0.5	ng/wet g	50	0	117	50 - 163%	PASS	27	30	PASS	

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 111082-CRM1	**QAQC CRM - SRM 1946**					**Matrix: Tissue**		**Sampled:**				**Received:**		
	Method: EPA 8270E					Batch ID: O-43054		Prepared: 14-Nov-23				Analyzed: 19-Nov-23		
PCB 018	Total	0.78	1	0.029	0.5	ng/wet g	0.84		93	60 - 140%	PASS			
PCB 028	Total	2.74	1	0.023	0.5	ng/wet g	2		137	60 - 140%	PASS			
PCB 031	Total	1.78	1	0.25	0.5	ng/wet g	1.46		122	60 - 140%	PASS			
PCB 044	Total	5.14	1	0.028	0.5	ng/wet g	4.66		110	60 - 140%	PASS			
PCB 049	Total	3.53	1	0.036	0.5	ng/wet g	3.8		93	60 - 140%	PASS			
PCB 052	Total	8.4	1	0.012	0.5	ng/wet g	8.1		104	60 - 140%	PASS			
PCB 056/60	Total	7.15	1	0.25	0.5	ng/wet g	5.77		124	60 - 140%	PASS			
PCB 066	Total	12.6	1	0.027	0.5	ng/wet g	10.8		117	60 - 140%	PASS			
PCB 070	Total	10.5	1	0.023	0.5	ng/wet g	14.9		70	60 - 140%	PASS			
PCB 074	Total	4.84	1	0.021	0.5	ng/wet g	4.83		100	60 - 140%	PASS			
PCB 077	Total	0.333	1	0.018	0.5	ng/wet g	0.327		102	80 - 120%	PASS			
PCB 087	Total	10.4	1	0.081	0.5	ng/wet g	9.4		111	60 - 140%	PASS			
PCB 095	Total	10.9	1	0.25	0.5	ng/wet g	11.4		96	60 - 140%	PASS			
PCB 099	Total	20.6	1	0.028	0.5	ng/wet g	25.6		80	60 - 140%	PASS			
PCB 101	Total	30.6	1	0.027	0.5	ng/wet g	34.6		88	60 - 140%	PASS			
PCB 105	Total	19.6	1	0.047	0.5	ng/wet g	19.9		98	60 - 140%	PASS			
PCB 110	Total	18.6	1	0.074	0.5	ng/wet g	22.8		82	60 - 140%	PASS			
PCB 118	Total	37	1	0.069	0.5	ng/wet g	52.1		71	60 - 140%	PASS			
PCB 128	Total	21.9	1	0.081	0.5	ng/wet g	22.8		96	60 - 140%	PASS			
PCB 138	Total	114	1	0.057	0.5	ng/wet g	115		99	60 - 140%	PASS			
PCB 149	Total	18.8	1	0.092	0.5	ng/wet g	26.3		71	60 - 140%	PASS			
PCB 153	Total	187	1	0.065	0.5	ng/wet g	170		110	60 - 140%	PASS			
PCB 156	Total	8.61	1	0.089	0.5	ng/wet g	9.52		90	60 - 140%	PASS			

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 158	Total	8.78	1	0.074	0.5	ng/wet g	7.66		115	60 - 140%	PASS			
PCB 169	Total	0.112	1	0.116	0.5	ng/wet g	0.106		106	80 - 120%	PASS			
PCB 170	Total	23.4	1	0.118	0.5	ng/wet g	25.2		92	60 - 140%	PASS			
PCB 174	Total	7.84	1	0.25	0.5	ng/wet g	9.3		84	60 - 140%	PASS			
PCB 180	Total	63.4	1	0.154	0.5	ng/wet g	74.4		85	60 - 140%	PASS			
PCB 183	Total	18.9	1	0.056	0.5	ng/wet g	21.9		86	60 - 140%	PASS			
PCB 187	Total	54.6	1	0.168	0.5	ng/wet g	55.2		99	60 - 140%	PASS			
PCB 194	Total	10.7	1	0.164	0.5	ng/wet g	13		82	60 - 140%	PASS			
PCB 195	Total	4.8	1	0.093	0.5	ng/wet g	5.3		91	60 - 140%	PASS			
PCB 201	Total	1.89	1	0.104	0.5	ng/wet g	2.83		67	60 - 140%	PASS			
PCB 206	Total	5.12	1	0.155	0.5	ng/wet g	5.4		95	60 - 140%	PASS			
PCB 209	Total	1.09	1	0.25	0.5	ng/wet g	1.3		84	60 - 140%	PASS			

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons — QUALITY CONTROL REPORT

Sample ID: 111080-B1 — **QAQC Procedural Blank** — **Matrix: BlankMatrix** — **Sampled:** — **Received:**

Method: EPA 8270E — Batch ID: O-43054 — Prepared: 14-Nov-23 — Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(d10-Acenaphthene)	Total	90	1			% Recovery	100		90	27 - 133% PASS			
(d10-Phenanthrene)	Total	101	1			% Recovery	100		101	43 - 129% PASS			
(d12-Chrysene)	Total	99	1			% Recovery	100		99	52 - 144% PASS			
(d12-Perylene)	Total	88	1			% Recovery	100		88	36 - 161% PASS			
(d8-Naphthalene)	Total	93	1			% Recovery	100		93	25 - 125% PASS			
1-Methylnaphthalene	Total	ND	1	1	5	ng/wet g							
1-Methylphenanthrene	Total	ND	1	1	5	ng/wet g							
2,3,5-Trimethylnaphthalene	Total	ND	1	1	5	ng/wet g							
2,6-Dimethylnaphthalene	Total	ND	1	1	5	ng/wet g							
2-Methylnaphthalene	Total	ND	1	1	5	ng/wet g							
Acenaphthene	Total	ND	1	1	5	ng/wet g							
Acenaphthylene	Total	ND	1	1	5	ng/wet g							
Anthracene	Total	ND	1	1	5	ng/wet g							
Benz[a]anthracene	Total	ND	1	1	5	ng/wet g							
Benzo[a]pyrene	Total	ND	1	1	5	ng/wet g							
Benzo[b]fluoranthene	Total	ND	1	1	5	ng/wet g							
Benzo[e]pyrene	Total	ND	1	1	5	ng/wet g							
Benzo[g,h,i]perylene	Total	ND	1	1	5	ng/wet g							
Benzo[k]fluoranthene	Total	ND	1	1	5	ng/wet g							
Biphenyl	Total	ND	1	1	5	ng/wet g							
Chrysene	Total	ND	1	1	5	ng/wet g							
Dibenz[a,h]anthracene	Total	ND	1	1	5	ng/wet g							
Dibenzothiophene	Total	ND	1	1	5	ng/wet g							

Polynuclear Aromatic Hydrocarbons

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Fluoranthene	Total	ND	1	1	5	ng/wet g							
Fluorene	Total	ND	1	1	5	ng/wet g							
Indeno[1,2,3-cd]pyrene	Total	ND	1	1	5	ng/wet g							
Naphthalene	Total	ND	1	1	5	ng/wet g							
Perylene	Total	ND	1	1	5	ng/wet g							
Phenanthrene	Total	ND	1	1	5	ng/wet g							
Pyrene	Total	ND	1	1	5	ng/wet g							

Polynuclear Aromatic Hydrocarbons QUALITY CONTROL REPORT

Sample ID: 111080-BS1 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(d10-Acenaphthene)	Total	82	1			% Recovery	100	0	82	27 - 133% PASS			
(d10-Phenanthrene)	Total	92	1			% Recovery	100	0	92	43 - 129% PASS			
(d12-Chrysene)	Total	92	1			% Recovery	100	0	92	52 - 144% PASS			
(d12-Perylene)	Total	77	1			% Recovery	100	0	77	36 - 161% PASS			
(d8-Naphthalene)	Total	87	1			% Recovery	100	0	87	25 - 125% PASS			
1-Methylnaphthalene	Total	398	1	1	5	ng/wet g	500	0	80	31 - 128% PASS			
1-Methylphenanthrene	Total	446	1	1	5	ng/wet g	500	0	89	67 - 127% PASS			
2,3,5-Trimethylnaphthalene	Total	398	1	1	5	ng/wet g	500	0	80	55 - 122% PASS			
2,6-Dimethylnaphthalene	Total	390	1	1	5	ng/wet g	500	0	78	48 - 120% PASS			
2-Methylnaphthalene	Total	401	1	1	5	ng/wet g	500	0	80	37 - 123% PASS			
Acenaphthene	Total	392	1	1	5	ng/wet g	500	0	78	42 - 131% PASS			
Acenaphthylene	Total	394	1	1	5	ng/wet g	500	0	79	45 - 128% PASS			
Anthracene	Total	414	1	1	5	ng/wet g	500	0	83	57 - 119% PASS			
Benz[a]anthracene	Total	454	1	1	5	ng/wet g	500	0	91	37 - 182% PASS			
Benzo[a]pyrene	Total	405	1	1	5	ng/wet g	500	0	81	51 - 159% PASS			
Benzo[b]fluoranthene	Total	459	1	1	5	ng/wet g	500	0	92	42 - 187% PASS			
Benzo[e]pyrene	Total	457	1	1	5	ng/wet g	500	0	91	58 - 158% PASS			
Benzo[g,h,i]perylene	Total	420	1	1	5	ng/wet g	500	0	84	82 - 121% PASS			
Benzo[k]fluoranthene	Total	409	1	1	5	ng/wet g	500	0	82	58 - 150% PASS			
Biphenyl	Total	396	1	1	5	ng/wet g	500	0	79	42 - 122% PASS			
Chrysene	Total	445	1	1	5	ng/wet g	500	0	89	59 - 138% PASS			
Dibenz[a,h]anthracene	Total	502	1	1	5	ng/wet g	500	0	100	59 - 146% PASS			
Dibenzothiophene	Total	290	1	1	5	ng/wet g	500	0	58	46 - 126% PASS			

Polynuclear Aromatic Hydrocarbons

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Fluoranthene	Total	453	1	1	5	ng/wet g	500	0	91	63 - 142%	PASS			
Fluorene	Total	406	1	1	5	ng/wet g	500	0	81	50 - 132%	PASS			
Indeno[1,2,3-cd]pyrene	Total	516	1	1	5	ng/wet g	500	0	103	52 - 151%	PASS			
Naphthalene	Total	409	1	1	5	ng/wet g	500	0	82	25 - 130%	PASS			
Perylene	Total	368	1	1	5	ng/wet g	500	0	74	43 - 147%	PASS			
Phenanthrene	Total	429	1	1	5	ng/wet g	500	0	86	59 - 133%	PASS			
Pyrene	Total	471	1	1	5	ng/wet g	500	0	94	67 - 136%	PASS			

Polynuclear Aromatic Hydrocarbons — QUALITY CONTROL REPORT

Sample ID: 111080-BS2 **QAQC Procedural Blank** **Matrix:** BlankMatrix **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43054 Prepared: 14-Nov-23 Analyzed: 19-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
(d10-Acenaphthene)	Total	85	1			% Recovery	100	0	85	27 - 133%	PASS	4	30	PASS	
(d10-Phenanthrene)	Total	92	1			% Recovery	100	0	92	43 - 129%	PASS	0	30	PASS	
(d12-Chrysene)	Total	94	1			% Recovery	100	0	94	52 - 144%	PASS	2	30	PASS	
(d12-Perylene)	Total	79	1			% Recovery	100	0	79	36 - 161%	PASS	3	30	PASS	
(d8-Naphthalene)	Total	89	1			% Recovery	100	0	89	25 - 125%	PASS	2	30	PASS	
1-Methylnaphthalene	Total	404	1	1	5	ng/wet g	500	0	81	31 - 128%	PASS	1	30	PASS	
1-Methylphenanthrene	Total	453	1	1	5	ng/wet g	500	0	91	67 - 127%	PASS	2	30	PASS	
2,3,5-Trimethylnaphthalene	Total	410	1	1	5	ng/wet g	500	0	82	55 - 122%	PASS	2	30	PASS	
2,6-Dimethylnaphthalene	Total	395	1	1	5	ng/wet g	500	0	79	48 - 120%	PASS	1	30	PASS	
2-Methylnaphthalene	Total	414	1	1	5	ng/wet g	500	0	83	37 - 123%	PASS	4	30	PASS	
Acenaphthene	Total	400	1	1	5	ng/wet g	500	0	80	42 - 131%	PASS	3	30	PASS	
Acenaphthylene	Total	406	1	1	5	ng/wet g	500	0	81	45 - 128%	PASS	2	30	PASS	
Anthracene	Total	410	1	1	5	ng/wet g	500	0	82	57 - 119%	PASS	1	30	PASS	
Benz[a]anthracene	Total	452	1	1	5	ng/wet g	500	0	90	37 - 182%	PASS	1	30	PASS	
Benzo[a]pyrene	Total	414	1	1	5	ng/wet g	500	0	83	51 - 159%	PASS	2	30	PASS	
Benzo[b]fluoranthene	Total	458	1	1	5	ng/wet g	500	0	92	42 - 187%	PASS	0	30	PASS	
Benzo[e]pyrene	Total	465	1	1	5	ng/wet g	500	0	93	58 - 158%	PASS	2	30	PASS	
Benzo[g,h,i]perylene	Total	423	1	1	5	ng/wet g	500	0	85	82 - 121%	PASS	1	30	PASS	
Benzo[k]fluoranthene	Total	403	1	1	5	ng/wet g	500	0	81	58 - 150%	PASS	1	30	PASS	
Biphenyl	Total	396	1	1	5	ng/wet g	500	0	79	42 - 122%	PASS	0	30	PASS	
Chrysene	Total	446	1	1	5	ng/wet g	500	0	89	59 - 138%	PASS	0	30	PASS	
Dibenz[a,h]anthracene	Total	473	1	1	5	ng/wet g	500	0	95	59 - 146%	PASS	5	30	PASS	
Dibenzothiophene	Total	318	1	1	5	ng/wet g	500	0	64	46 - 126%	PASS	10	30	PASS	

Polynuclear Aromatic Hydrocarbons

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
Fluoranthene	Total	460	1	1	5	ng/wet g	500	0	92	63 - 142%	PASS	1	30	PASS	
Fluorene	Total	402	1	1	5	ng/wet g	500	0	80	50 - 132%	PASS	1	30	PASS	
Indeno[1,2,3-cd]pyrene	Total	508	1	1	5	ng/wet g	500	0	102	52 - 151%	PASS	1	30	PASS	
Naphthalene	Total	421	1	1	5	ng/wet g	500	0	84	25 - 130%	PASS	2	30	PASS	
Perylene	Total	390	1	1	5	ng/wet g	500	0	78	43 - 147%	PASS	5	30	PASS	
Phenanthrene	Total	434	1	1	5	ng/wet g	500	0	87	59 - 133%	PASS	1	30	PASS	
Pyrene	Total	471	1	1	5	ng/wet g	500	0	94	67 - 136%	PASS	0	30	PASS	

Total Extractable Organics

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 111080-B1	**QAQC Procedural Blank**					**Matrix: BlankMatrix**	**Sampled:**			**Received:**			
	Method: Gravimetric					Batch ID: C-54129	Prepared: 16-Nov-23			Analyzed: 17-Nov-23			
Percent Lipids	NA	ND	1	0.01	0.05	% wet weight							
Sample ID: 111082-CRM1	**QAQC CRM - SRM 1946**					**Matrix: Tissue**	**Sampled:**			**Received:**			
	Method: Gravimetric					Batch ID: C-54129	Prepared: 16-Nov-23			Analyzed: 17-Nov-23			
Percent Lipids	NA	10.3	1	0.01	0.05	ng/wet g	10.2		101	80 - 120%	PASS		

PHYSIS
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-001
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Conventionals

QUALITY CONTROL REPORT

SAMPLE ID		BATCH ID	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODE
Percent Solids		**Method: SM 2540 B**			**Fraction: NA**				**Prepared: 14-Nov-23**			**Analyzed: 16-Nov-23**		
111080-B1	QAQC Procedural Blank	C-78004	ND	1	0.1	0.1	%							
112325-R2	BOT-3	C-78004	16.3	1	0.1	0.1	%					0	30	PASS

CHAIN OF CUSTODY

TENERA
Environmental, Inc.
141 Suburban Road, Suite A2
San Luis Obispo, CA 93401
805.541.0310 [phone] 805.541.0421 [fax]

CHAIN OF CUSTODY FORM

Total Number of Samples: 150

Samples Sent From:
Tenera Environmental
141 suburban Rd., Suite A2
San Luis Obispo, CA 93401

Samples Sent To:
Physis Labs (Attn: Sample Logistics)
1904 E. Wright Circle
Anaheim, CA 92806

Client Information:
Tenera Environmental
141 suburban Rd., Suite A2
San Luis Obispo, CA 93401

Project Number: 22238101
Shipping Method: Fed-Ex Priority Overnight
Tracking #: 783704371652
Project Location: Santa Barbara Channel
Field Sampled By: KMJ, GRC, PMK, HAW

Sample Description: 150 mussels in plastic cooler w/wet ice.
Requested Analyses: See attached list of parameters to be tested
Contact Info: jphelan@tenera.com Kjohnson@tenera.com, 805.541.0310

Sample Number	Collection Date	Collection Time	# of Cont.	Analysis	Sample Number	Collection Date	Collection Time	# of Cont.	Preservative
BOT-1	09/13/23	7:30 AM	1	See attached list.					

Relinquished By:	Date/Time:	Relinquished To:	Date/Time:
Kathleen Johnson	9/13/2023 @ 8:00 am	Fed-Ex Priority Overnight	9/13/2023 @ 8:00 am
Fed-Ex Priority Overnight	9/14/2023 @	Physis Labs Yrheng	9/14/23 0945

*Please complete the highlighted portion and scan and email to Kjohnson@tenera.com

[redacted]

List of parameters to be tested.

Parameters	Method	Lowest Value	MDL	RL	Units
Trace Metals					
Silver (Ag)	EPA 6020		0.025	0.05	µg/wet g
Aluminum (Al)	EPA 6020	75	1	5	µg/wet g
Antimony (Sb)	EPA 6020	0.021	0.025	0.05	µg/wet g
Arsenic (As)	EPA 6020	7	0.025	0.05	µg/wet g
Barium (Ba)	EPA 6020	0.6	0.025	0.05	µg/wet g
Beryllium (Be)	EPA 6020	0.032	0.025	0.05	µg/wet g
Cadmium (Cd)	EPA 6020	1	0.025	0.05	µg/wet g
Chromium (Cr)	EPA 6020	1.5	0.025	0.05	µg/wet g
Cobalt (Co)	EPA 6020	0.3	0.025	0.05	µg/wet g
Copper (Cu)	EPA 6020	4.5	0.025	0.05	µg/wet g
Iron (Fe)	EPA 6020	125	1	5	µg/wet g
Lead (Pb)	EPA 6020	0.5	0.025	0.05	µg/wet g
Molybdenum (Mo)	EPA 6020	1	0.025	0.05	µg/wet g
Nickel (Ni)	EPA 6020	0.75	0.025	0.05	µg/wet g
Selenium (Se)	EPA 6020	5	0.025	0.05	µg/wet g
Thallium (Tl)	EPA 6020	0.014	0.025	0.05	µg/wet g
Vanadium (V)	EPA 6020	0.3	0.025	0.05	µg/wet g
Zinc (Zn)	EPA 6020	100	0.025	0.05	µg/wet g
Trace Mercury	EPA 245.7	0.045	0.00001	0.00002	µg/wet g
Chlorinated Pesticides					
2,4'-DDD	EPA 8270E	0.025	0.267	0.5	ng/wet g
2,4'-DDE	EPA 8270E	0.025	0.2	0.5	ng/wet g
2,4'-DDT	EPA 8270E	0.025	0.194	0.5	ng/wet g
4,4'-DDD	EPA 8270E	0.025	0.198	0.5	ng/wet g
4,4'-DDE	EPA 8270E	0.025	0.193	0.5	ng/wet g
4,4'-DDT	EPA 8270E	0.025	0.128	0.5	ng/wet g
BHC-alpha	EPA 8270E	0.002	0.25	0.5	ng/wet g
BHC-beta	EPA 8270E	0.002	0.25	0.5	ng/wet g
BHC-delta	EPA 8270E	0.002	0.25	0.5	ng/wet g
BHC-gamma	EPA 8270E	0.002	0.25	0.5	ng/wet g
Chlordane-alpha	EPA 8270E	0.003	0.187	0.5	ng/wet g
Chlordane-gamma	EPA 8270E	0.003	0.179	0.5	ng/wet g
cis-Nonachlor	EPA 8270E	0.003	0.192	0.5	ng/wet g

Parameters	Method	Lowest Value	MDL	RL	Units
Dieldrin	EPA 8270E	0.0001	0.1	0.2	ng/wet g
Oxychlordane	EPA 8270E	0.003	0.25	0.5	ng/wet g
trans-Nonachlor	EPA 8270E	0.003	0.186	0.5	ng/wet g
Aroclor PCBs					
Aroclor 1016	EPA 8270E	0.039	10	20	ng/wet g
Aroclor 1221	EPA 8270E	0.039	10	20	ng/wet g
Aroclor 1232	EPA 8270E	0.039	10	20	ng/wet g
Aroclor 1242	EPA 8270E	0.039	10	20	ng/wet g
Aroclor 1248	EPA 8270E	0.039	10	20	ng/wet g
Aroclor 1254	EPA 8270E	0.039	10	20	ng/wet g
Aroclor 1260	EPA 8270E	0.039	10	20	ng/wet g
PCB Congeners					
PCB 003	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 008	EPA 8270E	0.01	0.017	0.5	ng/wet g
PCB 018	EPA 8270E	0.01	0.029	0.5	ng/wet g
PCB 028	EPA 8270E	0.01	0.023	0.5	ng/wet g
PCB 031	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 033	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 037	EPA 8270E	0.01	0.06	0.5	ng/wet g
PCB 044	EPA 8270E	0.01	0.028	0.5	ng/wet g
PCB 049	EPA 8270E	0.01	0.036	0.5	ng/wet g
PCB 052	EPA 8270E	0.01	0.012	0.5	ng/wet g
PCB 056/60	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 066	EPA 8270E	0.01	0.027	0.5	ng/wet g
PCB 070	EPA 8270E	0.01	0.023	0.5	ng/wet g
PCB 074	EPA 8270E	0.01	0.021	0.5	ng/wet g
PCB 077	EPA 8270E	0.01	0.018	0.5	ng/wet g
PCB 081	EPA 8270E	0.01	0.084	0.5	ng/wet g
PCB 087	EPA 8270E	0.01	0.081	0.5	ng/wet g
PCB 095	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 097	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 099	EPA 8270E	0.01	0.028	0.5	ng/wet g
PCB 101	EPA 8270E	0.01	0.027	0.5	ng/wet g
PCB 105	EPA 8270E	0.01	0.047	0.5	ng/wet g
PCB 110	EPA 8270E	0.01	0.074	0.5	ng/wet g
PCB 114	EPA 8270E	0.01	0.072	0.5	ng/wet g
PCB 118	EPA 8270E	0.01	0.069	0.5	ng/wet g
PCB 119	EPA 8270E	0.01	0.071	0.5	ng/wet g
PCB 123	EPA 8270E	0.01	0.018	0.5	ng/wet g
PCB 126	EPA 8270E	0.01	0.086	0.5	ng/wet g

Parameters	Method	Lowest Value	MDL	RL	Units
PCB 128	EPA 8270E	0.01	0.081	0.5	ng/wet g
PCB 138	EPA 8270E	0.01	0.057	0.5	ng/wet g
PCB 141	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 149	EPA 8270E	0.01	0.092	0.5	ng/wet g
PCB 151	EPA 8270E	0.01	0.073	0.5	ng/wet g
PCB 153	EPA 8270E	0.01	0.065	0.5	ng/wet g
PCB 156	EPA 8270E	0.01	0.089	0.5	ng/wet g
PCB 157	EPA 8270E	0.01	0.103	0.5	ng/wet g
PCB 158	EPA 8270E	0.01	0.074	0.5	ng/wet g
PCB 167	EPA 8270E	0.01	0.049	0.5	ng/wet g
PCB 132/168	EPA 8270E	0.01	0.094	0.5	ng/wet g
PCB 169	EPA 8270E	0.01	0.116	0.5	ng/wet g
PCB 170	EPA 8270E	0.01	0.118	0.5	ng/wet g
PCB 174	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 177	EPA 8270E	0.01	0.085	0.5	ng/wet g
PCB 180	EPA 8270E	0.01	0.154	0.5	ng/wet g
PCB 183	EPA 8270E	0.01	0.056	0.5	ng/wet g
PCB 187	EPA 8270E	0.01	0.168	0.5	ng/wet g
PCB 189	EPA 8270E	0.01	0.109	0.5	ng/wet g
PCB 194	EPA 8270E	0.01	0.164	0.5	ng/wet g
PCB 195	EPA 8270E	0.01	0.093	0.5	ng/wet g
PCB 199	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 201	EPA 8270E	0.01	0.104	0.5	ng/wet g
PCB 206	EPA 8270E	0.01	0.155	0.5	ng/wet g
PCB 209	EPA 8270E	0.01	0.25	0.5	ng/wet g
PAHs					
1-Methylnaphthalene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
1-Methylphenanthrene	EPA 8270E	0.00206	0.2	0.5	ng/wet g
2,3,5-Trimethylnaphthalene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
2,6-Dimethylnaphthalene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
2-Methylnaphthalene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
Acenaphthene	EPA 8270E		0.2	0.5	ng/wet g
Acenaphthylene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
Anthracene	EPA 8270E	0.00206	0.2	0.5	ng/wet g
Benz[a]anthracene	EPA 8270E	0.00206	0.2	0.5	ng/wet g
Benzo[a]pyrene	EPA 8270E	0.00197	0.2	0.5	ng/wet g
Benzo[b]fluoranthene	EPA 8270E	0.00197	0.2	0.5	ng/wet g

Parameters	Method	Lowest Value	MDL	RL	Units
Benzo[e]pyrene	EPA 8270E	0.00197	0.2	0.5	ng/wet g
Benzo[g,h,i]perylene	EPA 8270E		0.2	0.5	ng/wet g
Benzo[k]fluoranthene	EPA 8270E	0.00197	0.2	0.5	ng/wet g
Biphenyl	EPA 8270E		0.2	0.5	ng/wet g
Chrysene	EPA 8270E	0.00132	0.2	0.5	ng/wet g
Dibenz[a,h]anthracene	EPA 8270E	0.00206	0.2	0.5	ng/wet g
Dibenzothiophene	EPA 8270E	0.00812	0.2	0.5	ng/wet g
Fluoranthene	EPA 8270E	0.00197	0.2	0.5	ng/wet g
Fluorene	EPA 8270E	0.00221	0.2	0.5	ng/wet g
Indeno[1,2,3-cd]pyrene	EPA 8270E	0.00197	0.2	0.5	ng/wet g
Naphthalene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
Perylene	EPA 8270E		0.2	0.5	ng/wet g
Phenanthrene	EPA 8270E	0.00206	0.2	0.5	ng/wet g
Pyrene	EPA 8270E	0.00197	0.2	0.5	ng/wet g
Other					
Percent Solids	SM 2540 B	--	0.1	0.1	%
Percent Lipids	Gravimetric	--	0.01	0.05	% wet weight

PHYSIS
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

Project Iteration ID:	2309005-001
Client Name:	Tenera Environmental, Inc.
Project Name:	Santa Barbara Channel PO # 22238101
COC Page Number:	6 of 6
Bottle Label Color:	NA

Sample Receipt Summary

Receiving Info

1. Initials Received By: yc
2. Date Received: 9/14/23
3. Time Received: 0935
4. Client Name: Tenera environmental
5. Courier Information: (Please circle)
   - Client
   - UPS
   - Area Fast
   - DRS
   - (FedEx) [circled]
   - GSO/GLS
   - Ontrac
   - PAMS
   - PHYSIS Driver:
     - i. Start Time: ______
     - ii. End Time: ______
     - iii. Total Mileage: ______
     - iv. Number of Pickups: ______
6. Container Information: (Please put the # of containers or circle none)
   - 1 Cooler
   - __ Styrofoam Cooler
   - ____ Boxes
   - None
   - ___ Carboy(s)
   - __Carboy Trash Can(s)
   - ____ Carboy Cap(s)
   - Other ______
7. What type of ice was used: (Please circle any that apply)
   - (Wet Ice) [circled]
   - Blue Ice
   - Dry Ice
   - Water
   - None
8. ~~Randomly~~ Selected Samples Temperature (°C): 3.3 Used I/R Thermometer # 1-2

Inspection Info

1. Initials Inspected By: RGH

Sample Integrity Upon Receipt:

1.	COC(s) included and completely filled out	(Yes)	/	No
2.	All sample containers arrived intact	(Yes)	/	No
3.	All samples listed on COC(s) are present	(Yes)	/	No
4.	Information on containers consistent with information on COC(s)	(Yes)	/	No
5.	Correct containers and volume for all analyses indicated	(Yes)	/	No
6.	All samples received within method holding time	(Yes)	/	No
7.	Correct preservation used for all analyses indicated	(Yes)	/	No
8.	Name of sampler included on COC(s)	Yes	/	(No)

Notes:

January 16, 2024

Kaitlin Johnson
Tenera Environmental, Inc.
141 Suburban Rd SPC A2
San Luis Obispo, CA 93401-

Project Name: Santa Barbara Channel PO # 22238101
Physis Project ID: 2309005-002

Dear Kaitlin,

Enclosed are the analytical results for samples submitted to PHYSIS Environmental Laboratories, Inc. (PHYSIS) on 11/8/2023. A total of 17 samples were received for analysis in accordance with the attached chain of custody (COC). Per the COC, the samples were analyzed for:

Elements
Trace Metals by EPA 6020
Trace Mercury by EPA 245.7
Organics
Polynuclear Aromatic Hydrocarbons by EPA 8270E
Percent Solids by SM 2540 B
Percent Lipids by Gravimetric
Organochlorine Pesticides & PCB Congeners/Aroclors by EPA 8270E

Analytical results in this report apply only to samples submitted to PHYSIS in accordance with the COC and are intended to be considered in their entirety.

Please feel free to contact me at any time with any questions. PHYSIS appreciates the opportunity to provide you with our analytical and support services.

Regards,

Rachel Hansen
714 602-5320
Extension 203
rachelhansen@physislabs.com

PROJECT SAMPLE LIST

Tenera Environmental, Inc. PHYSIS Project ID: 2309005-002

Santa Barbara Channel PO # 22238101 Total Samples: 17

PHYSIS ID	Sample ID	Description	Date	Time	Matrix	Sample Type
112747	Shallow Ref-1		11/8/2023		Tissue	Not Specified
112748	Shallow Ref-2		11/8/2023		Tissue	Not Specified
112749	Deep Ref-1		11/8/2023		Tissue	Not Specified
112750	Deep Ref-2		11/8/2023		Tissue	Not Specified
112751	Deep Ref-3		11/8/2023		Tissue	Not Specified
112752	Heidi-1		11/8/2023		Tissue	Not Specified
112753	Heidi-2		11/8/2023		Tissue	Not Specified
112754	Heidi-3		11/8/2023		Tissue	Not Specified
112755	Hope-1		11/8/2023		Tissue	Not Specified
112756	Hope-2		11/8/2023		Tissue	Not Specified
112757	Hope-3		11/8/2023		Tissue	Not Specified
112758	Hazel-1		11/8/2023		Tissue	Not Specified
112759	Hazel-2		11/8/2023		Tissue	Not Specified
112760	Hazel-3		11/8/2023		Tissue	Not Specified
112761	Hilda-1		11/8/2023		Tissue	Not Specified
112762	Hilda-2		11/8/2023		Tissue	Not Specified
112763	Hilda-3		11/8/2023		Tissue	Not Specified

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ABBREVIATIONS and ACRONYMS

QM	Quality Manual
QA	Quality Assurance
QC	Quality Control
MDL	method detection limit
RL	reporting limit
R1	project sample
R2	project sample replicate
MS1	matrix spike
MS2	matrix spike replicate
B1	procedural blank
B2	procedural blank replicate
BS1	blank spike
BS2	blank spike replicate
LCS1	laboratory control spike
LCS2	laboratory control spike replicate
LCM1	laboratory control material
LCM2	laboratory control material replicate
CRM1	certified reference material
CRM2	certified reference material replicate
RPD	relative percent difference
LMW	low molecular weight
HMW	high molecular weight

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QUALITY ASSURANCE SUMMARY

LABORATORY BATCH: Physis' QM defines a laboratory batch as a group of 20 or fewer project samples of similar matrix, processed together under the same conditions and with the same reagents. QC samples are associated with each batch and were used to assess the validity of the sample analyses.

PROCEDURAL BLANK: Laboratory contamination introduced during method use is assessed through the preparation and analysis of procedural blanks is provided at a minimum frequency of one per batch.

ACCURACY: Accuracy of analytical measurements is the degree of closeness based on percent recovery calculations between measured values and the actual or true value and includes a combination of reproducibility error and systematic bias due to sampling and analytical operations. Accuracy of the project data was indicated by analysis of MS, BS, LCS, LCM, CRM, and/or surrogate spikes on a minimum frequency of one per batch. Physis' QM requires that 95% of the target compounds greater than 10 times the MDL be within the specified acceptance limits.

PRECISION: Precision is the agreement among a set of replicate measurements without assumption of knowledge of the true value and is based on RPD calculations between repeated values. Precision of the project data was determined by analysis of replicate MS1/MS2, BS1/BS2, LCS1/LCS2, LCM1/LCM2, CRM1/CRM2, surrogate spikes and/or replicate project sample analysis (R1/R2) on a minimum frequency of one per batch. Physis' QM requires that for 95% of the compounds greater than 10 times the MDL, the percent RPD should be within the specified acceptance range.

BLANK SPIKES: BS is the introduction of a known concentration of analyte into the procedural blank. BS demonstrates performance of the preparation and analytical methods on a clean matrix void of potential matrix related interferences. The BS is performed in laboratory deionized water, making these recoveries a better indicator of the efficiency of the laboratory method per se.

MATRIX SPIKES: MS is the introduction of a known concentration of analyte into a sample. MS samples demonstrate the effect a particular project sample matrix has on the accuracy of a measurement. Individually, MS samples also indicate the bias of analytical measurements due to chemical interferences inherent in the in the specific project sample spiked. Intrinsic target analyte concentration in the specific project sample can also significantly impact MS recovery.

CERTIFIED REFERENCE MATERIALS: CRMs are materials of various matrices for which analytical information has been determined and certified by a recognized authority. These are used to provide a quantitative assessment of the accuracy of an analytical method. CRMs provide evidence that the laboratory preparation and analysis produces results that are comparable to those obtained by an independent organization.

LABORATORY CONTROL MATERIAL: LCM is provided because a suitable natural seawater CRM is not available and can be used to indicate accuracy of the method. Physis' internal LCM is seawater collected at ~800 meters in the Southern California San Pedro Basin and can be used as a reference for background concentrations in clean, natural seawater for comparison to project samples.

LABORATORY CONTROL SPIKES: LCS is the introduction of a known concentration of analyte into Physis' LCM. LCS samples were employed to assess the effect the seawater matrix has on the accuracy of a measurement. LCS also indicate the bias of this method due to chemical interferences inherent in the in the seawater matrix. Intrinsic LCM concentration can also significantly impact LCS recovery.

SURROGATES: A surrogate is a pure analyte unlikely to be found in any project sample, behaves similarly to

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the target analyte and most often used with organic analytical procedures. Surrogates are added in known concentration to all samples and are measured to indicate overall efficiency of the method including processing and analyses.

HOLDING TIME: Method recommended holding times are the length of time a project sample can be stored under specific conditions after collection and prior to analysis without significantly affecting the analyte's concentration. Holding times can be extended if preservation techniques are employed to reduce biodegradation, volatilization, oxidation, sorption, precipitation, and other physical and chemical processes.

SAMPLE STORAGE/RETENTION: In order to maintain chemical integrity prior to analysis, all samples submitted to Physis are refrigerated (liquids) or frozen (solids) upon receipt unless otherwise recommended by applicable methods. Solid samples are retained for 1 year from collection while liquid samples are retained until method recommended holding times elapse.

TOTAL/DISSOLVED FRACTION: In some instances, the results for the dissolved fraction may be higher than the total fraction for a particular analyte (e.g. trace metals). This is typically caused by the analytical variation for each result and indicates that the target analyte is primarily in the dissolved phase, within the sample.

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PHYSIS QUALIFIER CODES

CODE	DEFINITION
#	see Case Narrative
ND	analyte not detected at or above the MDL
B	analyte was detected in the procedural blank greater than 10 times the MDL
E	analyte concentration exceeds the upper limit of the linear calibration range, reported value is estimated
H	sample received and/or analyzed past the recommended holding time
J	analyte was detected at a concentration below the RL and above the MDL, reported value is estimated
N	insufficient sample, analysis could not be performed
M	analyte was outside the specified accuracy and/or precision acceptance limits due to matrix interference. The associated B/BS were within limits, therefore the sample data was reported without further clarification
SH	analyte concentration in the project sample exceeded the spike concentration, therefore accuracy and/or precision acceptance limits do not apply
SL	analyte results were lower than 10 times the MDL, therefore accuracy and/or precision acceptance limits do not apply
NH	project sample was heterogeneous and sample homogeneity could not be readily achieved using routine laboratory practices, therefore accuracy and/or precision acceptance limits do not apply
Q	analyte was outside the specified QAPP acceptance limits for precision and/or accuracy but within Physis derived acceptance limits, therefore the sample data was reported without further clarification
R	Physis' QM allows for 5% of the target compounds greater than 10 times the MDL to be outside the specified acceptance limits for precision and/or accuracy. This is often due to random error and does not indicate any significant problems with the analysis of these project samples

ANALYTICAL REPORT

PHYSIS

TERRA AQUA AURA

ENVIRONMENTAL LABORATORIES, INC.

Innovative Solutions for Nature

Aroclor PCBs

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112747-R1	**Shallow Ref-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	08-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	08-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	08-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	08-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	08-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	08-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	08-Jan-24
Sample ID: 112748-R1	**Shallow Ref-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Sample ID: 112749-R1	**Deep Ref-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24

Aroclor PCBs

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112750-R1	**Deep Ref-2**		**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Sample ID: 112751-R1	**Deep Ref-3**		**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Sample ID: 112752-R1	**Heidi-1**		**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Aroclor PCBs

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112753-R1	**Heidi-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Sample ID: 112754-R1	**Heidi-3**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Sample ID: 112755-R1	**Hope-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Aroclor PCBs

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112756-R1 Hope-2			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Sample ID: 112757-R1 Hope-3			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Sample ID: 112758-R1 Hazel-1			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Aroclor PCBs

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112759-R1	**Hazel-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Sample ID: 112760-R1	**Hazel-3**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Sample ID: 112761-R1	**Hilda-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Aroclor PCBs

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112762-R1 Hilda-2			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Sample ID: 112763-R1 Hilda-3			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Aroclor 1016	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1221	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1232	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1242	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1248	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1254	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24
Aroclor 1260	EPA 8270E	ng/wet g	ND	1	10	20	Total		O-43086	26-Dec-23	10-Jan-24

Chlorinated Pesticides

Sample ID: 112747-R1 Shallow Ref-1 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	75	1			Total		O-43086	26-Dec-23	08-Jan-24
(PCB112)	EPA 8270E	% Recovery	77	1			Total		O-43086	26-Dec-23	08-Jan-24
(PCB198)	EPA 8270E	% Recovery	84	1			Total		O-43086	26-Dec-23	08-Jan-24
(TCMX)	EPA 8270E	% Recovery	61	1			Total		O-43086	26-Dec-23	08-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	08-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	1.01	1	0.2	0.5	Total		O-43086	26-Dec-23	08-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	08-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	1.22	1	0.198	0.5	Total		O-43086	26-Dec-23	08-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	6.49	1	0.193	0.5	Total		O-43086	26-Dec-23	08-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	08-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	0.756	1	0.187	0.5	Total		O-43086	26-Dec-23	08-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	08-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	0.365	1	0.192	0.5	Total	J	O-43086	26-Dec-23	08-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	08-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	08-Jan-24

Chlorinated Pesticides

Sample ID: 112748-R1 Shallow Ref-2 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	65	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	81	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	78	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	56	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	0.984	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	0.409	1	0.198	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	5.13	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	0.221	1	0.186	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112749-R1	**Deep Ref-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
(PCB030)	EPA 8270E	% Recovery	60	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	88	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	91	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	56	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	0.906	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	0.854	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	6.01	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

Sample ID: 112750-R1 **Deep Ref-2** **Matrix: Tissue** **Sampled: 08-Nov-23** **Received: 08-Nov-23**

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	52	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	68	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	75	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	48	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	1.68	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	0.747	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	5.08	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	09-Jan-24

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112751-R1	**Deep Ref-3**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
(PCB030)	EPA 8270E	% Recovery	65	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	88	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	100	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	57	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	1.68	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	0.943	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	5.91	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	09-Jan-24

Chlorinated Pesticides

Sample ID: 112752-R1 Heidi-1 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	64	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	107	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	104	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	53	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	0.782	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	8.96	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	09-Jan-24

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112753-R1 Heidi-2		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
(PCB030)	EPA 8270E	% Recovery	66	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	87	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	89	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	52	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	0.654	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	0.778	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	5.49	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

Sample ID: 112754-R1 Heidi-3 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	68	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	96	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	103	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	53	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	ND	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	5.45	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	0.329	1	0.192	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112755-R1	**Hope-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
(PCB030)	EPA 8270E	% Recovery	60	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	77	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	80	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	51	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	ND	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	4.28	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

Sample ID: 112756-R1 Hope-2 | Matrix: Tissue | Sampled: 08-Nov-23 | Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	59	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	80	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	93	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	47	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	0.957	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	4.12	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	0.214	1	0.186	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112757-R1 Hope-3		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
(PCB030)	EPA 8270E	% Recovery	54	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	70	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	66	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	44	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	0.386	1	0.2	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	3.51	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112758-R1 Hazel-1		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
(PCB030)	EPA 8270E	% Recovery	53	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB112)	EPA 8270E	% Recovery	73	1			Total		O-43086	26-Dec-23	09-Jan-24
(PCB198)	EPA 8270E	% Recovery	83	1			Total		O-43086	26-Dec-23	09-Jan-24
(TCMX)	EPA 8270E	% Recovery	44	1			Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	0.62	1	0.2	0.5	Total		O-43086	26-Dec-23	09-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	1.24	1	0.198	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	5.58	1	0.193	0.5	Total		O-43086	26-Dec-23	09-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	09-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	09-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	09-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	0.298	1	0.186	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112759-R1 Hazel-2		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
(PCB030)	EPA 8270E	% Recovery	65	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB112)	EPA 8270E	% Recovery	79	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB198)	EPA 8270E	% Recovery	91	1			Total		O-43086	26-Dec-23	10-Jan-24
(TCMX)	EPA 8270E	% Recovery	59	1			Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	1.01	1	0.2	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	5.44	1	0.193	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	10-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	10-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	0.3	1	0.186	0.5	Total	J	O-43086	26-Dec-23	10-Jan-24

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112760-R1	**Hazel-3**	**Matrix: Tissue**					**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
(PCB030)	EPA 8270E	% Recovery	69	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB112)	EPA 8270E	% Recovery	92	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB198)	EPA 8270E	% Recovery	81	1			Total		O-43086	26-Dec-23	10-Jan-24
(TCMX)	EPA 8270E	% Recovery	58	1			Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	1.06	1	0.2	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	0.758	1	0.198	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	5.17	1	0.193	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	10-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	10-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112761-R1 Hilda-1		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
(PCB030)	EPA 8270E	% Recovery	61	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB112)	EPA 8270E	% Recovery	69	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB198)	EPA 8270E	% Recovery	92	1			Total		O-43086	26-Dec-23	10-Jan-24
(TCMX)	EPA 8270E	% Recovery	53	1			Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	1.33	1	0.2	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	0.759	1	0.198	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	3.74	1	0.193	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	10-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	10-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

Sample ID: 112762-R1 **Hilda-2** **Matrix: Tissue** **Sampled: 08-Nov-23** **Received: 08-Nov-23**

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	63	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB112)	EPA 8270E	% Recovery	81	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB198)	EPA 8270E	% Recovery	98	1			Total		O-43086	26-Dec-23	10-Jan-24
(TCMX)	EPA 8270E	% Recovery	49	1			Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	1.55	1	0.2	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	5.07	1	0.193	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	10-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	10-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

Sample ID: 112763-R1 Hilda-3 | Matrix: Tissue | Sampled: 08-Nov-23 | Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(PCB030)	EPA 8270E	% Recovery	62	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB112)	EPA 8270E	% Recovery	84	1			Total		O-43086	26-Dec-23	10-Jan-24
(PCB198)	EPA 8270E	% Recovery	71	1			Total		O-43086	26-Dec-23	10-Jan-24
(TCMX)	EPA 8270E	% Recovery	46	1			Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.267	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDE	EPA 8270E	ng/wet g	0.568	1	0.2	0.5	Total		O-43086	26-Dec-23	10-Jan-24
2,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.194	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDD	EPA 8270E	ng/wet g	ND	1	0.198	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDE	EPA 8270E	ng/wet g	3.57	1	0.193	0.5	Total		O-43086	26-Dec-23	10-Jan-24
4,4'-DDT	EPA 8270E	ng/wet g	ND	1	0.128	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-alpha	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-beta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-delta	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
BHC-gamma	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-alpha	EPA 8270E	ng/wet g	ND	1	0.187	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Chlordane-gamma	EPA 8270E	ng/wet g	ND	1	0.179	0.5	Total		O-43086	26-Dec-23	10-Jan-24
cis-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.192	0.5	Total		O-43086	26-Dec-23	10-Jan-24
Dieldrin	EPA 8270E	ng/wet g	ND	1	0.1	0.2	Total		O-43086	26-Dec-23	10-Jan-24
Oxychlordane	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
trans-Nonachlor	EPA 8270E	ng/wet g	ND	1	0.186	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
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Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Conventionals

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112747-R1	**Shallow Ref-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	14.8	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112748-R1	**Shallow Ref-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	15.1	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112749-R1	**Deep Ref-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	15.6	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112750-R1	**Deep Ref-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	16	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112751-R1	**Deep Ref-3**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	15.1	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112752-R1	**Heidi-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	16.2	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112753-R1	**Heidi-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	15.7	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112754-R1	**Heidi-3**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	16	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112755-R1	**Hope-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	13.7	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112756-R1	**Hope-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	14.9	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112757-R1	**Hope-3**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Percent Solids	SM 2540 B	%	16.5	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
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PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Conventionals

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112758-R1 Hazel-1			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Solids	SM 2540 B	%	18.6	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112759-R1 Hazel-2			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Solids	SM 2540 B	%	17	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112760-R1 Hazel-3			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Solids	SM 2540 B	%	18.2	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112761-R1 Hilda-1			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Solids	SM 2540 B	%	17.8	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112762-R1 Hilda-2			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Solids	SM 2540 B	%	17.9	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23
Sample ID: 112763-R1 Hilda-3			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Solids	SM 2540 B	%	17	1	0.1	0.1	NA		C-78015	26-Dec-23	27-Dec-23

PHYSIS Environmental Laboratories, Inc.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

Sample ID: 112747-R1 **Shallow Ref-1** **Matrix: Tissue** **Sampled: 08-Nov-23** **Received: 08-Nov-23**

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Aluminum (Al)	EPA 6020	µg/wet g	62.7	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.05	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.947	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	0.989	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	4.5	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.104	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.826	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	108	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.054	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00581	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.942	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	1.97	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.497	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.06	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.318	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	14	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112748-R1	**Shallow Ref-2**		**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	135	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.32	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	1.05	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	1.06	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.346	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.091	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	2.33	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	134	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.068	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00514	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.401	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.336	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.543	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.489	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	13.7	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112749-R1 **Deep Ref-1**		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	66	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.23	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.798	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	1.2	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.204	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.078	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.869	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	105	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.069	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00612	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.372	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.264	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.552	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.038	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.337	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	16.4	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

Sample ID: 112750-R1 **Deep Ref-2** **Matrix: Tissue** **Sampled: 08-Nov-23** **Received: 08-Nov-23**

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Aluminum (Al)	EPA 6020	µg/wet g	48.8	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.36	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.56	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	1.21	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.289	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.075	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.864	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	78.7	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.053	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00492	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.336	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.257	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.608	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.246	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	15.2	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112751-R1	**Deep Ref-3**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	43.9	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.21	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.545	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	1.2	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.142	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.073	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.829	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	71.9	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.047	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00577	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.333	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.186	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.627	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.025	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.232	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	14.2	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112752-R1 Heidi-1			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	56.9	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.18	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.774	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	1.2	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.204	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.097	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	1.26	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	95.6	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.055	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.008	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.446	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.271	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.589	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.026	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.34	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	15.6	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112753-R1	**Heidi-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	55.8	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.29	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.691	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	1.14	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.229	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.093	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	1.56	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	82.1	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.057	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00669	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.382	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.292	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.571	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.04	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.316	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	14.4	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112754-R1 **Heidi-3**			**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	41.4	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.34	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.55	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	1.04	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.191	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.091	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	1.32	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	73.4	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.044	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00587	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.4	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.264	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.544	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.042	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.264	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	13.6	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112755-R1 Hope-1			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Aluminum (Al)	EPA 6020	µg/wet g	38.6	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.07	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.79	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	0.947	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.184	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.074	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.949	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	71.3	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.041	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00508	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.343	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.224	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.556	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.286	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	12.6	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112756-R1	**Hope-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	56.1	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.33	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.722	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	1.04	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.194	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.085	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.816	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	80.8	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.048	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00603	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.362	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.247	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.522	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.027	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.359	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	15.5	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112757-R1 **Hope-3**		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	71.6	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.16	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.97	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	0.937	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.227	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.079	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.947	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	111	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.06	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00442	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.319	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.276	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.525	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.03	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.399	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	14.1	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112758-R1 Hazel-1			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	53.5	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.58	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	1.66	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	0.883	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.232	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.103	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	1.04	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	83.3	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.052	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00574	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.373	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.281	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.653	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.025	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.303	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	14.7	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112759-R1 Hazel-2		**Matrix: Tissue**					**Sampled:** 08-Nov-23			**Received:** 08-Nov-23	
Aluminum (Al)	EPA 6020	µg/wet g	72.4	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.47	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	2.21	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	0.812	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.249	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.103	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.95	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	111	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.058	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00589	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.349	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.301	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.602	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.395	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	13.3	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112760-R1 Hazel-3			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	45.2	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.53	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	2.25	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	0.855	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.319	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.094	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.898	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	86.6	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.051	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00548	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.333	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.34	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.673	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.269	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	14.4	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112761-R1 **Hilda-1**			**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	37	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.4	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.69	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	0.859	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.88	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.111	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	1.15	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	65.9	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.036	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00615	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.42	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.43	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.647	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	0.027	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.279	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	13.7	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
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Project: Santa Barbara Channel PO # 22238101

Elements

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112762-R1 Hilda-2			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Aluminum (Al)	EPA 6020	µg/wet g	37.5	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.33	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	0.455	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	0.94	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.196	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.094	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	0.761	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	58.6	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.037	1	0.025	0.05	NA	J	E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00568	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.372	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.237	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.62	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.258	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	12.9	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
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PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Elements

Sample ID: 112763-R1 Hilda-3 **Matrix:** Tissue **Sampled:** 08-Nov-23 **Received:** 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Aluminum (Al)	EPA 6020	µg/wet g	89.1	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Antimony (Sb)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Arsenic (As)	EPA 6020	µg/wet g	1.19	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Barium (Ba)	EPA 6020	µg/wet g	1.2	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Beryllium (Be)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cadmium (Cd)	EPA 6020	µg/wet g	0.79	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Chromium (Cr)	EPA 6020	µg/wet g	0.294	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Cobalt (Co)	EPA 6020	µg/wet g	0.1	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Copper (Cu)	EPA 6020	µg/wet g	1.16	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Iron (Fe)	EPA 6020	µg/wet g	118	1	1	5	NA		E-29074	09-Jan-24	10-Jan-24
Lead (Pb)	EPA 6020	µg/wet g	0.058	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Mercury (Hg)	EPA 245.7	µg/wet g	0.00583	1	0.00001	0.00002	NA		E-32024	12-Jan-24	12-Jan-24
Molybdenum (Mo)	EPA 6020	µg/wet g	0.24	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Nickel (Ni)	EPA 6020	µg/wet g	0.312	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Selenium (Se)	EPA 6020	µg/wet g	0.594	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Silver (Ag)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Thallium (Tl)	EPA 6020	µg/wet g	ND	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Vanadium (V)	EPA 6020	µg/wet g	0.443	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24
Zinc (Zn)	EPA 6020	µg/wet g	12.2	1	0.025	0.05	NA		E-29074	09-Jan-24	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112747-R1	**Shallow Ref-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	08-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.294	1	0.065	0.5	Total	J	O-43086	26-Dec-23	08-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	08-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	08-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	08-Jan-24

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Project: Santa Barbara Channel PO # 22238101

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112748-R1	**Shallow Ref-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	ND	1	0.065	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112749-R1	**Deep Ref-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.483	1	0.065	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	0.668	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112750-R1	**Deep Ref-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	0.387	1	0.25	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	0.268	1	0.074	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.482	1	0.065	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112751-R1	Deep Ref-3		Matrix: Tissue				Sampled:	08-Nov-23		Received:	08-Nov-23
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	0.601	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.507	1	0.065	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	0.238	1	0.089	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

Sample ID: 112752-R1 Heidi-1 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS Environmental Laboratories, Inc.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.256	1	0.065	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112753-R1 Heidi-2		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	0.789	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	0.658	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.596	1	0.065	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112754-R1	**Heidi-3**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	0.497	1	0.074	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.498	1	0.065	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	0.351	1	0.085	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112755-R1 Hope-1			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.546	1	0.065	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	0.153	1	0.103	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112756-R1	**Hope-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	0.469	1	0.074	0.5	Total	J	O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	ND	1	0.065	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	0.545	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112757-R1	**Hope-3**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	0.525	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	ND	1	0.065	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112758-R1 Hazel-1			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 101	EPA 8270E	ng/wet g	0.926	1	0.027	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 153	EPA 8270E	ng/wet g	ND	1	0.065	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	09-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	09-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112759-R1	**Hazel-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 153	EPA 8270E	ng/wet g	ND	1	0.065	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 177	EPA 8270E	ng/wet g	0.526	1	0.085	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112760-R1 Hazel-3		Matrix: Tissue					Sampled: 08-Nov-23			Received:	08-Nov-23
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 049	EPA 8270E	ng/wet g	0.457	1	0.036	0.5	Total	J	O-43086	26-Dec-23	10-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 138	EPA 8270E	ng/wet g	0.74	1	0.057	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.421	1	0.065	0.5	Total	J	O-43086	26-Dec-23	10-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

Sample ID: 112761-R1 Hilda-1 | Matrix: Tissue | Sampled: 08-Nov-23 | Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.451	1	0.065	0.5	Total	J	O-43086	26-Dec-23	10-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 157	EPA 8270E	ng/wet g	0.265	1	0.103	0.5	Total	J	O-43086	26-Dec-23	10-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112762-R1	**Hilda-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 101	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 153	EPA 8270E	ng/wet g	0.494	1	0.065	0.5	Total	J	O-43086	26-Dec-23	10-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 195	EPA 8270E	ng/wet g	0.292	1	0.093	0.5	Total	J	O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112763-R1 Hilda-3			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
PCB 003	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 008	EPA 8270E	ng/wet g	ND	1	0.017	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 018	EPA 8270E	ng/wet g	ND	1	0.029	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 028	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 031	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 033	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 037	EPA 8270E	ng/wet g	ND	1	0.06	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 044	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 049	EPA 8270E	ng/wet g	ND	1	0.036	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 052	EPA 8270E	ng/wet g	ND	1	0.012	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 056/60	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 066	EPA 8270E	ng/wet g	ND	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 070	EPA 8270E	ng/wet g	ND	1	0.023	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 074	EPA 8270E	ng/wet g	ND	1	0.021	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 077	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 081	EPA 8270E	ng/wet g	ND	1	0.084	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 087	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 095	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 097	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 099	EPA 8270E	ng/wet g	ND	1	0.028	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 101	EPA 8270E	ng/wet g	0.746	1	0.027	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 105	EPA 8270E	ng/wet g	ND	1	0.047	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 110	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 114	EPA 8270E	ng/wet g	ND	1	0.072	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 118	EPA 8270E	ng/wet g	ND	1	0.069	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 119	EPA 8270E	ng/wet g	ND	1	0.071	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 123	EPA 8270E	ng/wet g	ND	1	0.018	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 126	EPA 8270E	ng/wet g	ND	1	0.086	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 128	EPA 8270E	ng/wet g	ND	1	0.081	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 132/168	EPA 8270E	ng/wet g	ND	1	0.094	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 138	EPA 8270E	ng/wet g	ND	1	0.057	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 141	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 149	EPA 8270E	ng/wet g	ND	1	0.092	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 151	EPA 8270E	ng/wet g	ND	1	0.073	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 153	EPA 8270E	ng/wet g	ND	1	0.065	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 156	EPA 8270E	ng/wet g	ND	1	0.089	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 157	EPA 8270E	ng/wet g	ND	1	0.103	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 158	EPA 8270E	ng/wet g	ND	1	0.074	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 167	EPA 8270E	ng/wet g	ND	1	0.049	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 169	EPA 8270E	ng/wet g	ND	1	0.116	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 170	EPA 8270E	ng/wet g	ND	1	0.118	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 174	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 177	EPA 8270E	ng/wet g	ND	1	0.085	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 180	EPA 8270E	ng/wet g	ND	1	0.154	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 183	EPA 8270E	ng/wet g	ND	1	0.056	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 187	EPA 8270E	ng/wet g	ND	1	0.168	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 189	EPA 8270E	ng/wet g	ND	1	0.109	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 194	EPA 8270E	ng/wet g	ND	1	0.164	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 195	EPA 8270E	ng/wet g	ND	1	0.093	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PCB Congeners

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
PCB 199	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 201	EPA 8270E	ng/wet g	ND	1	0.104	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 206	EPA 8270E	ng/wet g	ND	1	0.155	0.5	Total		O-43086	26-Dec-23	10-Jan-24
PCB 209	EPA 8270E	ng/wet g	ND	1	0.25	0.5	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112747-R1	**Shallow Ref-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
(d10-Acenaphthene)	EPA 8270E	% Recovery	77	1			Total		O-43086	26-Dec-23	08-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	96	1			Total		O-43086	26-Dec-23	08-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	99	1			Total		O-43086	26-Dec-23	08-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	77	1			Total		O-43086	26-Dec-23	08-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	53	1			Total		O-43086	26-Dec-23	08-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.47	1	1	5	Total	J	O-43086	26-Dec-23	08-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Biphenyl	EPA 8270E	ng/wet g	1.14	1	1	5	Total	J	O-43086	26-Dec-23	08-Jan-24
Chrysene	EPA 8270E	ng/wet g	1.45	1	1	5	Total	J	O-43086	26-Dec-23	08-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	08-Jan-24
Pyrene	EPA 8270E	ng/wet g	1.09	1	1	5	Total	J	O-43086	26-Dec-23	08-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112748-R1	Shallow Ref-2		Matrix: Tissue				Sampled:	08-Nov-23		Received:	08-Nov-23
(d10-Acenaphthene)	EPA 8270E	% Recovery	79	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	94	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	124	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	82	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	51	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	1.3	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.39	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	1	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

Sample ID: 112749-R1 Deep Ref-1 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	75	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	92	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	100	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	76	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	45	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.34	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112750-R1	**Deep Ref-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
(d10-Acenaphthene)	EPA 8270E	% Recovery	81	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	96	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	123	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	84	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	66	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.31	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112751-R1	Deep Ref-3		Matrix: Tissue				Sampled:	08-Nov-23		Received:	08-Nov-23
(d10-Acenaphthene)	EPA 8270E	% Recovery	72	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	89	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	117	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	85	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	52	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.18	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	1.25	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112752-R1 Heidi-1			**Matrix: Tissue**				**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
(d10-Acenaphthene)	EPA 8270E	% Recovery	67	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	90	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	111	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	68	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	48	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

Sample ID: 112753-R1 Heidi-2 — Matrix: Tissue — Sampled: 08-Nov-23 — Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	78	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	98	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	117	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	97	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	58	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

Sample ID: 112754-R1 Heidi-3 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	85	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	97	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	121	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	84	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	62	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.54	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	1.14	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112755-R1	**Hope-1**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
(d10-Acenaphthene)	EPA 8270E	% Recovery	81	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	92	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	114	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	77	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	55	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

Sample ID: 112756-R1 Hope-2 — Matrix: Tissue — Sampled: 08-Nov-23 — Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	81	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	99	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	107	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	88	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	62	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.1	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

Sample ID: 112757-R1 Hope-3 — Matrix: Tissue — Sampled: 08-Nov-23 — Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	72	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	90	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	118	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	85	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	63	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	1.07	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

Sample ID: 112758-R1 Hazel-1 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	76	1			Total		O-43086	26-Dec-23	09-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	84	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	102	1			Total		O-43086	26-Dec-23	09-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	77	1			Total		O-43086	26-Dec-23	09-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	73	1			Total		O-43086	26-Dec-23	09-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.16	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Naphthalene	EPA 8270E	ng/wet g	3.46	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	09-Jan-24
Pyrene	EPA 8270E	ng/wet g	1.28	1	1	5	Total	J	O-43086	26-Dec-23	09-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112759-R1	**Hazel-2**		**Matrix: Tissue**				**Sampled:**	**08-Nov-23**		**Received:**	**08-Nov-23**
(d10-Acenaphthene)	EPA 8270E	% Recovery	92	1			Total		O-43086	26-Dec-23	10-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	108	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	125	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	102	1			Total		O-43086	26-Dec-23	10-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	75	1			Total		O-43086	26-Dec-23	10-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.55	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	1.16	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24

Polynuclear Aromatic Hydrocarbons

Sample ID: 112760-R1 Hazel-3 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	89	1			Total		O-43086	26-Dec-23	10-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	101	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	110	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	80	1			Total		O-43086	26-Dec-23	10-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	64	1			Total		O-43086	26-Dec-23	10-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	1.41	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.79	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Naphthalene	EPA 8270E	ng/wet g	3.9	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112761-R1 Hilda-1		Matrix: Tissue					Sampled: 08-Nov-23			Received: 08-Nov-23	
(d10-Acenaphthene)	EPA 8270E	% Recovery	79	1			Total		O-43086	26-Dec-23	10-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	103	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	102	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	97	1			Total		O-43086	26-Dec-23	10-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	62	1			Total		O-43086	26-Dec-23	10-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	1.04	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.25	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Naphthalene	EPA 8270E	ng/wet g	3.07	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24

Polynuclear Aromatic Hydrocarbons

Sample ID: 112762-R1 Hilda-2 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	80	1			Total		O-43086	26-Dec-23	10-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	99	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	129	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	91	1			Total		O-43086	26-Dec-23	10-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	66	1			Total		O-43086	26-Dec-23	10-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	1.7	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Naphthalene	EPA 8270E	ng/wet g	3	1	1	5	Total	J	O-43086	26-Dec-23	10-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

Sample ID: 112763-R1 Hilda-3 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
(d10-Acenaphthene)	EPA 8270E	% Recovery	83	1			Total		O-43086	26-Dec-23	10-Jan-24
(d10-Phenanthrene)	EPA 8270E	% Recovery	97	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Chrysene)	EPA 8270E	% Recovery	131	1			Total		O-43086	26-Dec-23	10-Jan-24
(d12-Perylene)	EPA 8270E	% Recovery	86	1			Total		O-43086	26-Dec-23	10-Jan-24
(d8-Naphthalene)	EPA 8270E	% Recovery	50	1			Total		O-43086	26-Dec-23	10-Jan-24
1-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
1-Methylphenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,3,5-Trimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2,6-Dimethylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
2-Methylnaphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Acenaphthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Acenaphthylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benz[a]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[a]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[b]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[e]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[g,h,i]perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Benzo[k]fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Biphenyl	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Chrysene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenz[a,h]anthracene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Dibenzothiophene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Fluoranthene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24

Polynuclear Aromatic Hydrocarbons

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Fluorene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Indeno[1,2,3-cd]pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Naphthalene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Perylene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Phenanthrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24
Pyrene	EPA 8270E	ng/wet g	ND	1	1	5	Total		O-43086	26-Dec-23	10-Jan-24

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Total Extractable Organics

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112747-R1	**Shallow Ref-1**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.48	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112748-R1	**Shallow Ref-2**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.38	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112749-R1	**Deep Ref-1**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.43	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112750-R1	**Deep Ref-2**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.5	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112751-R1	**Deep Ref-3**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.26	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112752-R1	**Heidi-1**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.21	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112753-R1	**Heidi-2**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.31	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112754-R1	**Heidi-3**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.32	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112755-R1	**Hope-1**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	0.954	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112756-R1	**Hope-2**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.43	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112757-R1	**Hope-3**	**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received:**	**08-Nov-23**
Percent Lipids	Gravimetric	% wet weight	1.32	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Total Extractable Organics

ANALYTE	Method	Units	RESULT	DF	MDL	RL	Fraction	QA CODE	Batch ID	Date Processed	Date Analyzed
Sample ID: 112758-R1 Hazel-1		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Lipids	Gravimetric	% wet weight	1.6	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112759-R1 Hazel-2		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Lipids	Gravimetric	% wet weight	1.7	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112760-R1 Hazel-3		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Lipids	Gravimetric	% wet weight	1.6	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112761-R1 Hilda-1		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Lipids	Gravimetric	% wet weight	1.71	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112762-R1 Hilda-2		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Lipids	Gravimetric	% wet weight	1.78	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23
Sample ID: 112763-R1 Hilda-3		**Matrix: Tissue**					**Sampled: 08-Nov-23**			**Received: 08-Nov-23**	
Percent Lipids	Gravimetric	% wet weight	1.34	1	0.01	0.05	NA		C-54134	29-Dec-23	30-Dec-23

QUALITY CONTROL REPORT

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Aroclor PCBs

QUALITY CONTROL REPORT

Sample ID: 112744-B1 | **QAQC Procedural Blank** | **Matrix: BlankMatrix** | **Sampled:** | **Received:**

Method: EPA 8270E | Batch ID: O-43086 | Prepared: 26-Dec-23 | Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Aroclor 1016	Total	ND	1	10	20	ng/wet g							
Aroclor 1221	Total	ND	1	10	20	ng/wet g							
Aroclor 1232	Total	ND	1	10	20	ng/wet g							
Aroclor 1242	Total	ND	1	10	20	ng/wet g							
Aroclor 1248	Total	ND	1	10	20	ng/wet g							
Aroclor 1254	Total	ND	1	10	20	ng/wet g							
Aroclor 1260	Total	ND	1	10	20	ng/wet g							

Sample ID: 112747-R2 | **Shallow Ref-1** | **Matrix: Tissue** | **Sampled: 08-Nov-23** | **Received: 08-Nov-23**

Method: EPA 8270E | Batch ID: O-43086 | Prepared: 26-Dec-23 | Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Aroclor 1016	Total	ND	1	10	20	ng/wet g					0	30	PASS
Aroclor 1221	Total	ND	1	10	20	ng/wet g					0	30	PASS
Aroclor 1232	Total	ND	1	10	20	ng/wet g					0	30	PASS
Aroclor 1242	Total	ND	1	10	20	ng/wet g					0	30	PASS
Aroclor 1248	Total	ND	1	10	20	ng/wet g					0	30	PASS
Aroclor 1254	Total	ND	1	10	20	ng/wet g					0	30	PASS
Aroclor 1260	Total	ND	1	10	20	ng/wet g					0	30	PASS

Chlorinated Pesticides

QUALITY CONTROL REPORT

Sample ID: 112744-B1 **QAQC Procedural Blank** **Matrix:** BlankMatrix **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(PCB030)	Total	84	1			% Recovery	100		84	52 - 124% PASS			
(PCB112)	Total	83	1			% Recovery	100		83	49 - 133% PASS			
(PCB198)	Total	94	1			% Recovery	100		94	60 - 129% PASS			
(TCMX)	Total	82	1			% Recovery	100		82	6 - 124% PASS			
2,4'-DDD	Total	ND	1	0.267	0.5	ng/wet g							
2,4'-DDE	Total	ND	1	0.2	0.5	ng/wet g							
2,4'-DDT	Total	ND	1	0.194	0.5	ng/wet g							
4,4'-DDD	Total	ND	1	0.198	0.5	ng/wet g							
4,4'-DDE	Total	ND	1	0.193	0.5	ng/wet g							
4,4'-DDT	Total	ND	1	0.128	0.5	ng/wet g							
BHC-alpha	Total	ND	1	0.25	0.5	ng/wet g							
BHC-beta	Total	ND	1	0.25	0.5	ng/wet g							
BHC-delta	Total	ND	1	0.25	0.5	ng/wet g							
BHC-gamma	Total	ND	1	0.25	0.5	ng/wet g							
Chlordane-alpha	Total	ND	1	0.187	0.5	ng/wet g							
Chlordane-gamma	Total	ND	1	0.179	0.5	ng/wet g							
cis-Nonachlor	Total	ND	1	0.192	0.5	ng/wet g							
Dieldrin	Total	ND	1	0.1	0.2	ng/wet g							
Oxychlordane	Total	ND	1	0.25	0.5	ng/wet g							
trans-Nonachlor	Total	ND	1	0.186	0.5	ng/wet g							

Chlorinated Pesticides — QUALITY CONTROL REPORT

Sample ID: 112744-BS1 **QAQC Procedural Blank** **Matrix:** BlankMatrix **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(PCB030)	Total	68	1			% Recovery	100	0	68	52 - 124% PASS			
(PCB112)	Total	85	1			% Recovery	100	0	85	49 - 133% PASS			
(PCB198)	Total	85	1			% Recovery	100	0	85	60 - 129% PASS			
(TCMX)	Total	67	1			% Recovery	100	0	67	6 - 124% PASS			
2,4'-DDD	Total	545	1	0.267	0.5	ng/wet g	500	0	109	61 - 134% PASS			
2,4'-DDE	Total	385	1	0.2	0.5	ng/wet g	500	0	77	66 - 140% PASS			
2,4'-DDT	Total	329	1	0.194	0.5	ng/wet g	500	0	66	61 - 138% PASS			
4,4'-DDD	Total	457	1	0.198	0.5	ng/wet g	500	0	91	63 - 143% PASS			
4,4'-DDE	Total	390	1	0.193	0.5	ng/wet g	500	0	78	70 - 113% PASS			
4,4'-DDT	Total	327	1	0.128	0.5	ng/wet g	500	0	65	59 - 162% PASS			
BHC-alpha	Total	354	1	0.25	0.5	ng/wet g	500	0	71	49 - 124% PASS			
BHC-beta	Total	317	1	0.25	0.5	ng/wet g	500	0	63	55 - 127% PASS			
BHC-delta	Total	304	1	0.25	0.5	ng/wet g	500	0	61	58 - 121% PASS			
BHC-gamma	Total	355	1	0.25	0.5	ng/wet g	500	0	71	54 - 122% PASS			
Chlordane-alpha	Total	396	1	0.187	0.5	ng/wet g	500	0	79	61 - 114% PASS			
Chlordane-gamma	Total	386	1	0.179	0.5	ng/wet g	500	0	77	63 - 120% PASS			
cis-Nonachlor	Total	371	1	0.192	0.5	ng/wet g	500	0	74	64 - 112% PASS			
Dieldrin	Total	471	1	0.1	0.2	ng/wet g	500	0	94	56 - 123% PASS			
Oxychlordane	Total	400	1	0.25	0.5	ng/wet g	500	0	80	57 - 131% PASS			
trans-Nonachlor	Total	322	1	0.186	0.5	ng/wet g	500	0	64	62 - 114% PASS			

Chlorinated Pesticides

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 112744-BS2	**QAQC Procedural Blank**					**Matrix: BlankMatrix**		**Sampled:**				**Received:**		
	Method: EPA 8270E					Batch ID: O-43086		Prepared: 26-Dec-23				Analyzed: 08-Jan-24		
(PCB030)	Total	80	1			% Recovery	100	0	80	52 - 124%	PASS	16	30	PASS
(PCB112)	Total	83	1			% Recovery	100	0	83	49 - 133%	PASS	2	30	PASS
(PCB198)	Total	107	1			% Recovery	100	0	107	60 - 129%	PASS	23	30	PASS
(TCMX)	Total	75	1			% Recovery	100	0	75	6 - 124%	PASS	11	30	PASS
2,4'-DDD	Total	498	1	0.267	0.5	ng/wet g	500	0	100	61 - 134%	PASS	9	30	PASS
2,4'-DDE	Total	416	1	0.2	0.5	ng/wet g	500	0	83	66 - 140%	PASS	8	30	PASS
2,4'-DDT	Total	347	1	0.194	0.5	ng/wet g	500	0	69	61 - 138%	PASS	4	30	PASS
4,4'-DDD	Total	509	1	0.198	0.5	ng/wet g	500	0	102	63 - 143%	PASS	11	30	PASS
4,4'-DDE	Total	413	1	0.193	0.5	ng/wet g	500	0	83	70 - 113%	PASS	6	30	PASS
4,4'-DDT	Total	294	1	0.128	0.5	ng/wet g	500	0	59	59 - 162%	PASS	10	30	PASS
BHC-alpha	Total	342	1	0.25	0.5	ng/wet g	500	0	68	49 - 124%	PASS	4	30	PASS
BHC-beta	Total	333	1	0.25	0.5	ng/wet g	500	0	67	55 - 127%	PASS	6	30	PASS
BHC-delta	Total	360	1	0.25	0.5	ng/wet g	500	0	72	58 - 121%	PASS	17	30	PASS
BHC-gamma	Total	392	1	0.25	0.5	ng/wet g	500	0	78	54 - 122%	PASS	9	30	PASS
Chlordane-alpha	Total	398	1	0.187	0.5	ng/wet g	500	0	80	61 - 114%	PASS	1	30	PASS
Chlordane-gamma	Total	408	1	0.179	0.5	ng/wet g	500	0	82	63 - 120%	PASS	6	30	PASS
cis-Nonachlor	Total	420	1	0.192	0.5	ng/wet g	500	0	84	64 - 112%	PASS	13	30	PASS
Dieldrin	Total	427	1	0.1	0.2	ng/wet g	500	0	85	56 - 123%	PASS	10	30	PASS
Oxychlordane	Total	407	1	0.25	0.5	ng/wet g	500	0	81	57 - 131%	PASS	1	30	PASS
trans-Nonachlor	Total	321	1	0.186	0.5	ng/wet g	500	0	64	62 - 114%	PASS	0	30	PASS

Chlorinated Pesticides

QUALITY CONTROL REPORT

Sample ID: 112746-CRM1 QAQC CRM - SRM 1946 | **Matrix: Tissue** | **Sampled:** | **Received:**

Method: EPA 8270E | Batch ID: O-43086 | Prepared: 26-Dec-23 | Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(PCB030)	Total	106	1			% Recovery	100		106	60 - 140% PASS			
(PCB112)	Total	107	1			% Recovery	100		107	60 - 140% PASS			
(PCB198)	Total	89	1			% Recovery	100		89	60 - 140% PASS			
(TCMX)	Total	75	1			% Recovery	100		75	60 - 140% PASS			
2,4'-DDD	Total	1.58	1	0.267	0.5	ng/wet g	2.2		72	60 - 140% PASS			
2,4'-DDE	Total	1.22	1	0.2	0.5	ng/wet g	1.04		117	60 - 140% PASS			
2,4'-DDT	Total	13.4	1	0.194	0.5	ng/wet g	22.3		60	60 - 140% PASS			
4,4'-DDD	Total	21	1	0.198	0.5	ng/wet g	17.7		119	60 - 140% PASS			
4,4'-DDE	Total	243	1	0.193	0.5	ng/wet g	373		65	60 - 140% PASS			
4,4'-DDT	Total	34.7	1	0.128	0.5	ng/wet g	37.2		93	60 - 140% PASS			
BHC-alpha	Total	3.93	1	0.25	0.5	ng/wet g	5.72		69	60 - 140% PASS			
Chlordane-alpha	Total	22.9	1	0.187	0.5	ng/wet g	32.5		70	60 - 140% PASS			
Chlordane-gamma	Total	8.47	1	0.179	0.5	ng/wet g	8.36		101	60 - 140% PASS			
cis-Nonachlor	Total	40	1	0.192	0.5	ng/wet g	59.1		68	60 - 140% PASS			
Dieldrin	Total	25	1	0.1	0.2	ng/wet g	32.5		77	60 - 140% PASS			
Oxychlordane	Total	11.7	1	0.25	0.5	ng/wet g	18.9		62	60 - 140% PASS			
trans-Nonachlor	Total	83	1	0.186	0.5	ng/wet g	99.6		83	60 - 140% PASS			

Chlorinated Pesticides

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 112747-MS1	**Shallow Ref-1**					**Matrix: Tissue**		**Sampled: 08-Nov-23**				**Received: 08-Nov-23**		
	Method: EPA 8270E					Batch ID: O-43086		Prepared: 26-Dec-23				Analyzed: 08-Jan-24		
(PCB030)	Total	63	1			% Recovery	100	0	63	52 - 124%	PASS			
(PCB112)	Total	87	1			% Recovery	100	0	87	49 - 133%	PASS			
(PCB198)	Total	80	1			% Recovery	100	0	80	60 - 129%	PASS			
(TCMX)	Total	55	1			% Recovery	100	0	55	6 - 124%	PASS			
2,4'-DDD	Total	142	1	0.267	0.5	ng/wet g	146	0	97	66 - 138%	PASS			
2,4'-DDE	Total	115	1	0.2	0.5	ng/wet g	146	1.01	78	70 - 131%	PASS			
2,4'-DDT	Total	66.4	1	0.194	0.5	ng/wet g	146	0	45	44 - 157%	PASS			
4,4'-DDD	Total	145	1	0.198	0.5	ng/wet g	146	1.22	98	46 - 154%	PASS			
4,4'-DDE	Total	118	1	0.193	0.5	ng/wet g	146	6.49	76	44 - 148%	PASS			
4,4'-DDT	Total	74.3	1	0.128	0.5	ng/wet g	146	0	51	34 - 161%	PASS			
BHC-alpha	Total	94.9	1	0.25	0.5	ng/wet g	146	0	65	60 - 134%	PASS			
BHC-beta	Total	72	1	0.25	0.5	ng/wet g	146	0	49	44 - 141%	PASS			
BHC-delta	Total	79.5	1	0.25	0.5	ng/wet g	146	0	54	47 - 128%	PASS			
BHC-gamma	Total	91.5	1	0.25	0.5	ng/wet g	146	0	63	50 - 157%	PASS			
Chlordane-alpha	Total	119	1	0.187	0.5	ng/wet g	146	0.756	81	67 - 135%	PASS			
Chlordane-gamma	Total	113	1	0.179	0.5	ng/wet g	146	0	77	70 - 135%	PASS			
cis-Nonachlor	Total	94.4	1	0.192	0.5	ng/wet g	146	0.365	64	48 - 140%	PASS			
Dieldrin	Total	107	1	0.1	0.2	ng/wet g	146	0	73	51 - 147%	PASS			
Oxychlordane	Total	109	1	0.25	0.5	ng/wet g	146	0	75	43 - 156%	PASS			
trans-Nonachlor	Total	101	1	0.186	0.5	ng/wet g	146	0	69	66 - 135%	PASS			

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Chlorinated Pesticides

QUALITY CONTROL REPORT

Sample ID: 112747-MS2 **Shallow Ref-1** **Matrix: Tissue** **Sampled: 08-Nov-23** **Received: 08-Nov-23**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
(PCB030)	Total	58	1			% Recovery	100	0	58	52 - 124%	PASS	8	30	PASS	
(PCB112)	Total	82	1			% Recovery	100	0	82	49 - 133%	PASS	6	30	PASS	
(PCB198)	Total	111	1			% Recovery	100	0	111	60 - 129%	PASS	32	30	FAIL	M
(TCMX)	Total	52	1			% Recovery	100	0	52	6 - 124%	PASS	6	30	PASS	
2,4'-DDD	Total	139	1	0.267	0.5	ng/wet g	160	0	87	66 - 138%	PASS	11	30	PASS	
2,4'-DDE	Total	114	1	0.2	0.5	ng/wet g	160	1.01	71	70 - 131%	PASS	9	30	PASS	
2,4'-DDT	Total	72.4	1	0.194	0.5	ng/wet g	160	0	45	44 - 157%	PASS	0	30	PASS	
4,4'-DDD	Total	173	1	0.198	0.5	ng/wet g	160	1.22	107	46 - 154%	PASS	9	30	PASS	
4,4'-DDE	Total	115	1	0.193	0.5	ng/wet g	160	6.49	68	44 - 148%	PASS	11	30	PASS	
4,4'-DDT	Total	77.9	1	0.128	0.5	ng/wet g	160	0	49	34 - 161%	PASS	4	30	PASS	
BHC-alpha	Total	101	1	0.25	0.5	ng/wet g	160	0	63	60 - 134%	PASS	3	30	PASS	
BHC-beta	Total	72.5	1	0.25	0.5	ng/wet g	160	0	45	44 - 141%	PASS	9	30	PASS	
BHC-delta	Total	76.5	1	0.25	0.5	ng/wet g	160	0	48	47 - 128%	PASS	12	30	PASS	
BHC-gamma	Total	100	1	0.25	0.5	ng/wet g	160	0	62	50 - 157%	PASS	2	30	PASS	
Chlordane-alpha	Total	134	1	0.187	0.5	ng/wet g	160	0.756	83	67 - 135%	PASS	2	30	PASS	
Chlordane-gamma	Total	123	1	0.179	0.5	ng/wet g	160	0	77	70 - 135%	PASS	0	30	PASS	
cis-Nonachlor	Total	133	1	0.192	0.5	ng/wet g	160	0.365	83	48 - 140%	PASS	26	30	PASS	
Dieldrin	Total	145	1	0.1	0.2	ng/wet g	160	0	91	51 - 147%	PASS	22	30	PASS	
Oxychlordane	Total	95.2	1	0.25	0.5	ng/wet g	160	0	59	43 - 156%	PASS	24	30	PASS	
trans-Nonachlor	Total	114	1	0.186	0.5	ng/wet g	160	0	71	66 - 135%	PASS	3	30	PASS	

Chlorinated Pesticides

QUALITY CONTROL REPORT

Sample ID: 112747-R2 Shallow Ref-1 | **Matrix: Tissue** | **Sampled: 08-Nov-23** | **Received: 08-Nov-23**

Method: EPA 8270E | Batch ID: O-43086 | Prepared: 26-Dec-23 | Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
(PCB030)	Total	68	1			% Recovery	100		68	52 - 124%	PASS	10	30	PASS	
(PCB112)	Total	83	1			% Recovery	100		83	49 - 133%	PASS	8	30	PASS	
(PCB198)	Total	96	1			% Recovery	100		96	60 - 129%	PASS	13	30	PASS	
(TCMX)	Total	59	1			% Recovery	100		59	6 - 124%	PASS	3	30	PASS	
2,4'-DDD	Total	ND	1	0.267	0.5	ng/wet g						0	30	PASS	
2,4'-DDE	Total	ND	1	0.2	0.5	ng/wet g						134	30	FAIL	SL
2,4'-DDT	Total	ND	1	0.194	0.5	ng/wet g						0	30	PASS	
4,4'-DDD	Total	ND	1	0.198	0.5	ng/wet g						144	30	FAIL	SL
4,4'-DDE	Total	7.18	1	0.193	0.5	ng/wet g						10	30	PASS	
4,4'-DDT	Total	ND	1	0.128	0.5	ng/wet g						0	30	PASS	
BHC-alpha	Total	ND	1	0.25	0.5	ng/wet g						0	30	PASS	
BHC-beta	Total	ND	1	0.25	0.5	ng/wet g						0	30	PASS	
BHC-delta	Total	ND	1	0.25	0.5	ng/wet g						0	30	PASS	
BHC-gamma	Total	ND	1	0.25	0.5	ng/wet g						0	30	PASS	
Chlordane-alpha	Total	ND	1	0.187	0.5	ng/wet g						121	30	FAIL	SL
Chlordane-gamma	Total	ND	1	0.179	0.5	ng/wet g						0	30	PASS	
cis-Nonachlor	Total	ND	1	0.192	0.5	ng/wet g						62	30	FAIL	SL
Dieldrin	Total	ND	1	0.1	0.2	ng/wet g						0	30	PASS	
Oxychlordane	Total	ND	1	0.25	0.5	ng/wet g						0	30	PASS	
trans-Nonachlor	Total	ND	1	0.186	0.5	ng/wet g						0	30	PASS	

Elements

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 112744-B1	**QAQC Procedural Blank**					**Matrix: BlankMatrix**	**Sampled:**				**Received:**		
	Method: EPA 6020					Batch ID: E-29074	Prepared: 09-Jan-24				Analyzed: 10-Jan-24		
Aluminum (Al)	NA	ND	1	1	5	µg/wet g							
Antimony (Sb)	NA	ND	1	0.025	0.05	µg/wet g							
Arsenic (As)	NA	ND	1	0.025	0.05	µg/wet g							
Barium (Ba)	NA	ND	1	0.025	0.05	µg/wet g							
Beryllium (Be)	NA	ND	1	0.025	0.05	µg/wet g							
Cadmium (Cd)	NA	ND	1	0.025	0.05	µg/wet g							
Chromium (Cr)	NA	ND	1	0.025	0.05	µg/wet g							
Cobalt (Co)	NA	ND	1	0.025	0.05	µg/wet g							
Copper (Cu)	NA	ND	1	0.025	0.05	µg/wet g							
Iron (Fe)	NA	ND	1	1	5	µg/wet g							
Lead (Pb)	NA	ND	1	0.025	0.05	µg/wet g							
Molybdenum (Mo)	NA	ND	1	0.025	0.05	µg/wet g							
Nickel (Ni)	NA	ND	1	0.025	0.05	µg/wet g							
Selenium (Se)	NA	ND	1	0.025	0.05	µg/wet g							
Silver (Ag)	NA	ND	1	0.025	0.05	µg/wet g							
Thallium (Tl)	NA	ND	1	0.025	0.05	µg/wet g							
Vanadium (V)	NA	ND	1	0.025	0.05	µg/wet g							
Zinc (Zn)	NA	ND	1	0.025	0.05	µg/wet g							
	Method: EPA 245.7					Batch ID: E-32024	Prepared: 12-Jan-24				Analyzed: 12-Jan-24		
Mercury (Hg)	NA	ND	1	0.00001	0.00002	µg/wet g							

Elements

QUALITY CONTROL REPORT

Sample ID: 112744-BS1 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
	Method: EPA 6020					Batch ID: E-29074		Prepared: 09-Jan-24			Analyzed: 10-Jan-24		
Aluminum (Al)	NA	1.97	1	1	5	µg/wet g	2	0	99	89 - 119%	PASS		
Antimony (Sb)	NA	2.1	1	0.025	0.05	µg/wet g	2	0	105	87 - 117%	PASS		
Arsenic (As)	NA	2.2	1	0.025	0.05	µg/wet g	2	0	110	89 - 119%	PASS		
Barium (Ba)	NA	2.11	1	0.025	0.05	µg/wet g	2	0	105	88 - 118%	PASS		
Beryllium (Be)	NA	1.63	1	0.025	0.05	µg/wet g	2	0	81	73 - 120%	PASS		
Cadmium (Cd)	NA	2.01	1	0.025	0.05	µg/wet g	2	0	100	86 - 116%	PASS		
Chromium (Cr)	NA	2.12	1	0.025	0.05	µg/wet g	2	0	106	86 - 116%	PASS		
Cobalt (Co)	NA	2.18	1	0.025	0.05	µg/wet g	2	0	109	86 - 116%	PASS		
Copper (Cu)	NA	2.16	1	0.025	0.05	µg/wet g	2	0	108	83 - 116%	PASS		
Iron (Fe)	NA	2.08	1	1	5	µg/wet g	2	0	104	85 - 115%	PASS		
Lead (Pb)	NA	1.89	1	0.025	0.05	µg/wet g	2	0	94	89 - 119%	PASS		
Molybdenum (Mo)	NA	2	1	0.025	0.05	µg/wet g	2	0	100	85 - 115%	PASS		
Nickel (Ni)	NA	2.16	1	0.025	0.05	µg/wet g	2	0	108	81 - 119%	PASS		
Selenium (Se)	NA	2.15	1	0.025	0.05	µg/wet g	2	0	108	87 - 122%	PASS		
Silver (Ag)	NA	0.185	1	0.025	0.05	µg/wet g	0.2	0	93	75 - 123%	PASS		
Thallium (Tl)	NA	2	1	0.025	0.05	µg/wet g	2	0	100	75 - 125%	PASS		
Vanadium (V)	NA	2.14	1	0.025	0.05	µg/wet g	2	0	107	78 - 118%	PASS		
Zinc (Zn)	NA	2.11	1	0.025	0.05	µg/wet g	2	0	105	85 - 115%	PASS		
	Method: EPA 245.7					Batch ID: E-32024		Prepared: 12-Jan-24			Analyzed: 12-Jan-24		
Mercury (Hg)	NA	0.00102	1	0.00001	0.00002	µg/wet g		0		82 - 119%			

Elements

QUALITY CONTROL REPORT

Sample ID: 112744-BS2 | **QAQC Procedural Blank** | **Matrix: BlankMatrix** | **Sampled:** | **Received:**

Method: EPA 6020 | Batch ID: E-29074 | Prepared: 09-Jan-24 | Analyzed: 10-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
Aluminum (Al)	NA	1.89	1	1	5	µg/wet g	2	0	94	89 - 119%	PASS	4	30	PASS	
Antimony (Sb)	NA	2.09	1	0.025	0.05	µg/wet g	2	0	104	87 - 117%	PASS	1	30	PASS	
Arsenic (As)	NA	2.17	1	0.025	0.05	µg/wet g	2	0	109	89 - 119%	PASS	2	30	PASS	
Barium (Ba)	NA	2.13	1	0.025	0.05	µg/wet g	2	0	107	88 - 118%	PASS	2	30	PASS	
Beryllium (Be)	NA	1.61	1	0.025	0.05	µg/wet g	2	0	81	73 - 120%	PASS	2	30	PASS	
Cadmium (Cd)	NA	2	1	0.025	0.05	µg/wet g	2	0	100	86 - 116%	PASS	0	30	PASS	
Chromium (Cr)	NA	2.07	1	0.025	0.05	µg/wet g	2	0	103	86 - 116%	PASS	2	30	PASS	
Cobalt (Co)	NA	2.12	1	0.025	0.05	µg/wet g	2	0	106	86 - 116%	PASS	3	30	PASS	
Copper (Cu)	NA	2.1	1	0.025	0.05	µg/wet g	2	0	105	83 - 116%	PASS	3	30	PASS	
Iron (Fe)	NA	2	1	1	5	µg/wet g	2	0	100	85 - 115%	PASS	4	30	PASS	
Lead (Pb)	NA	1.9	1	0.025	0.05	µg/wet g	2	0	95	89 - 119%	PASS	1	30	PASS	
Molybdenum (Mo)	NA	2.01	1	0.025	0.05	µg/wet g	2	0	100	85 - 115%	PASS	0	30	PASS	
Nickel (Ni)	NA	2.11	1	0.025	0.05	µg/wet g	2	0	105	81 - 119%	PASS	3	30	PASS	
Selenium (Se)	NA	2.1	1	0.025	0.05	µg/wet g	2	0	105	87 - 122%	PASS	3	30	PASS	
Silver (Ag)	NA	0.201	1	0.025	0.05	µg/wet g	0.2	0	100	75 - 123%	PASS	8	30	PASS	
Thallium (Tl)	NA	2	1	0.025	0.05	µg/wet g	2	0	100	75 - 125%	PASS	0	30	PASS	
Vanadium (V)	NA	2.08	1	0.025	0.05	µg/wet g	2	0	104	78 - 118%	PASS	3	30	PASS	
Zinc (Zn)	NA	2.09	1	0.025	0.05	µg/wet g	2	0	104	85 - 115%	PASS	1	30	PASS	
Method: EPA 245.7						Batch ID: E-32024			Prepared: 12-Jan-24				Analyzed: 12-Jan-24		
Mercury (Hg)	NA	0.00104	1	0.00001	0.00002	µg/wet g		0		82 - 119%		0	30	PASS	

Elements

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 112745-CRM1	**QAQC CRM - SRM 1566b**					**Matrix: Tissue**		**Sampled:**				**Received:**		
	Method: EPA 6020					Batch ID: E-29074		Prepared: 09-Jan-24				Analyzed: 10-Jan-24		
Aluminum (Al)	NA	237	1	1	5	µg/dry g	197		120	80 - 120%	PASS			
Antimony (Sb)	NA	0.009	1	0.025	0.05	µg/dry g	0.011		82	80 - 120%	PASS			
Arsenic (As)	NA	6.96	1	0.025	0.05	µg/dry g	7.65		91	80 - 120%	PASS			
Cadmium (Cd)	NA	2.21	1	0.025	0.05	µg/dry g	2.48		89	80 - 120%	PASS			
Cobalt (Co)	NA	0.431	1	0.025	0.05	µg/dry g	0.371		116	80 - 120%	PASS			
Copper (Cu)	NA	59.4	1	0.025	0.05	µg/dry g	71.6		83	80 - 120%	PASS			
Iron (Fe)	NA	185	1	1	5	µg/dry g	206		90	80 - 120%	PASS			
Lead (Pb)	NA	0.259	1	0.025	0.05	µg/dry g	0.308		84	80 - 120%	PASS			
Selenium (Se)	NA	1.96	1	0.025	0.05	µg/dry g	2.06		95	80 - 120%	PASS			
Silver (Ag)	NA	0.7	1	0.025	0.05	µg/dry g	0.666		105	80 - 120%	PASS			
Vanadium (V)	NA	0.533	1	0.025	0.05	µg/dry g	0.577		92	80 - 120%	PASS			
Zinc (Zn)	NA	1230	1	0.025	0.05	µg/dry g	1420		87	80 - 120%	PASS			
	Method: EPA 245.7					Batch ID: E-32024		Prepared: 12-Jan-24				Analyzed: 12-Jan-24		
Mercury (Hg)	NA	0.0365	1	0.00001	0.00002	µg/dry g	0.0371		98	80 - 120%	PASS			

Elements

QUALITY CONTROL REPORT

Sample ID: 112747-MS1 Shallow Ref-1 | Matrix: Tissue | Sampled: 08-Nov-23 | Received: 08-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
	Method: EPA 6020					Batch ID: E-29074		Prepared: 09-Jan-24			Analyzed: 10-Jan-24		
Aluminum (Al)	NA	73.5	1	1	5	µg/wet g	15.1	62.7	72	63 - 142%	PASS		
Antimony (Sb)	NA	15.8	1	0.025	0.05	µg/wet g	15.1	0	105	87 - 117%	PASS		
Arsenic (As)	NA	18	1	0.025	0.05	µg/wet g	15.1	1.05	112	84 - 122%	PASS		
Barium (Ba)	NA	16.2	1	0.025	0.05	µg/wet g	15.1	0.947	101	74 - 137%	PASS		
Beryllium (Be)	NA	13.1	1	0.025	0.05	µg/wet g	15.1	0	87	83 - 119%	PASS		
Cadmium (Cd)	NA	16.2	1	0.025	0.05	µg/wet g	15.1	0.989	101	82 - 121%	PASS		
Chromium (Cr)	NA	20.6	1	0.025	0.05	µg/wet g	15.1	4.5	107	89 - 119%	PASS		
Cobalt (Co)	NA	16.1	1	0.025	0.05	µg/wet g	15.1	0.104	106	86 - 116%	PASS		
Copper (Cu)	NA	16.5	1	0.025	0.05	µg/wet g	15.1	0.826	104	83 - 113%	PASS		
Iron (Fe)	NA	125	1	1	5	µg/wet g	15.1	108	113	79 - 136%	PASS		
Lead (Pb)	NA	13.9	1	0.025	0.05	µg/wet g	15.1	0.054	92	79 - 118%	PASS		
Molybdenum (Mo)	NA	16.9	1	0.025	0.05	µg/wet g	15.1	0.942	106	83 - 140%	PASS		
Nickel (Ni)	NA	18	1	0.025	0.05	µg/wet g	15.1	1.97	106	85 - 115%	PASS		
Selenium (Se)	NA	17.4	1	0.025	0.05	µg/wet g	15.1	0.497	112	83 - 129%	PASS		
Silver (Ag)	NA	1.58	1	0.025	0.05	µg/wet g	1.51	0.06	101	67 - 127%	PASS		
Thallium (Tl)	NA	14.7	1	0.025	0.05	µg/wet g	15.1	0	97	75 - 125%	PASS		
Vanadium (V)	NA	16.5	1	0.025	0.05	µg/wet g	15.1	0.318	107	92 - 126%	PASS		
Zinc (Zn)	NA	30	1	0.025	0.05	µg/wet g	15.1	14	106	76 - 113%	PASS		
	Method: EPA 245.7					Batch ID: E-32024		Prepared: 12-Jan-24			Analyzed: 12-Jan-24		
Mercury (Hg)	NA	0.234	1	0.00001	0.00002	µg/wet g		0.00581		74 - 131%			

Elements

QUALITY CONTROL REPORT

Sample ID: 112747-MS2 Shallow Ref-1 Matrix: Tissue Sampled: 08-Nov-23 Received: 08-Nov-23

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
	Method: EPA 6020					Batch ID: E-29074		Prepared: 09-Jan-24				Analyzed: 10-Jan-24			
Aluminum (Al)	NA	72.7	1	1	5	µg/wet g	15.1	62.7	66	63 - 142%	PASS	9	30	PASS	
Antimony (Sb)	NA	15.8	1	0.025	0.05	µg/wet g	15.1	0	105	87 - 117%	PASS	0	30	PASS	
Arsenic (As)	NA	18.6	1	0.025	0.05	µg/wet g	15.1	1.05	116	84 - 122%	PASS	4	30	PASS	
Barium (Ba)	NA	16.6	1	0.025	0.05	µg/wet g	15.1	0.947	104	74 - 137%	PASS	3	30	PASS	
Beryllium (Be)	NA	14	1	0.025	0.05	µg/wet g	15.1	0	93	83 - 119%	PASS	7	30	PASS	
Cadmium (Cd)	NA	16.2	1	0.025	0.05	µg/wet g	15.1	0.989	101	82 - 121%	PASS	0	30	PASS	
Chromium (Cr)	NA	20.8	1	0.025	0.05	µg/wet g	15.1	4.5	108	89 - 119%	PASS	1	30	PASS	
Cobalt (Co)	NA	16.6	1	0.025	0.05	µg/wet g	15.1	0.104	109	86 - 116%	PASS	3	30	PASS	
Copper (Cu)	NA	16.8	1	0.025	0.05	µg/wet g	15.1	0.826	106	83 - 113%	PASS	2	30	PASS	
Iron (Fe)	NA	125	1	1	5	µg/wet g	15.1	108	113	79 - 136%	PASS	0	30	PASS	
Lead (Pb)	NA	14	1	0.025	0.05	µg/wet g	15.1	0.054	92	79 - 118%	PASS	0	30	PASS	
Molybdenum (Mo)	NA	16.8	1	0.025	0.05	µg/wet g	15.1	0.942	105	83 - 140%	PASS	1	30	PASS	
Nickel (Ni)	NA	18.4	1	0.025	0.05	µg/wet g	15.1	1.97	109	85 - 115%	PASS	3	30	PASS	
Selenium (Se)	NA	17.5	1	0.025	0.05	µg/wet g	15.1	0.497	113	83 - 129%	PASS	1	30	PASS	
Silver (Ag)	NA	1.57	1	0.025	0.05	µg/wet g	1.51	0.06	100	67 - 127%	PASS	1	30	PASS	
Thallium (Tl)	NA	14.7	1	0.025	0.05	µg/wet g	15.1	0	97	75 - 125%	PASS	0	30	PASS	
Vanadium (V)	NA	16.8	1	0.025	0.05	µg/wet g	15.1	0.318	109	92 - 126%	PASS	2	30	PASS	
Zinc (Zn)	NA	30.5	1	0.025	0.05	µg/wet g	15.1	14	109	76 - 113%	PASS	3	30	PASS	
	Method: EPA 245.7					Batch ID: E-32024		Prepared: 12-Jan-24				Analyzed: 12-Jan-24			
Mercury (Hg)	NA	0.198	1	0.00001	0.00002	µg/wet g		0.00581		74 - 131%		0	30	PASS	

Elements

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 112747-R2	**Shallow Ref-1**					**Matrix: Tissue**		**Sampled: 08-Nov-23**			**Received: 08-Nov-23**		
	Method: EPA 6020					Batch ID: E-29074		Prepared: 09-Jan-24			Analyzed: 10-Jan-24		
Aluminum (Al)	NA	58.7	1	1	5	µg/wet g					7	30	PASS
Antimony (Sb)	NA	ND	1	0.025	0.05	µg/wet g					0	30	PASS
Arsenic (As)	NA	1.1	1	0.025	0.05	µg/wet g					5	30	PASS
Barium (Ba)	NA	0.776	1	0.025	0.05	µg/wet g					20	30	PASS
Beryllium (Be)	NA	ND	1	0.025	0.05	µg/wet g					0	30	PASS
Cadmium (Cd)	NA	0.971	1	0.025	0.05	µg/wet g					2	30	PASS
Chromium (Cr)	NA	2.24	1	0.025	0.05	µg/wet g					67	30	FAIL M
Cobalt (Co)	NA	0.108	1	0.025	0.05	µg/wet g					4	30	PASS
Copper (Cu)	NA	0.867	1	0.025	0.05	µg/wet g					5	30	PASS
Iron (Fe)	NA	99.9	1	1	5	µg/wet g					8	30	PASS
Lead (Pb)	NA	0.053	1	0.025	0.05	µg/wet g					2	30	PASS
Molybdenum (Mo)	NA	0.537	1	0.025	0.05	µg/wet g					55	30	FAIL M
Nickel (Ni)	NA	1.95	1	0.025	0.05	µg/wet g					1	30	PASS
Selenium (Se)	NA	0.504	1	0.025	0.05	µg/wet g					1	30	PASS
Silver (Ag)	NA	0.033	1	0.025	0.05	µg/wet g					58	30	FAIL M
Thallium (Tl)	NA	ND	1	0.025	0.05	µg/wet g					0	30	PASS
Vanadium (V)	NA	0.284	1	0.025	0.05	µg/wet g					11	30	PASS
Zinc (Zn)	NA	14.3	1	0.025	0.05	µg/wet g					2	30	PASS
	Method: EPA 245.7					Batch ID: E-32024		Prepared: 12-Jan-24			Analyzed: 12-Jan-24		
Mercury (Hg)	NA	0.00515	1	0.00001	0.00002	µg/wet g					12	30	PASS

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 112744-B1	**QAQC Procedural Blank**					**Matrix: BlankMatrix**		**Sampled:**			**Received:**		
	Method: EPA 8270E					Batch ID: O-43086		Prepared: 26-Dec-23			Analyzed: 08-Jan-24		
PCB 003	Total	ND	1	0.25	0.5	ng/wet g							
PCB 008	Total	ND	1	0.017	0.5	ng/wet g							
PCB 018	Total	ND	1	0.029	0.5	ng/wet g							
PCB 028	Total	ND	1	0.023	0.5	ng/wet g							
PCB 031	Total	ND	1	0.25	0.5	ng/wet g							
PCB 033	Total	ND	1	0.25	0.5	ng/wet g							
PCB 037	Total	ND	1	0.06	0.5	ng/wet g							
PCB 044	Total	ND	1	0.028	0.5	ng/wet g							
PCB 049	Total	ND	1	0.036	0.5	ng/wet g							
PCB 052	Total	ND	1	0.012	0.5	ng/wet g							
PCB 056/60	Total	ND	1	0.25	0.5	ng/wet g							
PCB 066	Total	ND	1	0.027	0.5	ng/wet g							
PCB 070	Total	ND	1	0.023	0.5	ng/wet g							
PCB 074	Total	ND	1	0.021	0.5	ng/wet g							
PCB 077	Total	ND	1	0.018	0.5	ng/wet g							
PCB 081	Total	ND	1	0.084	0.5	ng/wet g							
PCB 087	Total	ND	1	0.081	0.5	ng/wet g							
PCB 095	Total	ND	1	0.25	0.5	ng/wet g							
PCB 097	Total	ND	1	0.25	0.5	ng/wet g							
PCB 099	Total	ND	1	0.028	0.5	ng/wet g							
PCB 101	Total	ND	1	0.027	0.5	ng/wet g							
PCB 105	Total	ND	1	0.047	0.5	ng/wet g							
PCB 110	Total	ND	1	0.074	0.5	ng/wet g							

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 114	Total	ND	1	0.072	0.5	ng/wet g							
PCB 118	Total	ND	1	0.069	0.5	ng/wet g							
PCB 119	Total	ND	1	0.071	0.5	ng/wet g							
PCB 123	Total	ND	1	0.018	0.5	ng/wet g							
PCB 126	Total	ND	1	0.086	0.5	ng/wet g							
PCB 128	Total	ND	1	0.081	0.5	ng/wet g							
PCB 132/168	Total	ND	1	0.094	0.5	ng/wet g							
PCB 138	Total	ND	1	0.057	0.5	ng/wet g							
PCB 141	Total	ND	1	0.25	0.5	ng/wet g							
PCB 149	Total	ND	1	0.092	0.5	ng/wet g							
PCB 151	Total	ND	1	0.073	0.5	ng/wet g							
PCB 153	Total	ND	1	0.065	0.5	ng/wet g							
PCB 156	Total	ND	1	0.089	0.5	ng/wet g							
PCB 157	Total	ND	1	0.103	0.5	ng/wet g							
PCB 158	Total	ND	1	0.074	0.5	ng/wet g							
PCB 167	Total	ND	1	0.049	0.5	ng/wet g							
PCB 169	Total	ND	1	0.116	0.5	ng/wet g							
PCB 170	Total	ND	1	0.118	0.5	ng/wet g							
PCB 174	Total	ND	1	0.25	0.5	ng/wet g							
PCB 177	Total	ND	1	0.085	0.5	ng/wet g							
PCB 180	Total	ND	1	0.154	0.5	ng/wet g							
PCB 183	Total	ND	1	0.056	0.5	ng/wet g							
PCB 187	Total	ND	1	0.168	0.5	ng/wet g							
PCB 189	Total	ND	1	0.109	0.5	ng/wet g							
PCB 194	Total	ND	1	0.164	0.5	ng/wet g							
PCB 195	Total	ND	1	0.093	0.5	ng/wet g							

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 199	Total	ND	1	0.25	0.5	ng/wet g							
PCB 201	Total	ND	1	0.104	0.5	ng/wet g							
PCB 206	Total	ND	1	0.155	0.5	ng/wet g							
PCB 209	Total	ND	1	0.25	0.5	ng/wet g							

PCB Congeners

QUALITY CONTROL REPORT

Sample ID: 112744-BS1 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 003	Total	37.1	1	0.25	0.5	ng/wet g	50	0	74	41 - 122% PASS			
PCB 008	Total	41	1	0.017	0.5	ng/wet g	50	0	82	47 - 123% PASS			
PCB 018	Total	35.1	1	0.029	0.5	ng/wet g	50	0	70	48 - 123% PASS			
PCB 028	Total	44	1	0.023	0.5	ng/wet g	50	0	88	53 - 121% PASS			
PCB 031	Total	29.9	1	0.25	0.5	ng/wet g	50	0	60	60 - 118% PASS			
PCB 033	Total	37.1	1	0.25	0.5	ng/wet g	50	0	74	58 - 120% PASS			
PCB 037	Total	46.1	1	0.06	0.5	ng/wet g	50	0	92	59 - 121% PASS			
PCB 044	Total	37.4	1	0.028	0.5	ng/wet g	50	0	75	57 - 126% PASS			
PCB 049	Total	41.2	1	0.036	0.5	ng/wet g	50	0	82	60 - 124% PASS			
PCB 052	Total	32.9	1	0.012	0.5	ng/wet g	50	0	66	56 - 130% PASS			
PCB 056/60	Total	97.9	1	0.25	0.5	ng/wet g	100	0	98	65 - 124% PASS			
PCB 066	Total	38.9	1	0.027	0.5	ng/wet g	50	0	78	62 - 128% PASS			
PCB 070	Total	34.5	1	0.023	0.5	ng/wet g	50	0	69	60 - 129% PASS			
PCB 074	Total	42.1	1	0.021	0.5	ng/wet g	50	0	84	62 - 126% PASS			
PCB 077	Total	49.7	1	0.018	0.5	ng/wet g	50	0	99	69 - 132% PASS			
PCB 081	Total	44.8	1	0.084	0.5	ng/wet g	50	0	90	64 - 131% PASS			
PCB 087	Total	41.8	1	0.081	0.5	ng/wet g	50	0	84	60 - 134% PASS			
PCB 095	Total	41.2	1	0.25	0.5	ng/wet g	50	0	82	59 - 126% PASS			
PCB 097	Total	41.8	1	0.25	0.5	ng/wet g	50	0	84	63 - 134% PASS			
PCB 099	Total	37.3	1	0.028	0.5	ng/wet g	50	0	75	62 - 130% PASS			
PCB 101	Total	41.9	1	0.027	0.5	ng/wet g	50	0	84	61 - 132% PASS			
PCB 105	Total	42.4	1	0.047	0.5	ng/wet g	50	0	85	69 - 117% PASS			
PCB 110	Total	57.7	1	0.074	0.5	ng/wet g	50	0	115	61 - 132% PASS			

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 114	Total	40.8	1	0.072	0.5	ng/wet g	50	0	82	59 - 141%	PASS			
PCB 118	Total	45.5	1	0.069	0.5	ng/wet g	50	0	91	60 - 139%	PASS			
PCB 119	Total	39	1	0.071	0.5	ng/wet g	50	0	78	62 - 130%	PASS			
PCB 123	Total	42	1	0.018	0.5	ng/wet g	50	0	84	61 - 139%	PASS			
PCB 126	Total	48	1	0.086	0.5	ng/wet g	50	0	96	63 - 148%	PASS			
PCB 128	Total	42.9	1	0.081	0.5	ng/wet g	50	0	86	64 - 140%	PASS			
PCB 132/168	Total	83.8	1	0.094	0.5	ng/wet g	100	0	84	60 - 127%	PASS			
PCB 138	Total	39.5	1	0.057	0.5	ng/wet g	50	0	79	69 - 132%	PASS			
PCB 141	Total	47.7	1	0.25	0.5	ng/wet g	50	0	95	64 - 122%	PASS			
PCB 149	Total	41.4	1	0.092	0.5	ng/wet g	50	0	83	54 - 137%	PASS			
PCB 151	Total	52.9	1	0.073	0.5	ng/wet g	50	0	106	59 - 146%	PASS			
PCB 153	Total	48.6	1	0.065	0.5	ng/wet g	50	0	97	69 - 132%	PASS			
PCB 156	Total	51.9	1	0.089	0.5	ng/wet g	50	0	104	59 - 156%	PASS			
PCB 157	Total	35.9	1	0.103	0.5	ng/wet g	50	0	72	59 - 136%	PASS			
PCB 158	Total	44.3	1	0.074	0.5	ng/wet g	50	0	89	72 - 127%	PASS			
PCB 167	Total	36.5	1	0.049	0.5	ng/wet g	50	0	73	67 - 139%	PASS			
PCB 169	Total	34.2	1	0.116	0.5	ng/wet g	50	0	68	51 - 173%	PASS			
PCB 170	Total	43.8	1	0.118	0.5	ng/wet g	50	0	88	55 - 157%	PASS			
PCB 174	Total	35.7	1	0.25	0.5	ng/wet g	50	0	71	67 - 129%	PASS			
PCB 177	Total	53.8	1	0.085	0.5	ng/wet g	50	0	108	62 - 142%	PASS			
PCB 180	Total	40.2	1	0.154	0.5	ng/wet g	50	0	80	60 - 152%	PASS			
PCB 183	Total	31.7	1	0.056	0.5	ng/wet g	50	0	63	60 - 145%	PASS			
PCB 187	Total	38	1	0.168	0.5	ng/wet g	50	0	76	66 - 140%	PASS			
PCB 189	Total	41.5	1	0.109	0.5	ng/wet g	50	0	83	43 - 173%	PASS			
PCB 194	Total	59.5	1	0.164	0.5	ng/wet g	50	0	119	45 - 168%	PASS			
PCB 195	Total	28.8	1	0.093	0.5	ng/wet g	50	0	58	57 - 158%	PASS			

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 199	Total	47.9	1	0.25	0.5	ng/wet g	50	0	96	52 - 137%	PASS			
PCB 201	Total	39	1	0.104	0.5	ng/wet g	50	0	78	59 - 143%	PASS			
PCB 206	Total	29.8	1	0.155	0.5	ng/wet g	50	0	60	46 - 172%	PASS			
PCB 209	Total	42.8	1	0.25	0.5	ng/wet g	50	0	86	50 - 163%	PASS			

PCB Congeners

QUALITY CONTROL REPORT

Sample ID: 112744-BS2 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 003	Total	46.4	1	0.25	0.5	ng/wet g	50	0	93	41 - 122%	PASS	23	30	PASS
PCB 008	Total	44.6	1	0.017	0.5	ng/wet g	50	0	89	47 - 123%	PASS	8	30	PASS
PCB 018	Total	35.5	1	0.029	0.5	ng/wet g	50	0	71	48 - 123%	PASS	1	30	PASS
PCB 028	Total	43.6	1	0.023	0.5	ng/wet g	50	0	87	53 - 121%	PASS	1	30	PASS
PCB 031	Total	37.2	1	0.25	0.5	ng/wet g	50	0	74	60 - 118%	PASS	21	30	PASS
PCB 033	Total	36.2	1	0.25	0.5	ng/wet g	50	0	72	58 - 120%	PASS	3	30	PASS
PCB 037	Total	48.7	1	0.06	0.5	ng/wet g	50	0	97	59 - 121%	PASS	5	30	PASS
PCB 044	Total	43.8	1	0.028	0.5	ng/wet g	50	0	88	57 - 126%	PASS	16	30	PASS
PCB 049	Total	46.3	1	0.036	0.5	ng/wet g	50	0	93	60 - 124%	PASS	13	30	PASS
PCB 052	Total	42.6	1	0.012	0.5	ng/wet g	50	0	85	56 - 130%	PASS	25	30	PASS
PCB 056/60	Total	82.4	1	0.25	0.5	ng/wet g	100	0	82	65 - 124%	PASS	18	30	PASS
PCB 066	Total	38.8	1	0.027	0.5	ng/wet g	50	0	78	62 - 128%	PASS	0	30	PASS
PCB 070	Total	31.5	1	0.023	0.5	ng/wet g	50	0	63	60 - 129%	PASS	9	30	PASS
PCB 074	Total	35.9	1	0.021	0.5	ng/wet g	50	0	72	62 - 126%	PASS	15	30	PASS
PCB 077	Total	42.2	1	0.018	0.5	ng/wet g	50	0	84	69 - 132%	PASS	16	30	PASS
PCB 081	Total	41.6	1	0.084	0.5	ng/wet g	50	0	83	64 - 131%	PASS	8	30	PASS
PCB 087	Total	40.8	1	0.081	0.5	ng/wet g	50	0	82	60 - 134%	PASS	2	30	PASS
PCB 095	Total	41.7	1	0.25	0.5	ng/wet g	50	0	83	59 - 126%	PASS	1	30	PASS
PCB 097	Total	38.5	1	0.25	0.5	ng/wet g	50	0	77	63 - 134%	PASS	9	30	PASS
PCB 099	Total	33.9	1	0.028	0.5	ng/wet g	50	0	68	62 - 130%	PASS	10	30	PASS
PCB 101	Total	37.7	1	0.027	0.5	ng/wet g	50	0	75	61 - 132%	PASS	11	30	PASS
PCB 105	Total	40.9	1	0.047	0.5	ng/wet g	50	0	82	69 - 117%	PASS	4	30	PASS
PCB 110	Total	44.2	1	0.074	0.5	ng/wet g	50	0	88	61 - 132%	PASS	27	30	PASS

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
PCB 114	Total	45.6	1	0.072	0.5	ng/wet g	50	0	91	59 - 141%	PASS	10	30	PASS	
PCB 118	Total	44.6	1	0.069	0.5	ng/wet g	50	0	89	60 - 139%	PASS	2	30	PASS	
PCB 119	Total	36.5	1	0.071	0.5	ng/wet g	50	0	73	62 - 130%	PASS	7	30	PASS	
PCB 123	Total	51.1	1	0.018	0.5	ng/wet g	50	0	102	61 - 139%	PASS	19	30	PASS	
PCB 126	Total	52.2	1	0.086	0.5	ng/wet g	50	0	104	63 - 148%	PASS	8	30	PASS	
PCB 128	Total	40.1	1	0.081	0.5	ng/wet g	50	0	80	64 - 140%	PASS	7	30	PASS	
PCB 132/168	Total	83.6	1	0.094	0.5	ng/wet g	100	0	84	60 - 127%	PASS	0	30	PASS	
PCB 138	Total	43.6	1	0.057	0.5	ng/wet g	50	0	87	69 - 132%	PASS	10	30	PASS	
PCB 141	Total	39.9	1	0.25	0.5	ng/wet g	50	0	80	64 - 122%	PASS	17	30	PASS	
PCB 149	Total	46.5	1	0.092	0.5	ng/wet g	50	0	93	54 - 137%	PASS	11	30	PASS	
PCB 151	Total	39.5	1	0.073	0.5	ng/wet g	50	0	79	59 - 146%	PASS	29	30	PASS	
PCB 153	Total	44	1	0.065	0.5	ng/wet g	50	0	88	69 - 132%	PASS	10	30	PASS	
PCB 156	Total	50.8	1	0.089	0.5	ng/wet g	50	0	102	59 - 156%	PASS	2	30	PASS	
PCB 157	Total	45.4	1	0.103	0.5	ng/wet g	50	0	91	59 - 136%	PASS	23	30	PASS	
PCB 158	Total	45.5	1	0.074	0.5	ng/wet g	50	0	91	72 - 127%	PASS	2	30	PASS	
PCB 167	Total	46.2	1	0.049	0.5	ng/wet g	50	0	92	67 - 139%	PASS	23	30	PASS	
PCB 169	Total	44.8	1	0.116	0.5	ng/wet g	50	0	90	51 - 173%	PASS	28	30	PASS	
PCB 170	Total	47.4	1	0.118	0.5	ng/wet g	50	0	95	55 - 157%	PASS	8	30	PASS	
PCB 174	Total	47	1	0.25	0.5	ng/wet g	50	0	94	67 - 129%	PASS	28	30	PASS	
PCB 177	Total	57.2	1	0.085	0.5	ng/wet g	50	0	114	62 - 142%	PASS	5	30	PASS	
PCB 180	Total	42.5	1	0.154	0.5	ng/wet g	50	0	85	60 - 152%	PASS	6	30	PASS	
PCB 183	Total	38.7	1	0.056	0.5	ng/wet g	50	0	77	60 - 145%	PASS	20	30	PASS	
PCB 187	Total	44.7	1	0.168	0.5	ng/wet g	50	0	89	66 - 140%	PASS	16	30	PASS	
PCB 189	Total	46.6	1	0.109	0.5	ng/wet g	50	0	93	43 - 173%	PASS	11	30	PASS	
PCB 194	Total	60.5	1	0.164	0.5	ng/wet g	50	0	121	45 - 168%	PASS	2	30	PASS	
PCB 195	Total	32.5	1	0.093	0.5	ng/wet g	50	0	65	57 - 158%	PASS	11	30	PASS	

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
PCB 199	Total	54.6	1	0.25	0.5	ng/wet g	50	0	109	52 - 137%	PASS	13	30	PASS	
PCB 201	Total	38.9	1	0.104	0.5	ng/wet g	50	0	78	59 - 143%	PASS	0	30	PASS	
PCB 206	Total	36.4	1	0.155	0.5	ng/wet g	50	0	73	46 - 172%	PASS	20	30	PASS	
PCB 209	Total	39.6	1	0.25	0.5	ng/wet g	50	0	79	50 - 163%	PASS	8	30	PASS	

PCB Congeners

QUALITY CONTROL REPORT

Sample ID: 112746-CRM1 QAQC CRM - SRM 1946 | **Matrix: Tissue** | **Sampled:** | **Received:**

Method: EPA 8270E | Batch ID: O-43086 | Prepared: 26-Dec-23 | Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 018	Total	0.763	1	0.029	0.5	ng/wet g	0.84		91	60 - 140% PASS			
PCB 028	Total	1.59	1	0.023	0.5	ng/wet g	2		80	60 - 140% PASS			
PCB 031	Total	1.32	1	0.25	0.5	ng/wet g	1.46		90	60 - 140% PASS			
PCB 044	Total	3.4	1	0.028	0.5	ng/wet g	4.66		73	60 - 140% PASS			
PCB 049	Total	3.54	1	0.036	0.5	ng/wet g	3.8		93	60 - 140% PASS			
PCB 052	Total	5.43	1	0.012	0.5	ng/wet g	8.1		67	60 - 140% PASS			
PCB 056/60	Total	5.84	1	0.25	0.5	ng/wet g	5.77		101	60 - 140% PASS			
PCB 066	Total	14.3	1	0.027	0.5	ng/wet g	10.8		132	60 - 140% PASS			
PCB 070	Total	14.5	1	0.023	0.5	ng/wet g	14.9		97	60 - 140% PASS			
PCB 074	Total	5.4	1	0.021	0.5	ng/wet g	4.83		112	60 - 140% PASS			
PCB 077	Total	0.28	1	0.018	0.5	ng/wet g	0.327		86	80 - 120% PASS			
PCB 087	Total	11.5	1	0.081	0.5	ng/wet g	9.4		122	60 - 140% PASS			
PCB 095	Total	9.53	1	0.25	0.5	ng/wet g	11.4		84	60 - 140% PASS			
PCB 099	Total	18.4	1	0.028	0.5	ng/wet g	25.6		72	60 - 140% PASS			
PCB 101	Total	32.7	1	0.027	0.5	ng/wet g	34.6		95	60 - 140% PASS			
PCB 105	Total	15.2	1	0.047	0.5	ng/wet g	19.9		76	60 - 140% PASS			
PCB 110	Total	17.8	1	0.074	0.5	ng/wet g	22.8		78	60 - 140% PASS			
PCB 118	Total	40.7	1	0.069	0.5	ng/wet g	52.1		78	60 - 140% PASS			
PCB 128	Total	18	1	0.081	0.5	ng/wet g	22.8		79	60 - 140% PASS			
PCB 138	Total	117	1	0.057	0.5	ng/wet g	115		102	60 - 140% PASS			
PCB 149	Total	20.2	1	0.092	0.5	ng/wet g	26.3		77	60 - 140% PASS			
PCB 153	Total	113	1	0.065	0.5	ng/wet g	170		66	60 - 140% PASS			
PCB 156	Total	8.23	1	0.089	0.5	ng/wet g	9.52		86	60 - 140% PASS			

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 158	Total	4.91	1	0.074	0.5	ng/wet g	7.66		64	60 - 140%	PASS			
PCB 169	Total	0.0887	1	0.116	0.5	ng/wet g	0.106		84	80 - 120%	PASS			
PCB 170	Total	24.2	1	0.118	0.5	ng/wet g	25.2		96	60 - 140%	PASS			
PCB 174	Total	7.65	1	0.25	0.5	ng/wet g	9.3		82	60 - 140%	PASS			
PCB 180	Total	44.6	1	0.154	0.5	ng/wet g	74.4		60	60 - 140%	PASS			
PCB 183	Total	14.1	1	0.056	0.5	ng/wet g	21.9		64	60 - 140%	PASS			
PCB 187	Total	40.6	1	0.168	0.5	ng/wet g	55.2		74	60 - 140%	PASS			
PCB 194	Total	15.1	1	0.164	0.5	ng/wet g	13		116	60 - 140%	PASS			
PCB 195	Total	3.16	1	0.093	0.5	ng/wet g	5.3		60	60 - 140%	PASS			
PCB 201	Total	2.58	1	0.104	0.5	ng/wet g	2.83		91	60 - 140%	PASS			
PCB 206	Total	4.47	1	0.155	0.5	ng/wet g	5.4		83	60 - 140%	PASS			
PCB 209	Total	1.45	1	0.25	0.5	ng/wet g	1.3		112	60 - 140%	PASS			

PCB Congeners

QUALITY CONTROL REPORT

Sample ID: 112747-MS1 **Shallow Ref-1** **Matrix: Tissue** **Sampled: 08-Nov-23** **Received: 08-Nov-23**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 003	Total	11.1	1	0.25	0.5	ng/wet g	14.7	0	76	65 - 153%	PASS			
PCB 008	Total	11.2	1	0.017	0.5	ng/wet g	14.7	0	76	60 - 151%	PASS			
PCB 018	Total	9.1	1	0.029	0.5	ng/wet g	14.7	0	62	59 - 136%	PASS			
PCB 028	Total	12.1	1	0.023	0.5	ng/wet g	14.7	0	82	57 - 137%	PASS			
PCB 031	Total	11.7	1	0.25	0.5	ng/wet g	14.7	0	80	45 - 143%	PASS			
PCB 033	Total	9.84	1	0.25	0.5	ng/wet g	14.7	0	67	59 - 132%	PASS			
PCB 037	Total	14	1	0.06	0.5	ng/wet g	14.7	0	95	57 - 137%	PASS			
PCB 044	Total	10.5	1	0.028	0.5	ng/wet g	14.7	0	71	62 - 132%	PASS			
PCB 049	Total	11.2	1	0.036	0.5	ng/wet g	14.7	0	76	62 - 132%	PASS			
PCB 052	Total	10.7	1	0.012	0.5	ng/wet g	14.7	0	73	56 - 138%	PASS			
PCB 056/60	Total	21.7	1	0.25	0.5	ng/wet g	29.3	0	74	42 - 151%	PASS			
PCB 066	Total	11.5	1	0.027	0.5	ng/wet g	14.7	0	78	52 - 141%	PASS			
PCB 070	Total	12.5	1	0.023	0.5	ng/wet g	14.7	0	85	53 - 139%	PASS			
PCB 074	Total	13	1	0.021	0.5	ng/wet g	14.7	0	88	51 - 135%	PASS			
PCB 077	Total	12.6	1	0.018	0.5	ng/wet g	14.7	0	86	58 - 139%	PASS			
PCB 081	Total	12.3	1	0.084	0.5	ng/wet g	14.7	0	84	51 - 137%	PASS			
PCB 087	Total	10.8	1	0.081	0.5	ng/wet g	14.7	0	73	42 - 140%	PASS			
PCB 095	Total	13	1	0.25	0.5	ng/wet g	14.7	0	88	44 - 144%	PASS			
PCB 097	Total	11.3	1	0.25	0.5	ng/wet g	14.7	0	77	51 - 136%	PASS			
PCB 099	Total	12.8	1	0.028	0.5	ng/wet g	14.7	0	87	32 - 149%	PASS			
PCB 101	Total	11.7	1	0.027	0.5	ng/wet g	14.7	0	80	45 - 143%	PASS			
PCB 105	Total	11.2	1	0.047	0.5	ng/wet g	14.7	0	76	58 - 132%	PASS			
PCB 110	Total	12.8	1	0.074	0.5	ng/wet g	14.7	0	87	41 - 140%	PASS			

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 114	Total	12	1	0.072	0.5	ng/wet g	14.7	0	82	34 - 147%	PASS			
PCB 118	Total	12	1	0.069	0.5	ng/wet g	14.7	0	82	22 - 160%	PASS			
PCB 119	Total	13.2	1	0.071	0.5	ng/wet g	14.7	0	90	41 - 145%	PASS			
PCB 123	Total	13.4	1	0.018	0.5	ng/wet g	14.7	0	91	37 - 149%	PASS			
PCB 126	Total	16.7	1	0.086	0.5	ng/wet g	14.7	0	114	54 - 161%	PASS			
PCB 128	Total	12.6	1	0.081	0.5	ng/wet g	14.7	0	86	53 - 158%	PASS			
PCB 132/168	Total	22.3	1	0.094	0.5	ng/wet g	29.3	0	76	46 - 143%	PASS			
PCB 138	Total	13.3	1	0.057	0.5	ng/wet g	14.7	0	90	38 - 164%	PASS			
PCB 141	Total	11.3	1	0.25	0.5	ng/wet g	14.7	0	77	51 - 145%	PASS			
PCB 149	Total	12.5	1	0.092	0.5	ng/wet g	14.7	0	85	39 - 140%	PASS			
PCB 151	Total	12.3	1	0.073	0.5	ng/wet g	14.7	0	84	33 - 159%	PASS			
PCB 153	Total	10.7	1	0.065	0.5	ng/wet g	14.7	0.294	71	38 - 167%	PASS			
PCB 156	Total	14.5	1	0.089	0.5	ng/wet g	14.7	0	99	42 - 166%	PASS			
PCB 157	Total	11.5	1	0.103	0.5	ng/wet g	14.7	0	78	37 - 148%	PASS			
PCB 158	Total	13.3	1	0.074	0.5	ng/wet g	14.7	0	90	57 - 145%	PASS			
PCB 167	Total	11.4	1	0.049	0.5	ng/wet g	14.7	0	78	56 - 148%	PASS			
PCB 169	Total	12.1	1	0.116	0.5	ng/wet g	14.7	0	82	26 - 183%	PASS			
PCB 170	Total	12.9	1	0.118	0.5	ng/wet g	14.7	0	88	47 - 160%	PASS			
PCB 174	Total	11.5	1	0.25	0.5	ng/wet g	14.7	0	78	48 - 156%	PASS			
PCB 177	Total	14.5	1	0.085	0.5	ng/wet g	14.7	0	99	42 - 157%	PASS			
PCB 180	Total	11.6	1	0.154	0.5	ng/wet g	14.7	0	79	27 - 170%	PASS			
PCB 183	Total	12.2	1	0.056	0.5	ng/wet g	14.7	0	83	52 - 151%	PASS			
PCB 187	Total	10.9	1	0.168	0.5	ng/wet g	14.7	0	74	38 - 158%	PASS			
PCB 189	Total	11.3	1	0.109	0.5	ng/wet g	14.7	0	77	21 - 178%	PASS			
PCB 194	Total	13.3	1	0.164	0.5	ng/wet g	14.7	0	90	16 - 175%	PASS			
PCB 195	Total	9.05	1	0.093	0.5	ng/wet g	14.7	0	62	35 - 164%	PASS			

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
PCB 199	Total	12	1	0.25	0.5	ng/wet g	14.7	0	82	49 - 138%	PASS			
PCB 201	Total	11.2	1	0.104	0.5	ng/wet g	14.7	0	76	22 - 164%	PASS			
PCB 206	Total	8.08	1	0.155	0.5	ng/wet g	14.7	0	55	16 - 169%	PASS			
PCB 209	Total	8.94	1	0.25	0.5	ng/wet g	14.7	0	61	18 - 170%	PASS			

PCB Congeners

QUALITY CONTROL REPORT

Sample ID: 112747-MS2 **Shallow Ref-1** **Matrix: Tissue** **Sampled: 08-Nov-23** **Received: 08-Nov-23**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
PCB 003	Total	11.9	1	0.25	0.5	ng/wet g	16	0	74	65 - 153%	PASS	3	30	PASS	
PCB 008	Total	11.5	1	0.017	0.5	ng/wet g	16	0	72	60 - 151%	PASS	5	30	PASS	
PCB 018	Total	10.4	1	0.029	0.5	ng/wet g	16	0	65	59 - 136%	PASS	5	30	PASS	
PCB 028	Total	11.8	1	0.023	0.5	ng/wet g	16	0	74	57 - 137%	PASS	10	30	PASS	
PCB 031	Total	10.4	1	0.25	0.5	ng/wet g	16	0	65	45 - 143%	PASS	21	30	PASS	
PCB 033	Total	10.1	1	0.25	0.5	ng/wet g	16	0	63	59 - 132%	PASS	6	30	PASS	
PCB 037	Total	13.6	1	0.06	0.5	ng/wet g	16	0	85	57 - 137%	PASS	11	30	PASS	
PCB 044	Total	12.3	1	0.028	0.5	ng/wet g	16	0	77	62 - 132%	PASS	8	30	PASS	
PCB 049	Total	11.3	1	0.036	0.5	ng/wet g	16	0	71	62 - 132%	PASS	7	30	PASS	
PCB 052	Total	11.9	1	0.012	0.5	ng/wet g	16	0	74	56 - 138%	PASS	1	30	PASS	
PCB 056/60	Total	25.8	1	0.25	0.5	ng/wet g	32	0	81	42 - 151%	PASS	9	30	PASS	
PCB 066	Total	15.1	1	0.027	0.5	ng/wet g	16	0	94	52 - 141%	PASS	19	30	PASS	
PCB 070	Total	12.6	1	0.023	0.5	ng/wet g	16	0	79	53 - 139%	PASS	7	30	PASS	
PCB 074	Total	12.8	1	0.021	0.5	ng/wet g	16	0	80	51 - 135%	PASS	10	30	PASS	
PCB 077	Total	12.3	1	0.018	0.5	ng/wet g	16	0	77	58 - 139%	PASS	11	30	PASS	
PCB 081	Total	15	1	0.084	0.5	ng/wet g	16	0	94	51 - 137%	PASS	11	30	PASS	
PCB 087	Total	14.2	1	0.081	0.5	ng/wet g	16	0	89	42 - 140%	PASS	20	30	PASS	
PCB 095	Total	12.6	1	0.25	0.5	ng/wet g	16	0	79	44 - 144%	PASS	11	30	PASS	
PCB 097	Total	12	1	0.25	0.5	ng/wet g	16	0	75	51 - 136%	PASS	3	30	PASS	
PCB 099	Total	12	1	0.028	0.5	ng/wet g	16	0	75	32 - 149%	PASS	15	30	PASS	
PCB 101	Total	11.6	1	0.027	0.5	ng/wet g	16	0	73	45 - 143%	PASS	11	30	PASS	
PCB 105	Total	17.4	1	0.047	0.5	ng/wet g	16	0	109	58 - 132%	PASS	36	30	FAIL	M
PCB 110	Total	12.1	1	0.074	0.5	ng/wet g	16	0	76	41 - 140%	PASS	13	30	PASS	

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
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PHYSIS Project ID: 2309005-002
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Project: Santa Barbara Channel PO # 22238101

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
PCB 114	Total	17.5	1	0.072	0.5	ng/wet g	16	0	109	34 - 147%	PASS	28	30	PASS	
PCB 118	Total	13.2	1	0.069	0.5	ng/wet g	16	0	82	22 - 160%	PASS	0	30	PASS	
PCB 119	Total	15	1	0.071	0.5	ng/wet g	16	0	94	41 - 145%	PASS	4	30	PASS	
PCB 123	Total	15.6	1	0.018	0.5	ng/wet g	16	0	98	37 - 149%	PASS	7	30	PASS	
PCB 126	Total	16.3	1	0.086	0.5	ng/wet g	16	0	102	54 - 161%	PASS	11	30	PASS	
PCB 128	Total	14.1	1	0.081	0.5	ng/wet g	16	0	88	53 - 158%	PASS	2	30	PASS	
PCB 132/168	Total	33.6	1	0.094	0.5	ng/wet g	32	0	105	46 - 143%	PASS	32	30	FAIL	M
PCB 138	Total	14.8	1	0.057	0.5	ng/wet g	16	0	93	38 - 164%	PASS	2	30	PASS	
PCB 141	Total	12	1	0.25	0.5	ng/wet g	16	0	75	51 - 145%	PASS	3	30	PASS	
PCB 149	Total	13.6	1	0.092	0.5	ng/wet g	16	0	85	39 - 140%	PASS	0	30	PASS	
PCB 151	Total	12.4	1	0.073	0.5	ng/wet g	16	0	77	33 - 159%	PASS	7	30	PASS	
PCB 153	Total	16	1	0.065	0.5	ng/wet g	16	0.294	98	38 - 167%	PASS	32	30	FAIL	M
PCB 156	Total	15.2	1	0.089	0.5	ng/wet g	16	0	95	42 - 166%	PASS	4	30	PASS	
PCB 157	Total	13.1	1	0.103	0.5	ng/wet g	16	0	82	37 - 148%	PASS	5	30	PASS	
PCB 158	Total	12.5	1	0.074	0.5	ng/wet g	16	0	78	57 - 145%	PASS	14	30	PASS	
PCB 167	Total	12.4	1	0.049	0.5	ng/wet g	16	0	77	56 - 148%	PASS	0	30	PASS	
PCB 169	Total	17.9	1	0.116	0.5	ng/wet g	16	0	112	26 - 183%	PASS	31	30	FAIL	M
PCB 170	Total	15.5	1	0.118	0.5	ng/wet g	16	0	97	47 - 160%	PASS	10	30	PASS	
PCB 174	Total	13.4	1	0.25	0.5	ng/wet g	16	0	84	48 - 156%	PASS	7	30	PASS	
PCB 177	Total	18.3	1	0.085	0.5	ng/wet g	16	0	114	42 - 157%	PASS	14	30	PASS	
PCB 180	Total	14.5	1	0.154	0.5	ng/wet g	16	0	91	27 - 170%	PASS	14	30	PASS	
PCB 183	Total	11.7	1	0.056	0.5	ng/wet g	16	0	73	52 - 151%	PASS	13	30	PASS	
PCB 187	Total	11.6	1	0.168	0.5	ng/wet g	16	0	73	38 - 158%	PASS	3	30	PASS	
PCB 189	Total	14.4	1	0.109	0.5	ng/wet g	16	0	90	21 - 178%	PASS	16	30	PASS	
PCB 194	Total	13.7	1	0.164	0.5	ng/wet g	16	0	86	16 - 175%	PASS	5	30	PASS	
PCB 195	Total	10.9	1	0.093	0.5	ng/wet g	16	0	68	35 - 164%	PASS	9	30	PASS	

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
PCB 199	Total	18.1	1	0.25	0.5	ng/wet g	16	0	113	49 - 138%	PASS	32	30	FAIL	M
PCB 201	Total	12.3	1	0.104	0.5	ng/wet g	16	0	77	22 - 164%	PASS	1	30	PASS	
PCB 206	Total	9.35	1	0.155	0.5	ng/wet g	16	0	58	16 - 169%	PASS	5	30	PASS	
PCB 209	Total	9.13	1	0.25	0.5	ng/wet g	16	0	57	18 - 170%	PASS	7	30	PASS	

PCB Congeners

QUALITY CONTROL REPORT

Sample ID: 112747-R2 **Shallow Ref-1** **Matrix:** Tissue **Sampled:** 08-Nov-23 **Received:** 08-Nov-23

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 003	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS
PCB 008	Total	ND	1	0.017	0.5	ng/wet g					0	30	PASS
PCB 018	Total	ND	1	0.029	0.5	ng/wet g					0	30	PASS
PCB 028	Total	ND	1	0.023	0.5	ng/wet g					0	30	PASS
PCB 031	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS
PCB 033	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS
PCB 037	Total	ND	1	0.06	0.5	ng/wet g					0	30	PASS
PCB 044	Total	ND	1	0.028	0.5	ng/wet g					0	30	PASS
PCB 049	Total	ND	1	0.036	0.5	ng/wet g					0	30	PASS
PCB 052	Total	ND	1	0.012	0.5	ng/wet g					0	30	PASS
PCB 056/60	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS
PCB 066	Total	ND	1	0.027	0.5	ng/wet g					0	30	PASS
PCB 070	Total	ND	1	0.023	0.5	ng/wet g					0	30	PASS
PCB 074	Total	ND	1	0.021	0.5	ng/wet g					0	30	PASS
PCB 077	Total	ND	1	0.018	0.5	ng/wet g					0	30	PASS
PCB 081	Total	ND	1	0.084	0.5	ng/wet g					0	30	PASS
PCB 087	Total	ND	1	0.081	0.5	ng/wet g					0	30	PASS
PCB 095	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS
PCB 097	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS
PCB 099	Total	ND	1	0.028	0.5	ng/wet g					0	30	PASS
PCB 101	Total	ND	1	0.027	0.5	ng/wet g					0	30	PASS
PCB 105	Total	ND	1	0.047	0.5	ng/wet g					0	30	PASS
PCB 110	Total	ND	1	0.074	0.5	ng/wet g					0	30	PASS

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 114	Total	ND	1	0.072	0.5	ng/wet g					0	30	PASS
PCB 118	Total	ND	1	0.069	0.5	ng/wet g					0	30	PASS
PCB 119	Total	ND	1	0.071	0.5	ng/wet g					0	30	PASS
PCB 123	Total	ND	1	0.018	0.5	ng/wet g					0	30	PASS
PCB 126	Total	ND	1	0.086	0.5	ng/wet g					0	30	PASS
PCB 128	Total	ND	1	0.081	0.5	ng/wet g					0	30	PASS
PCB 132/168	Total	ND	1	0.094	0.5	ng/wet g					0	30	PASS
PCB 138	Total	ND	1	0.057	0.5	ng/wet g					0	30	PASS
PCB 141	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS
PCB 149	Total	ND	1	0.092	0.5	ng/wet g					0	30	PASS
PCB 151	Total	ND	1	0.073	0.5	ng/wet g					0	30	PASS
PCB 153	Total	0.301	1	0.065	0.5	ng/wet g					2	30	PASS J
PCB 156	Total	ND	1	0.089	0.5	ng/wet g					0	30	PASS
PCB 157	Total	ND	1	0.103	0.5	ng/wet g					0	30	PASS
PCB 158	Total	ND	1	0.074	0.5	ng/wet g					0	30	PASS
PCB 167	Total	ND	1	0.049	0.5	ng/wet g					0	30	PASS
PCB 169	Total	ND	1	0.116	0.5	ng/wet g					0	30	PASS
PCB 170	Total	ND	1	0.118	0.5	ng/wet g					0	30	PASS
PCB 174	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS
PCB 177	Total	ND	1	0.085	0.5	ng/wet g					0	30	PASS
PCB 180	Total	ND	1	0.154	0.5	ng/wet g					0	30	PASS
PCB 183	Total	ND	1	0.056	0.5	ng/wet g					0	30	PASS
PCB 187	Total	ND	1	0.168	0.5	ng/wet g					0	30	PASS
PCB 189	Total	ND	1	0.109	0.5	ng/wet g					0	30	PASS
PCB 194	Total	ND	1	0.164	0.5	ng/wet g					0	30	PASS
PCB 195	Total	ND	1	0.093	0.5	ng/wet g					0	30	PASS

PCB Congeners

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
PCB 199	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS
PCB 201	Total	ND	1	0.104	0.5	ng/wet g					0	30	PASS
PCB 206	Total	ND	1	0.155	0.5	ng/wet g					0	30	PASS
PCB 209	Total	ND	1	0.25	0.5	ng/wet g					0	30	PASS

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons QUALITY CONTROL REPORT

Sample ID: 112744-B1 **QAQC Procedural Blank** **Matrix: BlankMatrix** **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(d10-Acenaphthene)	Total	70	1			% Recovery	100		70	27 - 133% PASS			
(d10-Phenanthrene)	Total	84	1			% Recovery	100		84	43 - 129% PASS			
(d12-Chrysene)	Total	98	1			% Recovery	100		98	52 - 144% PASS			
(d12-Perylene)	Total	83	1			% Recovery	100		83	36 - 161% PASS			
(d8-Naphthalene)	Total	68	1			% Recovery	100		68	25 - 125% PASS			
1-Methylnaphthalene	Total	ND	1	1	5	ng/wet g							
1-Methylphenanthrene	Total	ND	1	1	5	ng/wet g							
2,3,5-Trimethylnaphthalene	Total	ND	1	1	5	ng/wet g							
2,6-Dimethylnaphthalene	Total	ND	1	1	5	ng/wet g							
2-Methylnaphthalene	Total	ND	1	1	5	ng/wet g							
Acenaphthene	Total	ND	1	1	5	ng/wet g							
Acenaphthylene	Total	ND	1	1	5	ng/wet g							
Anthracene	Total	ND	1	1	5	ng/wet g							
Benz[a]anthracene	Total	ND	1	1	5	ng/wet g							
Benzo[a]pyrene	Total	ND	1	1	5	ng/wet g							
Benzo[b]fluoranthene	Total	ND	1	1	5	ng/wet g							
Benzo[e]pyrene	Total	ND	1	1	5	ng/wet g							
Benzo[g,h,i]perylene	Total	ND	1	1	5	ng/wet g							
Benzo[k]fluoranthene	Total	ND	1	1	5	ng/wet g							
Biphenyl	Total	ND	1	1	5	ng/wet g							
Chrysene	Total	ND	1	1	5	ng/wet g							
Dibenz[a,h]anthracene	Total	ND	1	1	5	ng/wet g							
Dibenzothiophene	Total	ND	1	1	5	ng/wet g							

Polynuclear Aromatic Hydrocarbons

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Fluoranthene	Total	ND	1	1	5	ng/wet g							
Fluorene	Total	ND	1	1	5	ng/wet g							
Indeno[1,2,3-cd]pyrene	Total	ND	1	1	5	ng/wet g							
Naphthalene	Total	ND	1	1	5	ng/wet g							
Perylene	Total	ND	1	1	5	ng/wet g							
Phenanthrene	Total	ND	1	1	5	ng/wet g							
Pyrene	Total	ND	1	1	5	ng/wet g							

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons QUALITY CONTROL REPORT

Sample ID: 112744-BS1 **QAQC Procedural Blank** **Matrix:** BlankMatrix **Sampled:** **Received:**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
(d10-Acenaphthene)	Total	75	1			% Recovery	100	0	75	27 - 133% PASS			
(d10-Phenanthrene)	Total	86	1			% Recovery	100	0	86	43 - 129% PASS			
(d12-Chrysene)	Total	105	1			% Recovery	100	0	105	52 - 144% PASS			
(d12-Perylene)	Total	84	1			% Recovery	100	0	84	36 - 161% PASS			
(d8-Naphthalene)	Total	66	1			% Recovery	100	0	66	25 - 125% PASS			
1-Methylnaphthalene	Total	255	1	1	5	ng/wet g	500	0	51	31 - 128% PASS			
1-Methylphenanthrene	Total	481	1	1	5	ng/wet g	500	0	96	67 - 127% PASS			
2,3,5-Trimethylnaphthalene	Total	367	1	1	5	ng/wet g	500	0	73	55 - 122% PASS			
2,6-Dimethylnaphthalene	Total	366	1	1	5	ng/wet g	500	0	73	48 - 120% PASS			
2-Methylnaphthalene	Total	308	1	1	5	ng/wet g	500	0	62	37 - 123% PASS			
Acenaphthene	Total	341	1	1	5	ng/wet g	500	0	68	42 - 131% PASS			
Acenaphthylene	Total	318	1	1	5	ng/wet g	500	0	64	45 - 128% PASS			
Anthracene	Total	396	1	1	5	ng/wet g	500	0	79	57 - 119% PASS			
Benz[a]anthracene	Total	494	1	1	5	ng/wet g	500	0	99	37 - 182% PASS			
Benzo[a]pyrene	Total	438	1	1	5	ng/wet g	500	0	88	51 - 159% PASS			
Benzo[b]fluoranthene	Total	461	1	1	5	ng/wet g	500	0	92	42 - 187% PASS			
Benzo[e]pyrene	Total	433	1	1	5	ng/wet g	500	0	87	58 - 158% PASS			
Benzo[g,h,i]perylene	Total	408	1	1	5	ng/wet g	500	0	82	82 - 121% PASS			
Benzo[k]fluoranthene	Total	492	1	1	5	ng/wet g	500	0	98	58 - 150% PASS			
Biphenyl	Total	329	1	1	5	ng/wet g	500	0	66	42 - 122% PASS			
Chrysene	Total	455	1	1	5	ng/wet g	500	0	91	59 - 138% PASS			
Dibenz[a,h]anthracene	Total	443	1	1	5	ng/wet g	500	0	89	59 - 146% PASS			
Dibenzothiophene	Total	376	1	1	5	ng/wet g	500	0	75	46 - 126% PASS			

Polynuclear Aromatic Hydrocarbons QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Fluoranthene	Total	491	1	1	5	ng/wet g	500	0	98	63 - 142%	PASS			
Fluorene	Total	339	1	1	5	ng/wet g	500	0	68	50 - 132%	PASS			
Indeno[1,2,3-cd]pyrene	Total	432	1	1	5	ng/wet g	500	0	86	52 - 151%	PASS			
Naphthalene	Total	288	1	1	5	ng/wet g	500	0	58	25 - 130%	PASS			
Perylene	Total	414	1	1	5	ng/wet g	500	0	83	43 - 147%	PASS			
Phenanthrene	Total	410	1	1	5	ng/wet g	500	0	82	59 - 133%	PASS			
Pyrene	Total	463	1	1	5	ng/wet g	500	0	93	67 - 136%	PASS			

PHYSIS
TERRA FAUNA FLORA AQUA AURA
ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Polynuclear Aromatic Hydrocarbons

QUALITY CONTROL REPORT

Sample ID: 112744-BS2 | **QAQC Procedural Blank** | **Matrix: BlankMatrix** | **Sampled:** | **Received:**

Method: EPA 8270E | Batch ID: O-43086 | Prepared: 26-Dec-23 | Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
(d10-Acenaphthene)	Total	80	1			% Recovery	100	0	80	27 - 133%	PASS	6	30	PASS
(d10-Phenanthrene)	Total	90	1			% Recovery	100	0	90	43 - 129%	PASS	5	30	PASS
(d12-Chrysene)	Total	101	1			% Recovery	100	0	101	52 - 144%	PASS	4	30	PASS
(d12-Perylene)	Total	79	1			% Recovery	100	0	79	36 - 161%	PASS	6	30	PASS
(d8-Naphthalene)	Total	57	1			% Recovery	100	0	57	25 - 125%	PASS	15	30	PASS
1-Methylnaphthalene	Total	289	1	1	5	ng/wet g	500	0	58	31 - 128%	PASS	13	30	PASS
1-Methylphenanthrene	Total	473	1	1	5	ng/wet g	500	0	95	67 - 127%	PASS	1	30	PASS
2,3,5-Trimethylnaphthalene	Total	385	1	1	5	ng/wet g	500	0	77	55 - 122%	PASS	5	30	PASS
2,6-Dimethylnaphthalene	Total	470	1	1	5	ng/wet g	500	0	94	48 - 120%	PASS	25	30	PASS
2-Methylnaphthalene	Total	294	1	1	5	ng/wet g	500	0	59	37 - 123%	PASS	5	30	PASS
Acenaphthene	Total	384	1	1	5	ng/wet g	500	0	77	42 - 131%	PASS	12	30	PASS
Acenaphthylene	Total	325	1	1	5	ng/wet g	500	0	65	45 - 128%	PASS	2	30	PASS
Anthracene	Total	420	1	1	5	ng/wet g	500	0	84	57 - 119%	PASS	6	30	PASS
Benz[a]anthracene	Total	472	1	1	5	ng/wet g	500	0	94	37 - 182%	PASS	5	30	PASS
Benzo[a]pyrene	Total	463	1	1	5	ng/wet g	500	0	93	51 - 159%	PASS	6	30	PASS
Benzo[b]fluoranthene	Total	522	1	1	5	ng/wet g	500	0	104	42 - 187%	PASS	12	30	PASS
Benzo[e]pyrene	Total	465	1	1	5	ng/wet g	500	0	93	58 - 158%	PASS	7	30	PASS
Benzo[g,h,i]perylene	Total	423	1	1	5	ng/wet g	500	0	85	82 - 121%	PASS	4	30	PASS
Benzo[k]fluoranthene	Total	495	1	1	5	ng/wet g	500	0	99	58 - 150%	PASS	1	30	PASS
Biphenyl	Total	336	1	1	5	ng/wet g	500	0	67	42 - 122%	PASS	2	30	PASS
Chrysene	Total	455	1	1	5	ng/wet g	500	0	91	59 - 138%	PASS	0	30	PASS
Dibenz[a,h]anthracene	Total	478	1	1	5	ng/wet g	500	0	96	59 - 146%	PASS	8	30	PASS
Dibenzothiophene	Total	405	1	1	5	ng/wet g	500	0	81	46 - 126%	PASS	8	30	PASS

Polynuclear Aromatic Hydrocarbons QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
Fluoranthene	Total	436	1	1	5	ng/wet g	500	0	87	63 - 142%	PASS	12	30	PASS	
Fluorene	Total	360	1	1	5	ng/wet g	500	0	72	50 - 132%	PASS	6	30	PASS	
Indeno[1,2,3-cd]pyrene	Total	467	1	1	5	ng/wet g	500	0	93	52 - 151%	PASS	8	30	PASS	
Naphthalene	Total	266	1	1	5	ng/wet g	500	0	53	25 - 130%	PASS	9	30	PASS	
Perylene	Total	382	1	1	5	ng/wet g	500	0	76	43 - 147%	PASS	9	30	PASS	
Phenanthrene	Total	428	1	1	5	ng/wet g	500	0	86	59 - 133%	PASS	5	30	PASS	
Pyrene	Total	471	1	1	5	ng/wet g	500	0	94	67 - 136%	PASS	1	30	PASS	

Polynuclear Aromatic Hydrocarbons — QUALITY CONTROL REPORT

Sample ID: 112747-MS1 **Shallow Ref-1** **Matrix: Tissue** **Sampled: 08-Nov-23** **Received: 08-Nov-23**

Method: EPA 8270E Batch ID: O-43086 Prepared: 26-Dec-23 Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
(d10-Acenaphthene)	Total	75	1			% Recovery	100	0	75	27 - 133%	PASS			
(d10-Phenanthrene)	Total	95	1			% Recovery	100	0	95	43 - 129%	PASS			
(d12-Chrysene)	Total	114	1			% Recovery	100	0	114	52 - 144%	PASS			
(d12-Perylene)	Total	85	1			% Recovery	100	0	85	36 - 161%	PASS			
(d8-Naphthalene)	Total	68	1			% Recovery	100	0	68	25 - 125%	PASS			
1-Methylnaphthalene	Total	92.3	1	1	5	ng/wet g	146	0	63	51 - 127%	PASS			
1-Methylphenanthrene	Total	157	1	1	5	ng/wet g	146	0	108	69 - 135%	PASS			
2,3,5-Trimethylnaphthalene	Total	118	1	1	5	ng/wet g	146	0	81	77 - 121%	PASS			
2,6-Dimethylnaphthalene	Total	117	1	1	5	ng/wet g	146	0	80	66 - 122%	PASS			
2-Methylnaphthalene	Total	95.9	1	1	5	ng/wet g	146	1.47	65	51 - 128%	PASS			
Acenaphthene	Total	117	1	1	5	ng/wet g	146	0	80	70 - 125%	PASS			
Acenaphthylene	Total	105	1	1	5	ng/wet g	146	0	72	68 - 127%	PASS			
Anthracene	Total	126	1	1	5	ng/wet g	146	0	86	78 - 116%	PASS			
Benz[a]anthracene	Total	173	1	1	5	ng/wet g	146	0	118	36 - 170%	PASS			
Benzo[a]pyrene	Total	127	1	1	5	ng/wet g	146	0	87	17 - 190%	PASS			
Benzo[b]fluoranthene	Total	148	1	1	5	ng/wet g	146	0	101	15 - 211%	PASS			
Benzo[e]pyrene	Total	124	1	1	5	ng/wet g	146	0	85	8 - 197%	PASS			
Benzo[g,h,i]perylene	Total	134	1	1	5	ng/wet g	146	0	92	77 - 130%	PASS			
Benzo[k]fluoranthene	Total	131	1	1	5	ng/wet g	146	0	90	21 - 185%	PASS			
Biphenyl	Total	105	1	1	5	ng/wet g	146	1.14	71	64 - 123%	PASS			
Chrysene	Total	137	1	1	5	ng/wet g	146	1.45	93	29 - 159%	PASS			
Dibenz[a,h]anthracene	Total	143	1	1	5	ng/wet g	146	0	98	7 - 243%	PASS			
Dibenzothiophene	Total	128	1	1	5	ng/wet g	146	0	88	79 - 116%	PASS			

Polynuclear Aromatic Hydrocarbons — QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS	QA CODEc
Fluoranthene	Total	172	1	1	5	ng/wet g	146	0	118	66 - 142%	PASS			
Fluorene	Total	126	1	1	5	ng/wet g	146	0	86	72 - 132%	PASS			
Indeno[1,2,3-cd]pyrene	Total	136	1	1	5	ng/wet g	146	0	93	25 - 208%	PASS			
Naphthalene	Total	97.1	1	1	5	ng/wet g	146	0	67	37 - 130%	PASS			
Perylene	Total	110	1	1	5	ng/wet g	146	0	75	14 - 185%	PASS			
Phenanthrene	Total	133	1	1	5	ng/wet g	146	0	91	75 - 129%	PASS			
Pyrene	Total	174	1	1	5	ng/wet g	146	1.09	118	63 - 141%	PASS			

Polynuclear Aromatic Hydrocarbons QUALITY CONTROL REPORT

Sample ID: 112747-MS2 Shallow Ref-1 | Matrix: Tissue | Sampled: 08-Nov-23 | Received: 08-Nov-23

Method: EPA 8270E | Batch ID: O-43086 | Prepared: 26-Dec-23 | Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
(d10-Acenaphthene)	Total	73	1			% Recovery	100	0	73	27 - 133%	PASS	3	30	PASS	
(d10-Phenanthrene)	Total	96	1			% Recovery	100	0	96	43 - 129%	PASS	1	30	PASS	
(d12-Chrysene)	Total	113	1			% Recovery	100	0	113	52 - 144%	PASS	1	30	PASS	
(d12-Perylene)	Total	89	1			% Recovery	100	0	89	36 - 161%	PASS	5	30	PASS	
(d8-Naphthalene)	Total	49	1			% Recovery	100	0	49	25 - 125%	PASS	32	30	FAIL	M
1-Methylnaphthalene	Total	92.4	1	1	5	ng/wet g	160	0	58	51 - 127%	PASS	8	30	PASS	
1-Methylphenanthrene	Total	169	1	1	5	ng/wet g	160	0	106	69 - 135%	PASS	2	30	PASS	
2,3,5-Trimethylnaphthalene	Total	130	1	1	5	ng/wet g	160	0	75	77 - 121%	PASS	8	30	PASS	
2,6-Dimethylnaphthalene	Total	131	1	1	5	ng/wet g	160	0	82	66 - 122%	PASS	2	30	PASS	
2-Methylnaphthalene	Total	97.5	1	1	5	ng/wet g	160	1.47	60	51 - 128%	PASS	8	30	PASS	
Acenaphthene	Total	121	1	1	5	ng/wet g	160	0	76	70 - 125%	PASS	5	30	PASS	
Acenaphthylene	Total	126	1	1	5	ng/wet g	160	0	79	68 - 127%	PASS	9	30	PASS	
Anthracene	Total	150	1	1	5	ng/wet g	160	0	94	78 - 116%	PASS	9	30	PASS	
Benz[a]anthracene	Total	190	1	1	5	ng/wet g	160	0	119	36 - 170%	PASS	1	30	PASS	
Benzo[a]pyrene	Total	134	1	1	5	ng/wet g	160	0	84	17 - 190%	PASS	4	30	PASS	
Benzo[b]fluoranthene	Total	148	1	1	5	ng/wet g	160	0	93	15 - 211%	PASS	9	30	PASS	
Benzo[e]pyrene	Total	136	1	1	5	ng/wet g	160	0	85	8 - 197%	PASS	0	30	PASS	
Benzo[g,h,i]perylene	Total	145	1	1	5	ng/wet g	160	0	91	77 - 130%	PASS	1	30	PASS	
Benzo[k]fluoranthene	Total	132	1	1	5	ng/wet g	160	0	82	21 - 185%	PASS	9	30	PASS	
Biphenyl	Total	106	1	1	5	ng/wet g	160	1.14	66	64 - 123%	PASS	7	30	PASS	
Chrysene	Total	150	1	1	5	ng/wet g	160	1.45	93	29 - 159%	PASS	0	30	PASS	
Dibenz[a,h]anthracene	Total	163	1	1	5	ng/wet g	160	0	102	7 - 243%	PASS	4	30	PASS	
Dibenzothiophene	Total	139	1	1	5	ng/wet g	160	0	87	79 - 116%	PASS	1	30	PASS	

Polynuclear Aromatic Hydrocarbons QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
Fluoranthene	Total	196	1	1	5	ng/wet g	160	0	123	66 - 142%	PASS	3	30	PASS	
Fluorene	Total	119	1	1	5	ng/wet g	160	0	74	72 - 132%	PASS	15	30	PASS	
Indeno[1,2,3-cd]pyrene	Total	161	1	1	5	ng/wet g	160	0	101	25 - 208%	PASS	8	30	PASS	
Naphthalene	Total	71.2	1	1	5	ng/wet g	160	0	44	37 - 130%	PASS	41	30	FAIL	M
Perylene	Total	132	1	1	5	ng/wet g	160	0	82	14 - 185%	PASS	9	30	PASS	
Phenanthrene	Total	151	1	1	5	ng/wet g	160	0	94	75 - 129%	PASS	3	30	PASS	
Pyrene	Total	184	1	1	5	ng/wet g	160	1.09	114	63 - 141%	PASS	3	30	PASS	

Polynuclear Aromatic Hydrocarbons — QUALITY CONTROL REPORT

Sample ID: 112747-R2 Shallow Ref-1 | **Matrix: Tissue** | **Sampled: 08-Nov-23** | **Received: 08-Nov-23**

Method: EPA 8270E | Batch ID: O-43086 | Prepared: 26-Dec-23 | Analyzed: 08-Jan-24

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS		PRECISION %	PRECISION LIMITS		QA CODEc
(d10-Acenaphthene)	Total	81	1			% Recovery	100		81	27 - 133%	PASS	5	30	PASS	
(d10-Phenanthrene)	Total	96	1			% Recovery	100		96	43 - 129%	PASS	0	30	PASS	
(d12-Chrysene)	Total	133	1			% Recovery	100		133	52 - 144%	PASS	29	30	PASS	
(d12-Perylene)	Total	83	1			% Recovery	100		83	36 - 161%	PASS	8	30	PASS	
(d8-Naphthalene)	Total	64	1			% Recovery	100		64	25 - 125%	PASS	19	30	PASS	
1-Methylnaphthalene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
1-Methylphenanthrene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
2,3,5-Trimethylnaphthalene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
2,6-Dimethylnaphthalene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
2-Methylnaphthalene	Total	1.12	1	1	5	ng/wet g						27	30	PASS	J
Acenaphthene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Acenaphthylene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Anthracene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Benz[a]anthracene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Benzo[a]pyrene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Benzo[b]fluoranthene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Benzo[e]pyrene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Benzo[g,h,i]perylene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Benzo[k]fluoranthene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Biphenyl	Total	ND	1	1	5	ng/wet g						13	30	PASS	
Chrysene	Total	ND	1	1	5	ng/wet g						37	30	FAIL	SL
Dibenz[a,h]anthracene	Total	ND	1	1	5	ng/wet g						0	30	PASS	
Dibenzothiophene	Total	ND	1	1	5	ng/wet g						0	30	PASS	

Polynuclear Aromatic Hydrocarbons QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS		QA CODEc
Fluoranthene	Total	ND	1	1	5	ng/wet g					0	30	PASS	
Fluorene	Total	ND	1	1	5	ng/wet g					0	30	PASS	
Indeno[1,2,3-cd]pyrene	Total	ND	1	1	5	ng/wet g					0	30	PASS	
Naphthalene	Total	ND	1	1	5	ng/wet g					0	30	PASS	
Perylene	Total	ND	1	1	5	ng/wet g					0	30	PASS	
Phenanthrene	Total	ND	1	1	5	ng/wet g					0	30	PASS	
Pyrene	Total	1.01	1	1	5	ng/wet g					8	30	PASS	J

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Total Extractable Organics

QUALITY CONTROL REPORT

ANALYTE	FRACTION	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODEc
Sample ID: 112744-B1	**QAQC Procedural Blank**					**Matrix: BlankMatrix**		**Sampled:**			**Received:**		
	Method: Gravimetric					Batch ID: C-54134		Prepared: 29-Dec-23			Analyzed: 30-Dec-23		
Percent Lipids	NA	ND	1	0.01	0.05	% wet weight							
Sample ID: 112746-CRM1	**QAQC CRM - SRM 1946**					**Matrix: Tissue**		**Sampled:**			**Received:**		
	Method: Gravimetric					Batch ID: C-54134		Prepared: 29-Dec-23			Analyzed: 30-Dec-23		
Percent Lipids	NA	11.7	1	0.01	0.05	ng/wet g	10.2		115	80 - 120%			PASS
Sample ID: 112747-R2	**Shallow Ref-1**					**Matrix: Tissue**		**Sampled: 08-Nov-23**			**Received: 08-Nov-23**		
	Method: Gravimetric					Batch ID: C-54134		Prepared: 29-Dec-23			Analyzed: 30-Dec-23		
Percent Lipids	NA	1.41	1	0.01	0.05	% wet weight					5	30	PASS

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
TERRA FAUNA FLORA AQUA AURA
Innovative Solutions for Nature

PHYSIS Project ID: 2309005-002
Client: Tenera Environmental, Inc.
Project: Santa Barbara Channel PO # 22238101

Conventionals

QUALITY CONTROL REPORT

SAMPLE ID		BATCH ID	RESULT	DF	MDL	RL	UNITS	SPIKE LEVEL	SOURCE RESULT	ACCURACY %	ACCURACY LIMITS	PRECISION %	PRECISION LIMITS	QA CODE
Percent Solids		**Method: SM 2540 B**			**Fraction: NA**				**Prepared: 26-Dec-23**			**Analyzed: 27-Dec-23**		
112744-B1	QAQC Procedural Blank	C-78015	ND	1	0.1	0.1	%							
112763-R2	Hilda-3	C-78015	16.8	1	0.1	0.1	%					1	30	PASS

CHAIN OF CUSTODY

TENERA
Environmental, Inc.
141 Suburban Road, Suite A2
San Luis Obispo, CA 93401
805.541.0310 [phone] 805.541.0421 [fax]

CHAIN OF CUSTODY FORM

Total Number of Samples: 17

Samples Sent From:	**Samples Sent To:**	**Client Information:**
Tenera Environmental	Physis Labs	Tenera Environmental
141 suburban Rd., Suite A2	1904 E. Wright Circle	141 suburban Rd., Suite A2
San Luis Obispo, CA 93401	Anaheim, CA 92806	San Luis Obispo, CA 93401

Project Number: 22238101
Shipping Method: Tenera Courier
Tracking #:
Project Location: Santa Barbara Channel
Field Sampled By: KMJ, GRC, PMK, ACH

Sample Desciption: Mussels for Bioaccumulation study
Requested Analyses: See attached list of parameters to be tested
Contact Info: jphelan@tenera.com Kjohnson@tenera.com, 805.541.0310

Sample Number	Collection Date	Collection Time	# of Cont.	Analysis	Sample Number	Collection Date	Collection Time	# of Cont.	Anaylsis
Shallow Ref-1	11/08/23		~50-80	See attached list.	Hazel-1	11/08/23		~50-80	See attached list.
Shallow Ref-2					Hazel-2				
Deep Ref-1					Hazel-3				
Deep Ref-2					Hilda-1				
Deep Ref-3					Hilda-2				
Heidi-1					Hilda-3				
Heidi-2									
Heidi-3									
Hope-1									
Hope-2									
Hope-3									

Relinquished By:	Date/Time:	Relinquished To:	Date/Time:
Emily Hulpe	11/08/2023 19:10	[signature]	11/08/23 1910
Relinquished By:	Date/Time:	Relinquished To:	Date/Time:

*Please complete the highlighted portion and scan and email to Kjohnson@tenera.com

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

COC Page Number: 2 of 7
Bottle Label Color: NA

Project Iteration ID: 2309005-002
Client Name: Tenera Environmental, Inc.
Project Name: Santa Barbara Channel PO # 22238101

8. Appendix

List of parameters to be tested.

Parameters	Method	Lowest Value	MDL	RL	Units
Trace Metals					
Silver (Ag)	EPA 6020		0.025	0.05	µg/wet g
Aluminum (Al)	EPA 6020	75	1	5	µg/wet g
Antimony (Sb)	EPA 6020	0.021	0.025	0.05	µg/wet g
Arsenic (As)	EPA 6020	7	0.025	0.05	µg/wet g
Barium (Ba)	EPA 6020	0.6	0.025	0.05	µg/wet g
Beryllium (Be)	EPA 6020	0.032	0.025	0.05	µg/wet g
Cadmium (Cd)	EPA 6020	1	0.025	0.05	µg/wet g
Chromium (Cr)	EPA 6020	1.5	0.025	0.05	µg/wet g
Cobalt (Co)	EPA 6020	0.3	0.025	0.05	µg/wet g
Copper (Cu)	EPA 6020	4.5	0.025	0.05	µg/wet g
Iron (Fe)	EPA 6020	125	1	5	µg/wet g
Lead (Pb)	EPA 6020	0.5	0.025	0.05	µg/wet g
Molybdenum (Mo)	EPA 6020	1	0.025	0.05	µg/wet g
Nickel (Ni)	EPA 6020	0.75	0.025	0.05	µg/wet g
Selenium (Se)	EPA 6020	5	0.025	0.05	µg/wet g
Thallium (Tl)	EPA 6020	0.014	0.025	0.05	µg/wet g
Vanadium (V)	EPA 6020	0.3	0.025	0.05	µg/wet g
Zinc (Zn)	EPA 6020	100	0.025	0.05	µg/wet g
Trace Mercury	EPA 245.7	0.045	0.00001	0.00002	µg/wet g
Chlorinated Pesticides					
2,4'-DDD	EPA 8270E	0.025	0.267	0.5	ng/wet g
2,4'-DDE	EPA 8270E	0.025	0.2	0.5	ng/wet g
2,4'-DDT	EPA 8270E	0.025	0.194	0.5	ng/wet g
4,4'-DDD	EPA 8270E	0.025	0.198	0.5	ng/wet g
4,4'-DDE	EPA 8270E	0.025	0.193	0.5	ng/wet g
4,4'-DDT	EPA 8270E	0.025	0.128	0.5	ng/wet g
BHC-alpha	EPA 8270E	0.002	0.25	0.5	ng/wet g
BHC-beta	EPA 8270E	0.002	0.25	0.5	ng/wet g
BHC-delta	EPA 8270E	0.002	0.25	0.5	ng/wet g
BHC-gamma	EPA 8270E	0.002	0.25	0.5	ng/wet g
Chlordane-alpha	EPA 8270E	0.003	0.187	0.5	ng/wet g
Chlordane-gamma	EPA 8270E	0.003	0.179	0.5	ng/wet g
cis-Nonachlor	EPA 8270E	0.003	0.192	0.5	ng/wet g

Parameters	Method	Lowest Value	MDL	RL	Units
PCB 128	EPA 8270E	0.01	0.081	0.5	ng/wet g
PCB 138	EPA 8270E	0.01	0.057	0.5	ng/wet g
PCB 141	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 149	EPA 8270E	0.01	0.092	0.5	ng/wet g
PCB 151	EPA 8270E	0.01	0.073	0.5	ng/wet g
PCB 153	EPA 8270E	0.01	0.065	0.5	ng/wet g
PCB 156	EPA 8270E	0.01	0.089	0.5	ng/wet g
PCB 157	EPA 8270E	0.01	0.103	0.5	ng/wet g
PCB 158	EPA 8270E	0.01	0.074	0.5	ng/wet g
PCB 167	EPA 8270E	0.01	0.049	0.5	ng/wet g
PCB 132/168	EPA 8270E	0.01	0.094	0.5	ng/wet g
PCB 169	EPA 8270E	0.01	0.116	0.5	ng/wet g
PCB 170	EPA 8270E	0.01	0.118	0.5	ng/wet g
PCB 174	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 177	EPA 8270E	0.01	0.085	0.5	ng/wet g
PCB 180	EPA 8270E	0.01	0.154	0.5	ng/wet g
PCB 183	EPA 8270E	0.01	0.056	0.5	ng/wet g
PCB 187	EPA 8270E	0.01	0.168	0.5	ng/wet g
PCB 189	EPA 8270E	0.01	0.109	0.5	ng/wet g
PCB 194	EPA 8270E	0.01	0.164	0.5	ng/wet g
PCB 195	EPA 8270E	0.01	0.093	0.5	ng/wet g
PCB 199	EPA 8270E	0.01	0.25	0.5	ng/wet g
PCB 201	EPA 8270E	0.01	0.104	0.5	ng/wet g
PCB 206	EPA 8270E	0.01	0.155	0.5	ng/wet g
PCB 209	EPA 8270E	0.01	0.25	0.5	ng/wet g
PAHs					
1-Methylnaphthalene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
1-Methylphenanthrene	EPA 8270E	0.00206	0.2	0.5	ng/wet g
2,3,5-Trimethylnaphthalene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
2,6-Dimethylnaphthalene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
2-Methylnaphthalene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
Acenaphthene	EPA 8270E		0.2	0.5	ng/wet g
Acenaphthylene	EPA 8270E	0.00514	0.2	0.5	ng/wet g
Anthracene	EPA 8270E	0.00206	0.2	0.5	ng/wet g
Benz[a]anthracene	EPA 8270E	0.00206	0.2	0.5	ng/wet g
Benzo[a]pyrene	EPA 8270E	0.00197	0.2	0.5	ng/wet g
Benzo[b]fluoranthene	EPA 8270E	0.00197	0.2	0.5	ng/wet g

4-H Shell Mound Study

Samples

Name	Date Collected	# Mussels sent	# Mussels sampled
BOT-1	9/13/2023	50	30
BOT-2	9/13/2023	50	30
BOT-3	9/13/2023	50	30
Shallow Ref-1	11/9/2023	~50-80	
Shallow Ref-2	11/9/2023	~50-80	
Shallow Ref-3	Lost!	~50-80	
Deep Ref-1	11/9/2023	~50-80	
Deep Ref-2	11/9/2023	~50-80	
Deep Ref-3	11/9/2023	~50-80	
Heidi-1	11/9/2023	~50-80	
Heidi-2	11/9/2023	~50-80	
Heidi-3	11/9/2023	~50-80	
Hope-1	11/9/2023	~50-80	
Hope-2	11/9/2023	~50-80	
Hope-3	11/9/2023	~50-80	
Hazel-1	11/9/2023	~50-80	
Hazel-2	11/9/2023	~50-80	
Hazel-3	11/9/2023	~50-80	
Hilda-1	11/9/2023	~50-80	
Hilda-2	11/9/2023	~50-80	
Hilda-3	11/9/2023	~50-80	

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ENVIRONMENTAL LABORATORIES, INC.
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Sample Receipt Summary

PHYSIS ENVIRONMENTAL LABORATORIES, INC.
Innovative Solutions for Nature

Project Iteration ID:	2309005-002
Client Name:	Tenera Environmental, Inc.
Project Name:	Santa Barbara Channel PO # 22238101
COC Page Number:	7 of 7
Bottle Label Color:	NA

Receiving Info

1. Initials Received By: RGH
2. Date Received: 11/8/23
3. Time Received: 1910
4. Client Name: Tenera
5. Courier Information: (Please circle)
   - (Client) (circled)
   - UPS
   - Area Fast
   - DRS
   - FedEx
   - GSO/GLS
   - Ontrac
   - PAMS
   - PHYSIS Driver:
     - i. Start Time: ______
     - ii. End Time: ______
     - iii. Total Mileage: ______
     - iv. Number of Pickups: ______
6. Container Information: (Please put the # of containers or circle none)
   - 1 Cooler
   - __ Styrofoam Cooler
   - ____ Boxes
   - None
   - ___ Carboy(s)
   - __ Carboy Trash Can(s)
   - ____ Carboy Cap(s)
   - Other ______
7. What type of ice was used: (Please circle any that apply)
   - Wet Ice (circled)
   - Blue Ice
   - Dry Ice
   - Water
   - None
8. Randomly Selected Samples Temperature (°C): 5.4 Used I/R Thermometer # 1-2

Inspection Info

1. Initials Inspected By: RGH

Sample Integrity Upon Receipt:

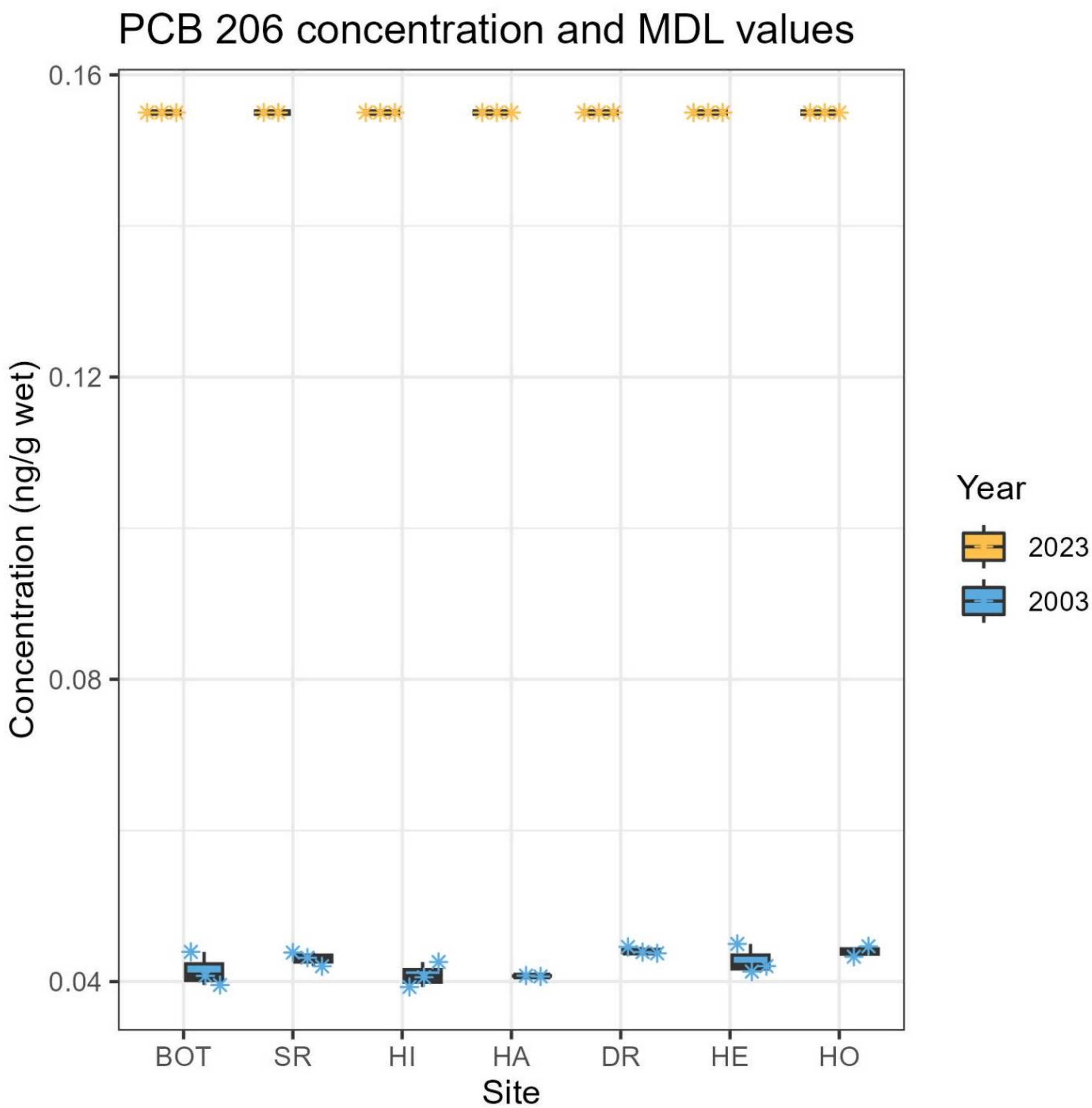
1. COC(s) included and completely filled out........ Yes (circled) / No
2. All sample containers arrived intact........ Yes (circled) / No
3. All samples listed on COC(s) are present........ Yes (circled) / No
4. Information on containers consistent with information on COC(s)........ Yes (circled) / No
5. Correct containers and volume for all analyses indicated........ Yes (circled) / No
6. All samples received within method holding time........ Yes (circled) / No
7. Correct preservation used for all analyses indicated........ Yes (circled) / No
8. Name of sampler included on COC(s)........ Yes / No (circled)

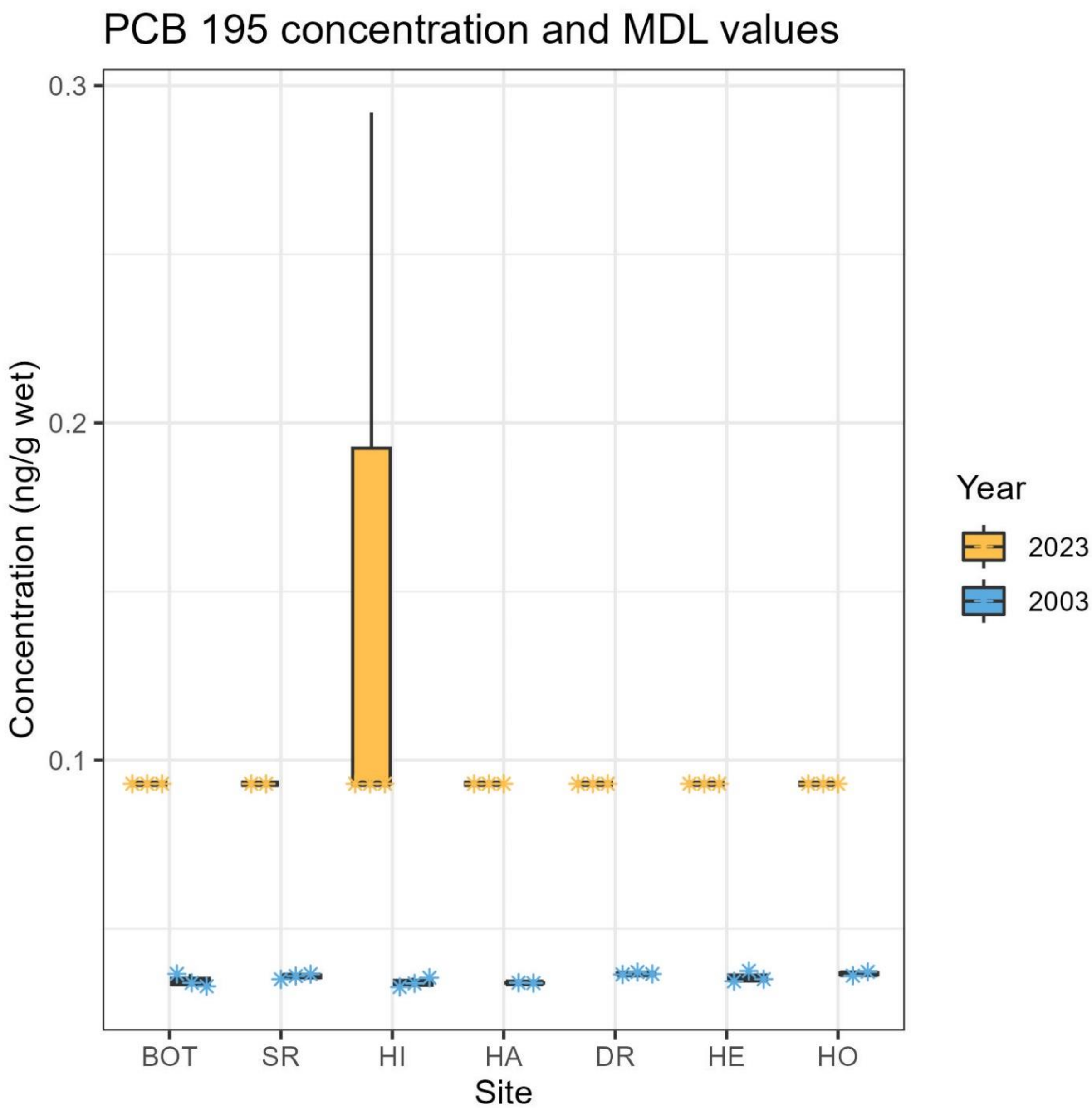
Notes:

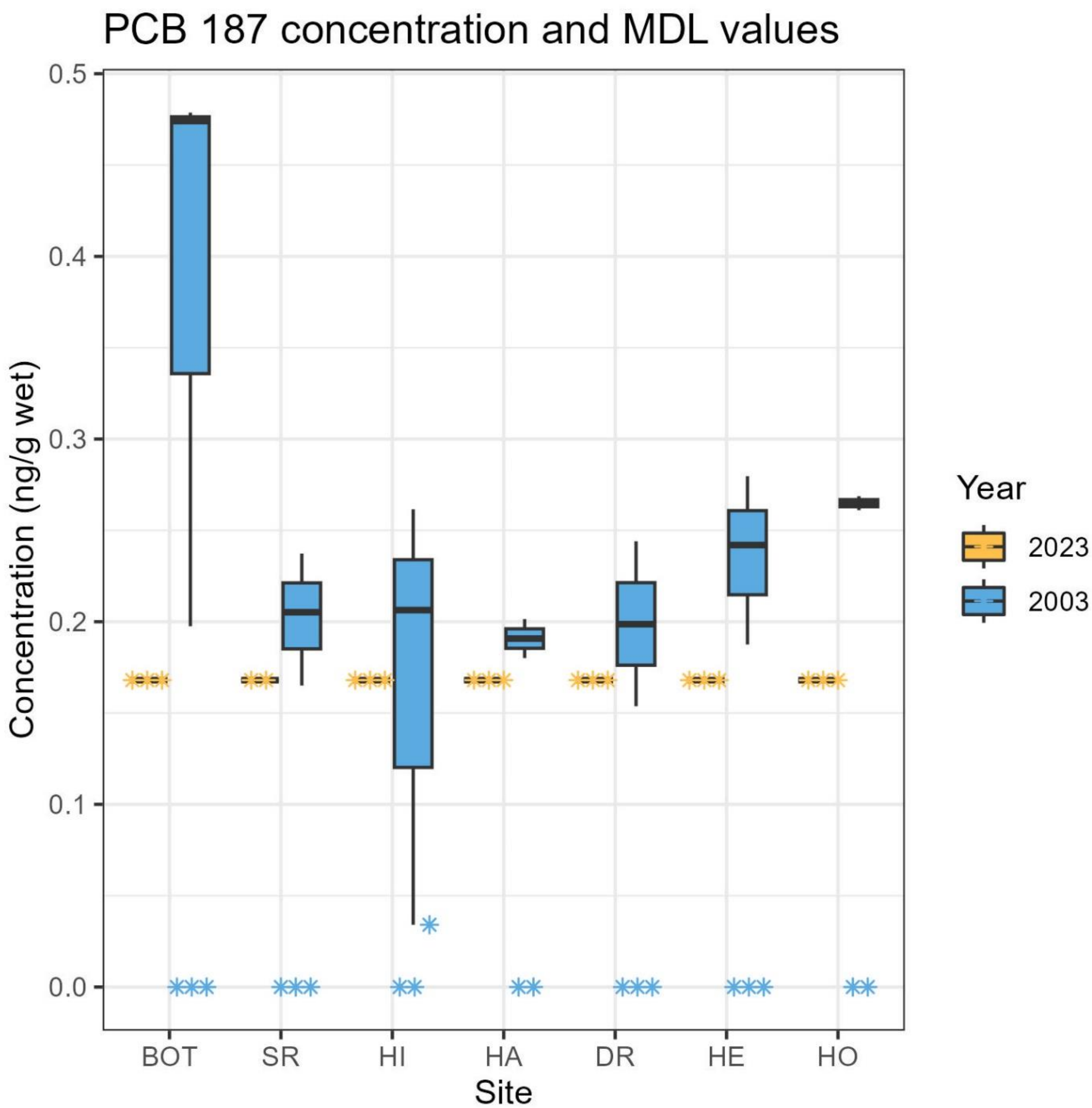
Appendix C

Boxplots of Raw Data

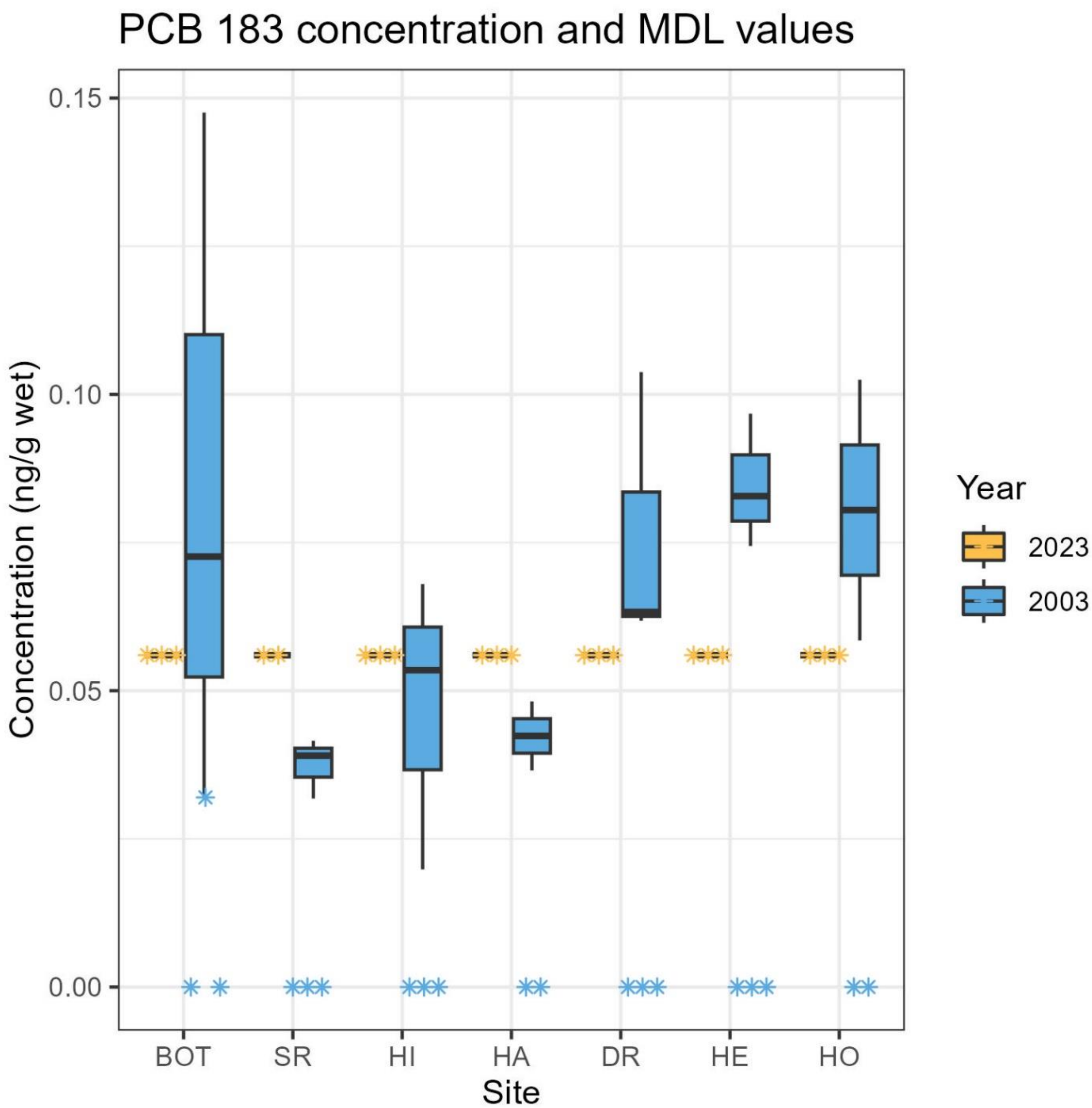
These boxplots include data for parameters tested in both 2003 and 2023. The lower and upper ends of each box in the boxplot correspond to the first and third quartiles of the data range. The center line of the boxplot corresponds to the median value. Whiskers extend to the largest and smallest values in the data that are inside of 1.5 times the inter quartile range. Any sample values lying outside this range are plotted as points. MDLs for tests of each sample are shown as stars. Colors correspond to the study years.

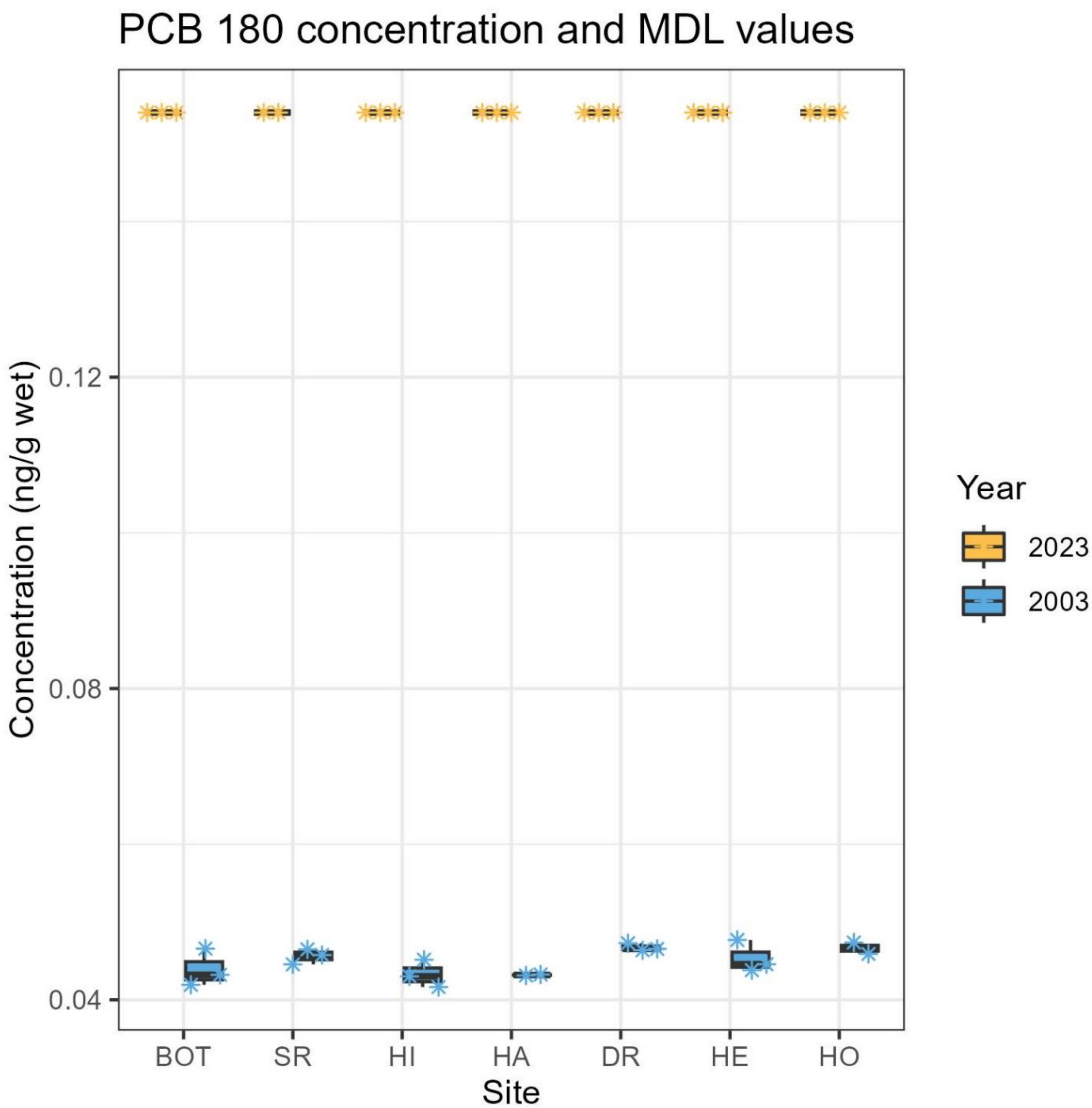

PCB 206 concentration and MDL values
Concentration (ng/g wet)
0.16
0.12
0.08
0.04
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

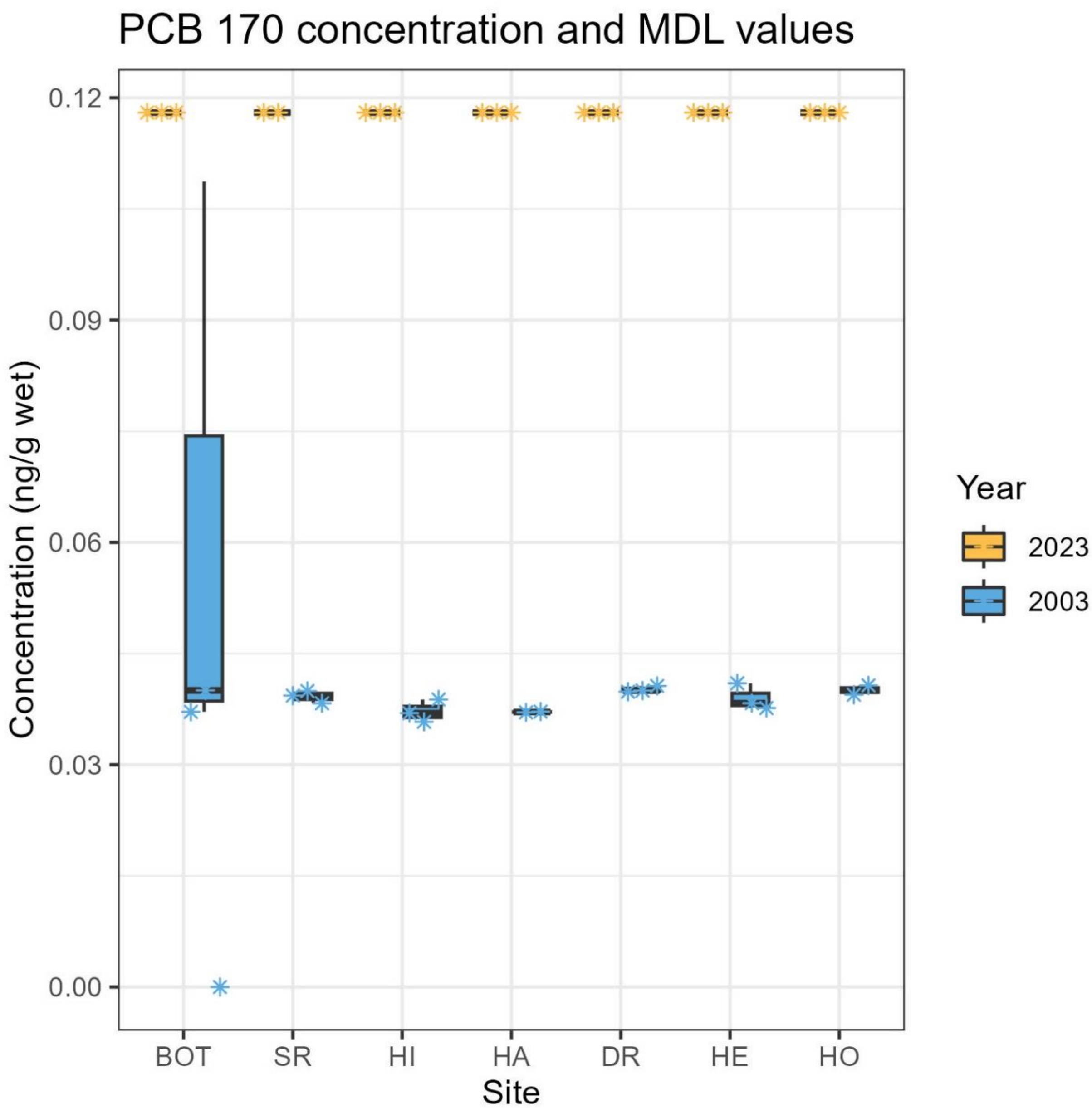

PCB 195 concentration and MDL values
0.3
0.2
0.1
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003



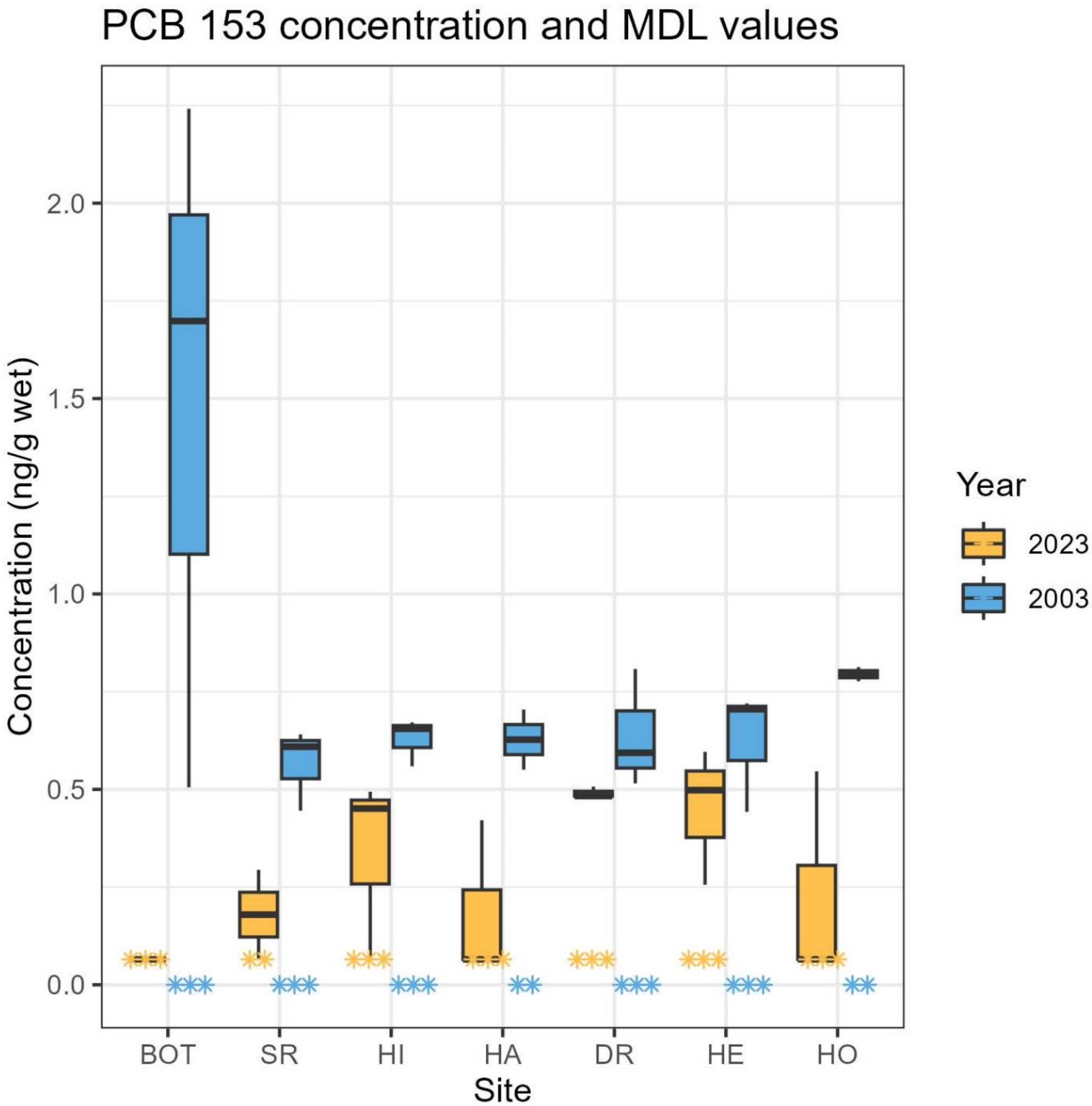
PCB 187 concentration and MDL values
Concentration (ng/g wet)
0.5
0.4
0.3
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

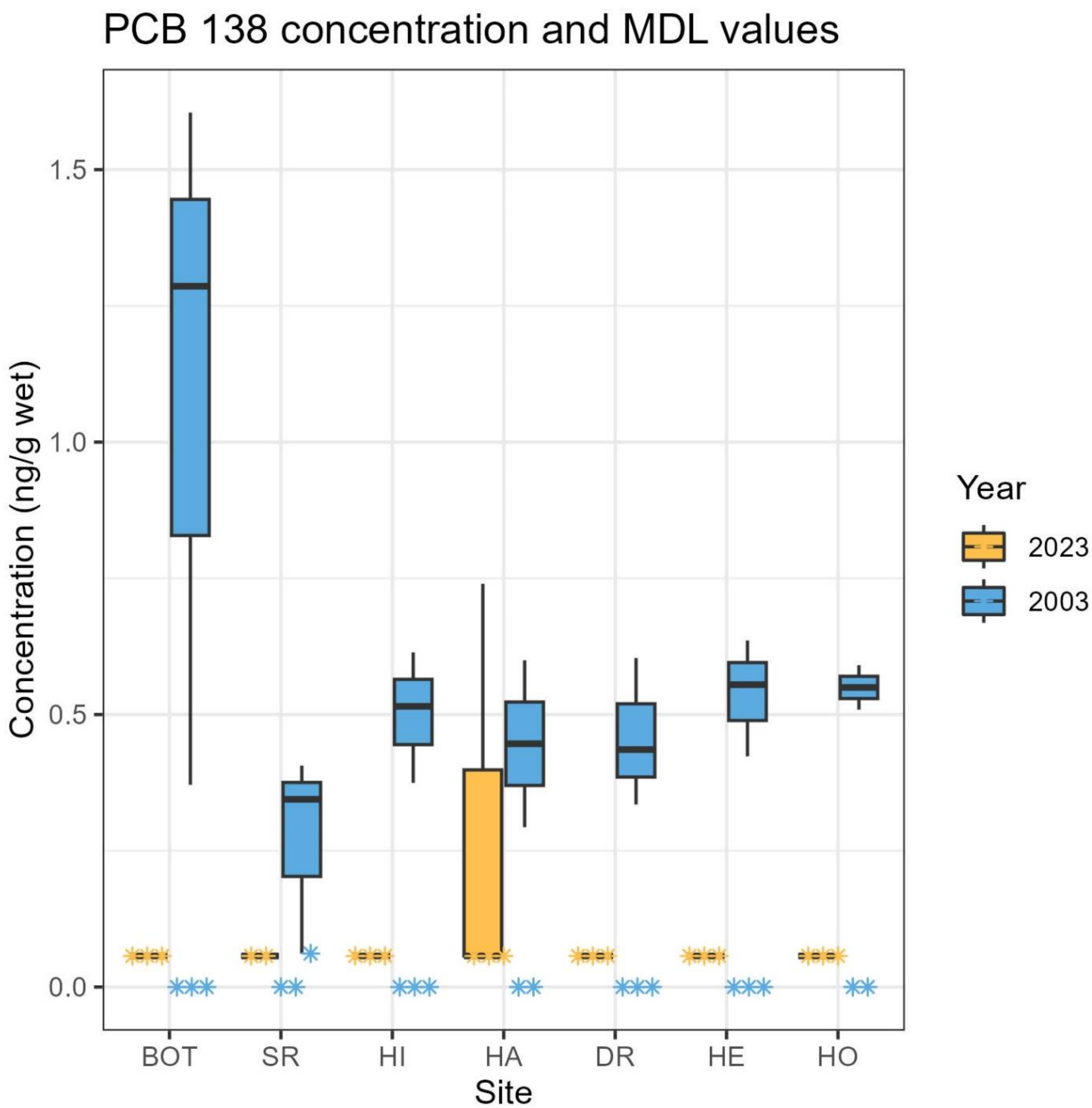

PCB 183 concentration and MDL values
Concentration (ng/g wet)
0.15
0.10
0.05
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

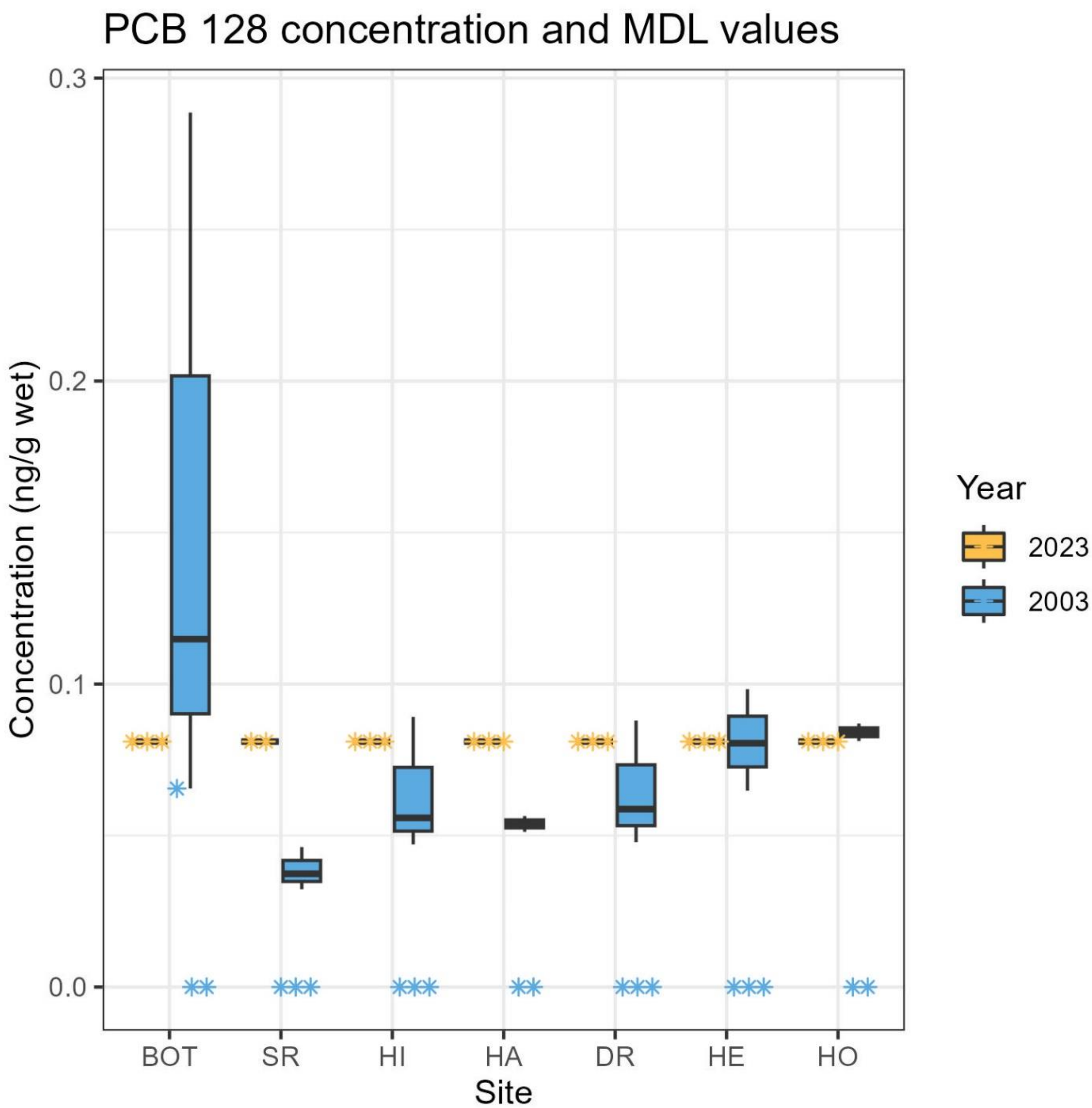

PCB 180 concentration and MDL values
Concentration (ng/g wet)
0.12
0.08
0.04
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

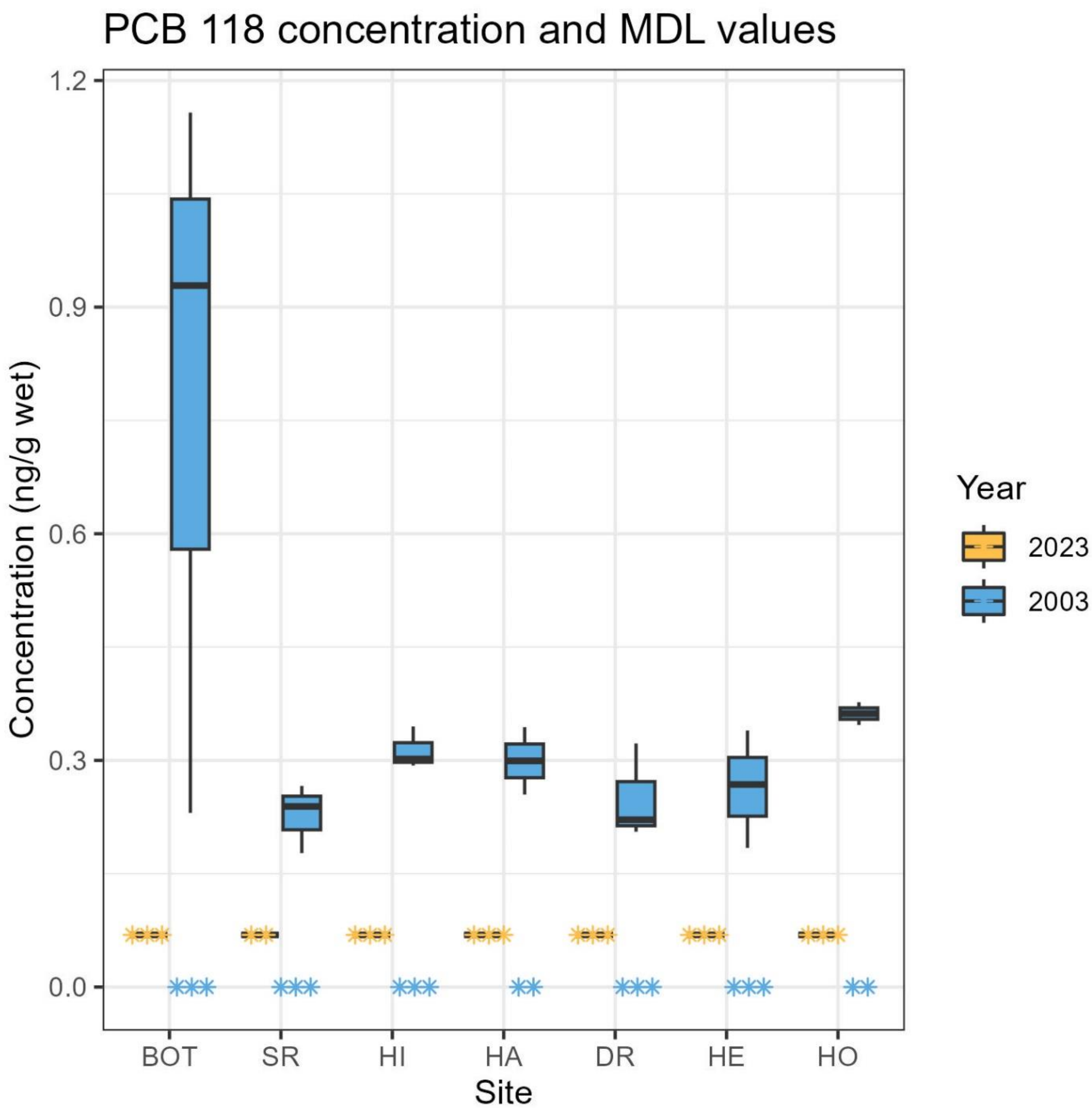


PCB 170 concentration and MDL values
0.12
0.09
0.06
0.03
0.00
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

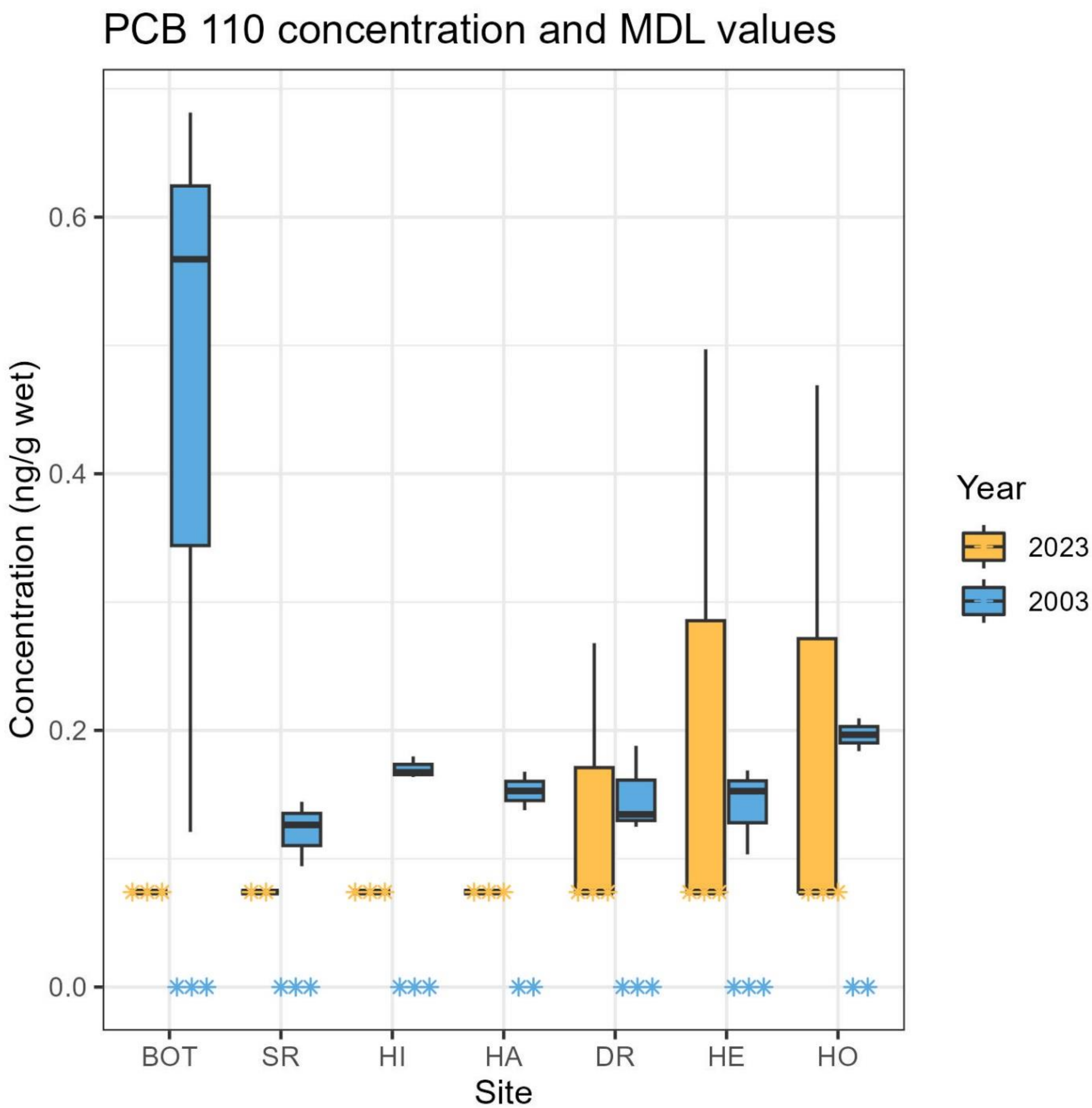

PCB 153 concentration and MDL values
Concentration (ng/g wet)
2.0
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

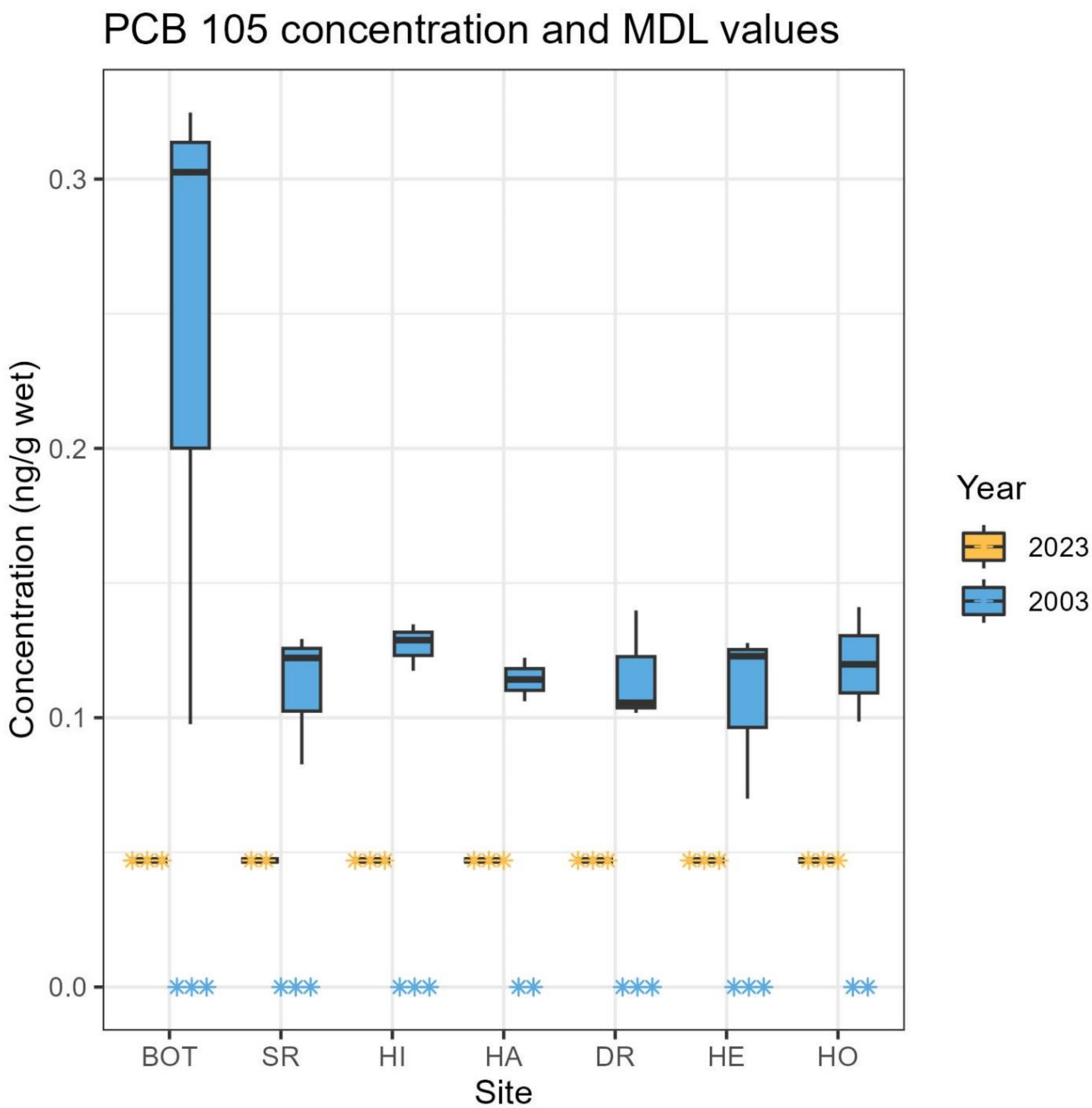

PCB 138 concentration and MDL values
Concentration (ng/g wet)
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

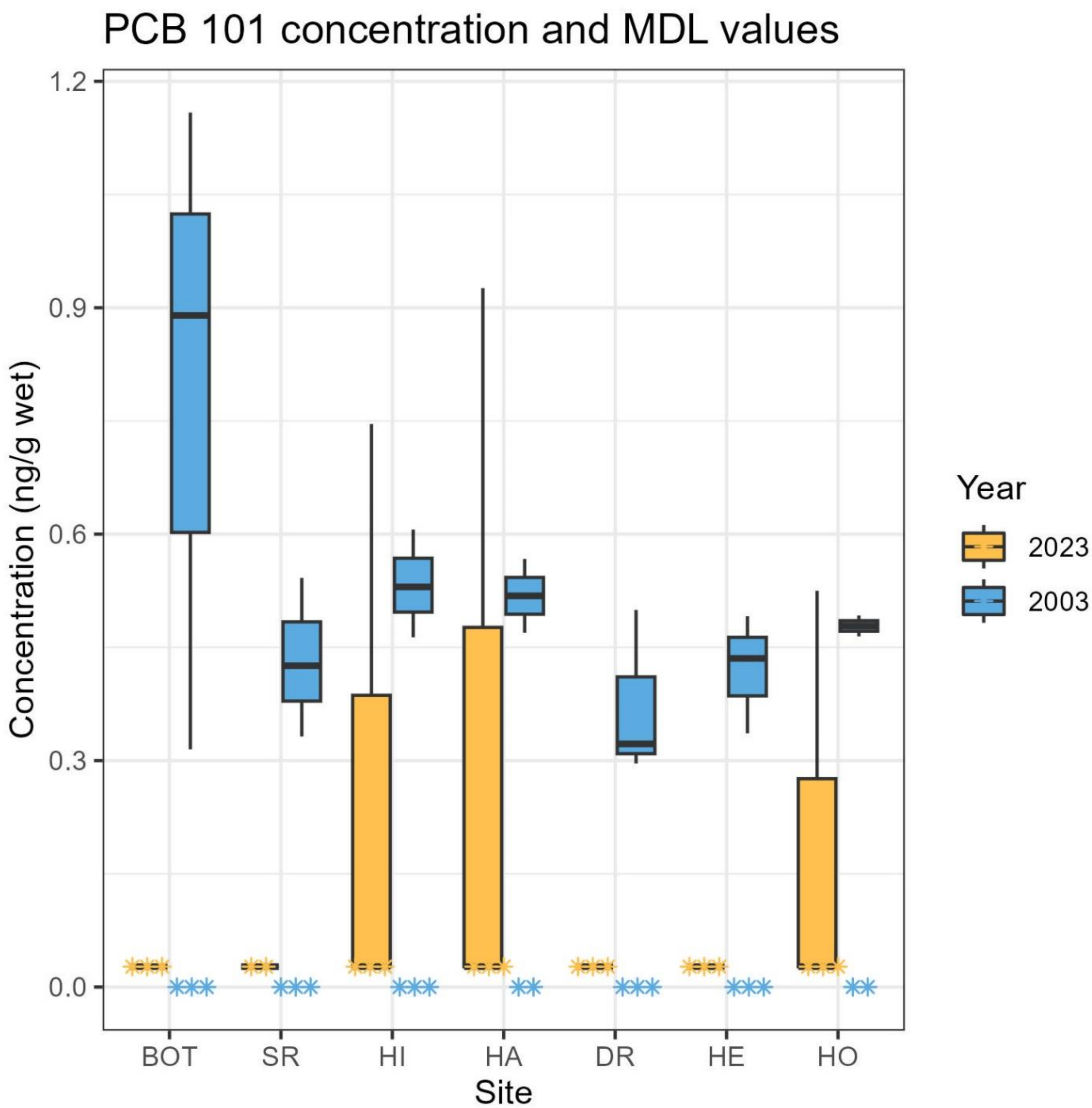

PCB 128 concentration and MDL values
Concentration (ng/g wet)
0.3
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

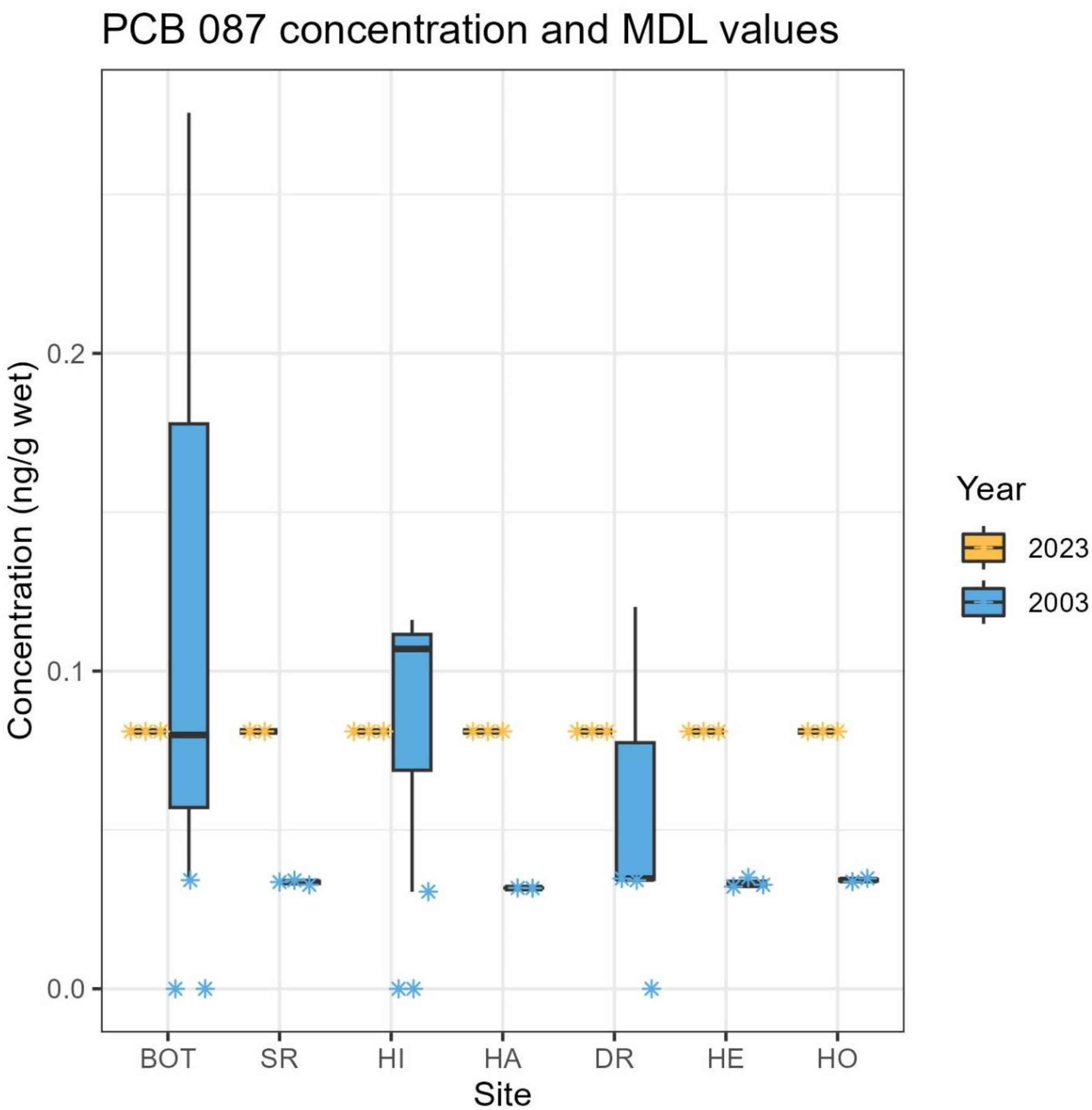


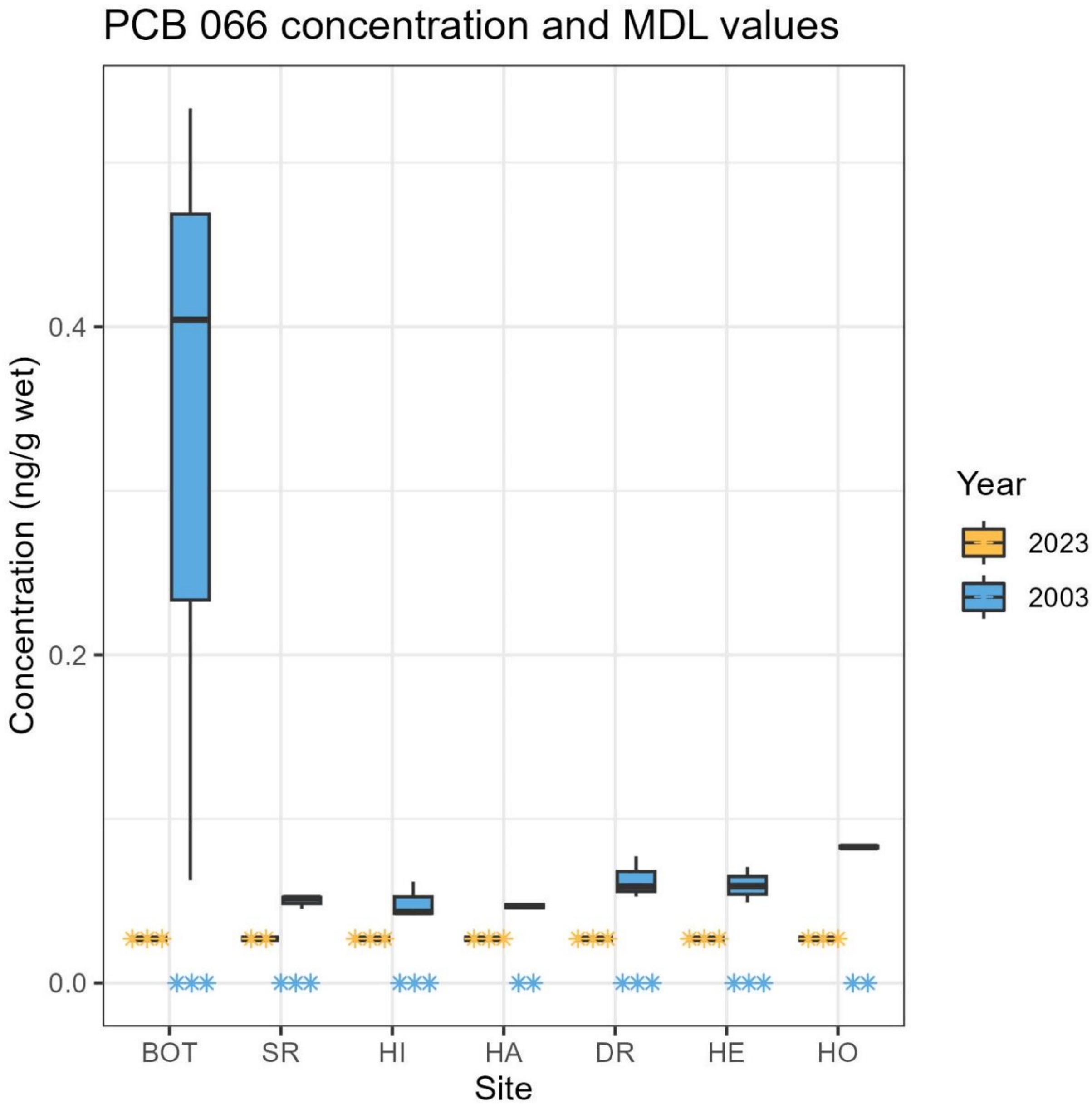
PCB 118 concentration and MDL values
Concentration (ng/g wet)
1.2
0.9
0.6
0.3
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

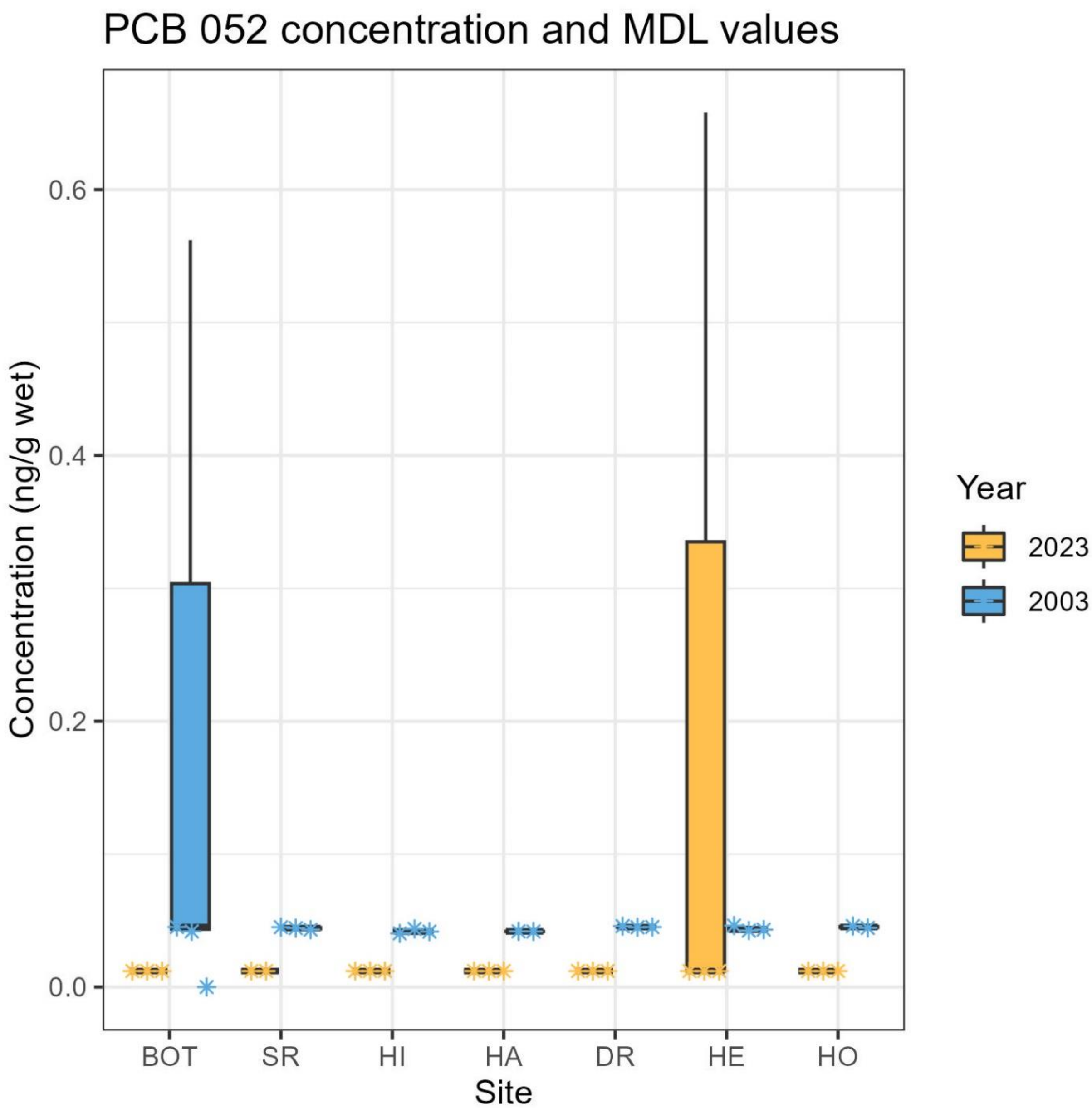

PCB 110 concentration and MDL values
Concentration (ng/g wet)
0.6
0.4
0.2
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

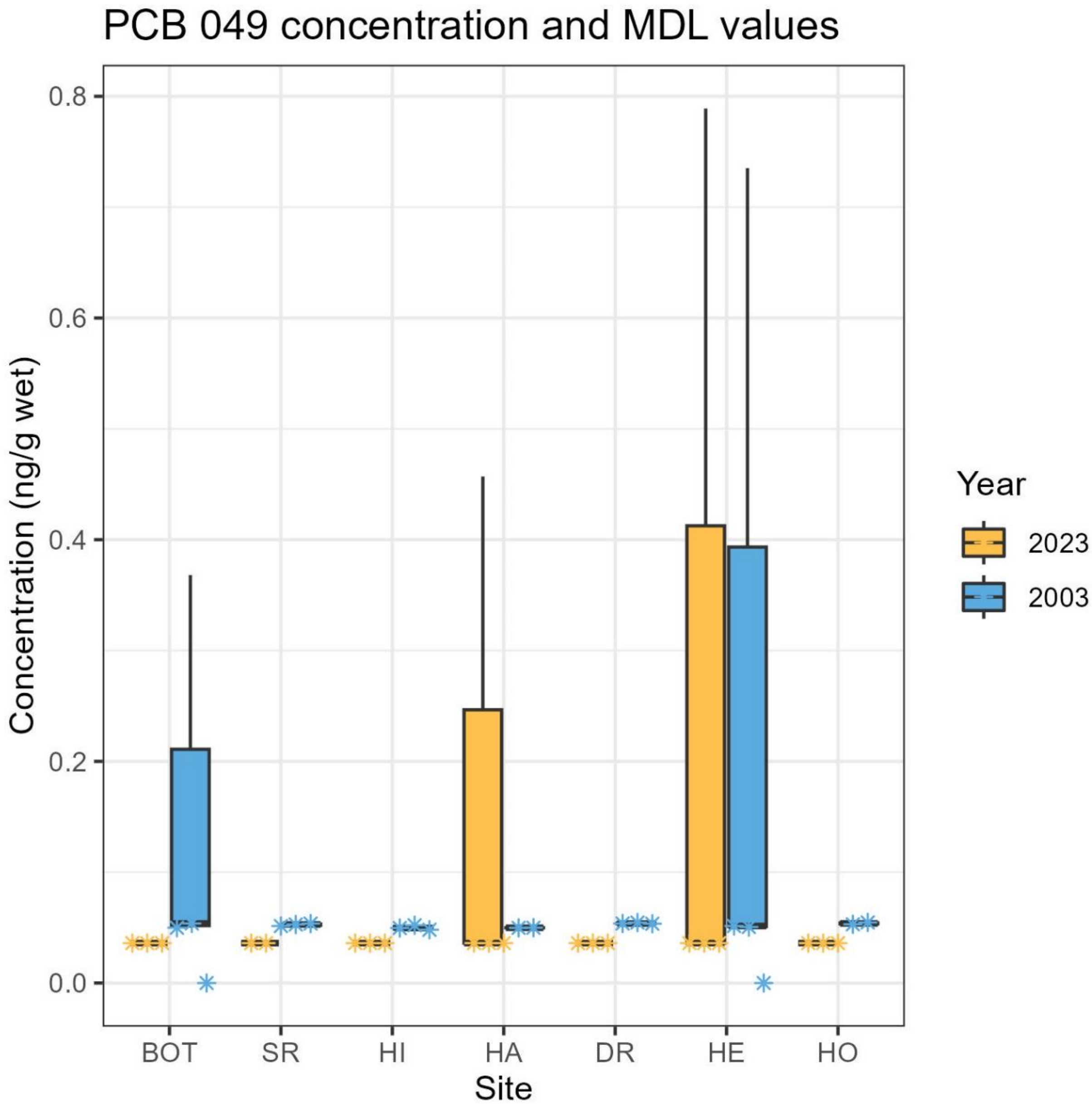

PCB 105 concentration and MDL values
Concentration (ng/g wet)
0.3
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

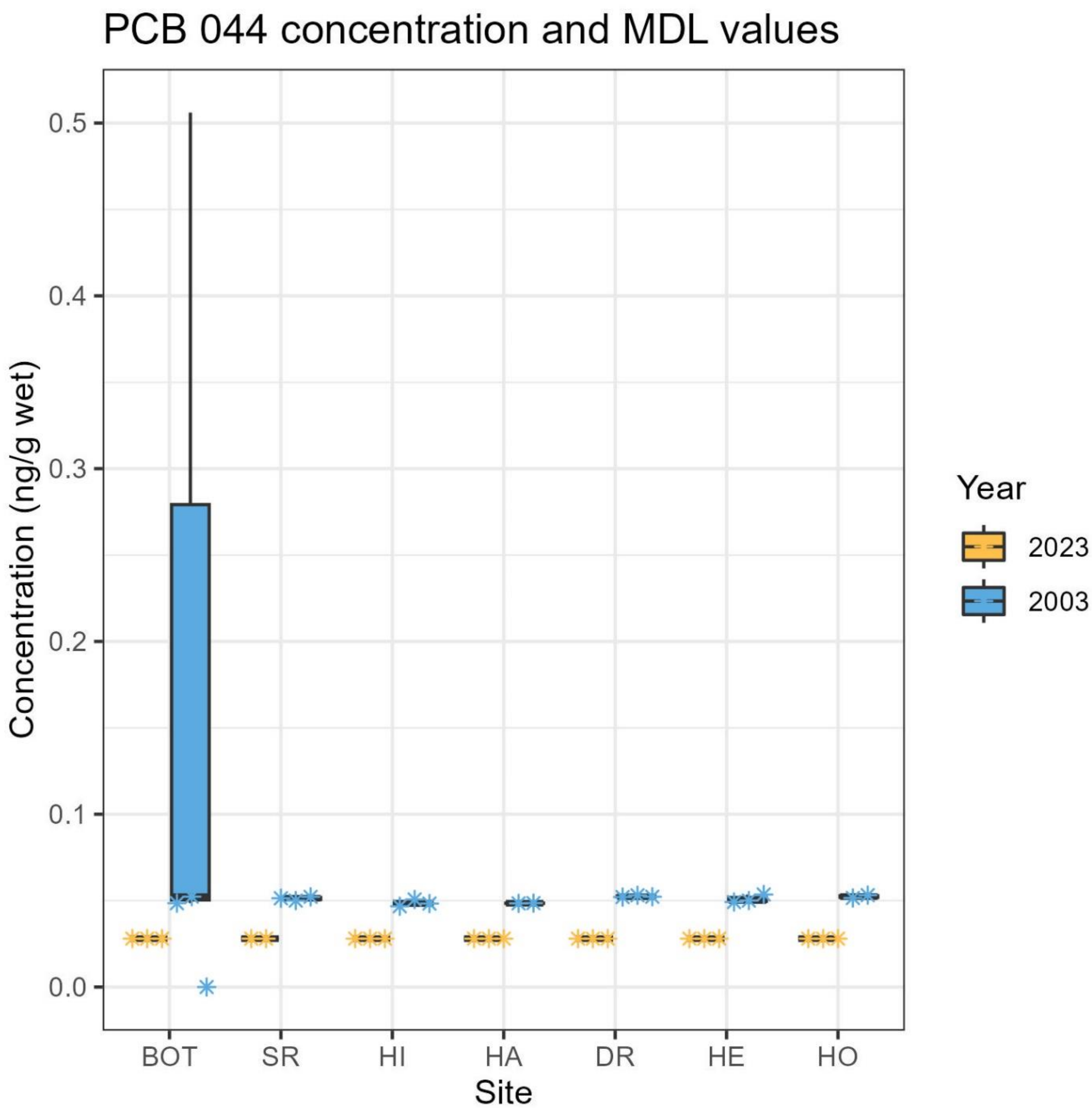

PCB 101 concentration and MDL values
1.2
0.9
0.6
0.3
0.0
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

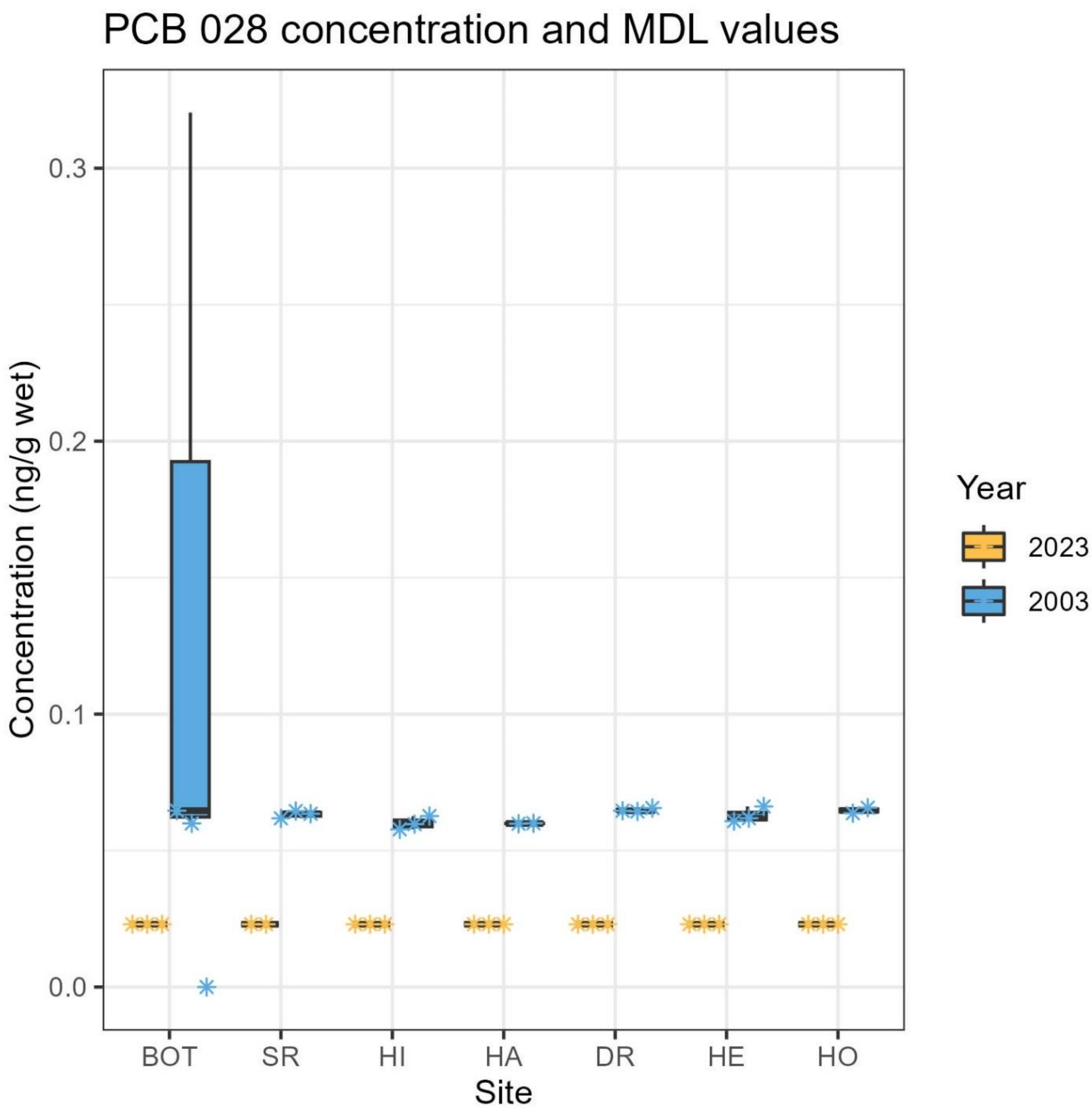

PCB 087 concentration and MDL values
Concentration (ng/g wet)
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

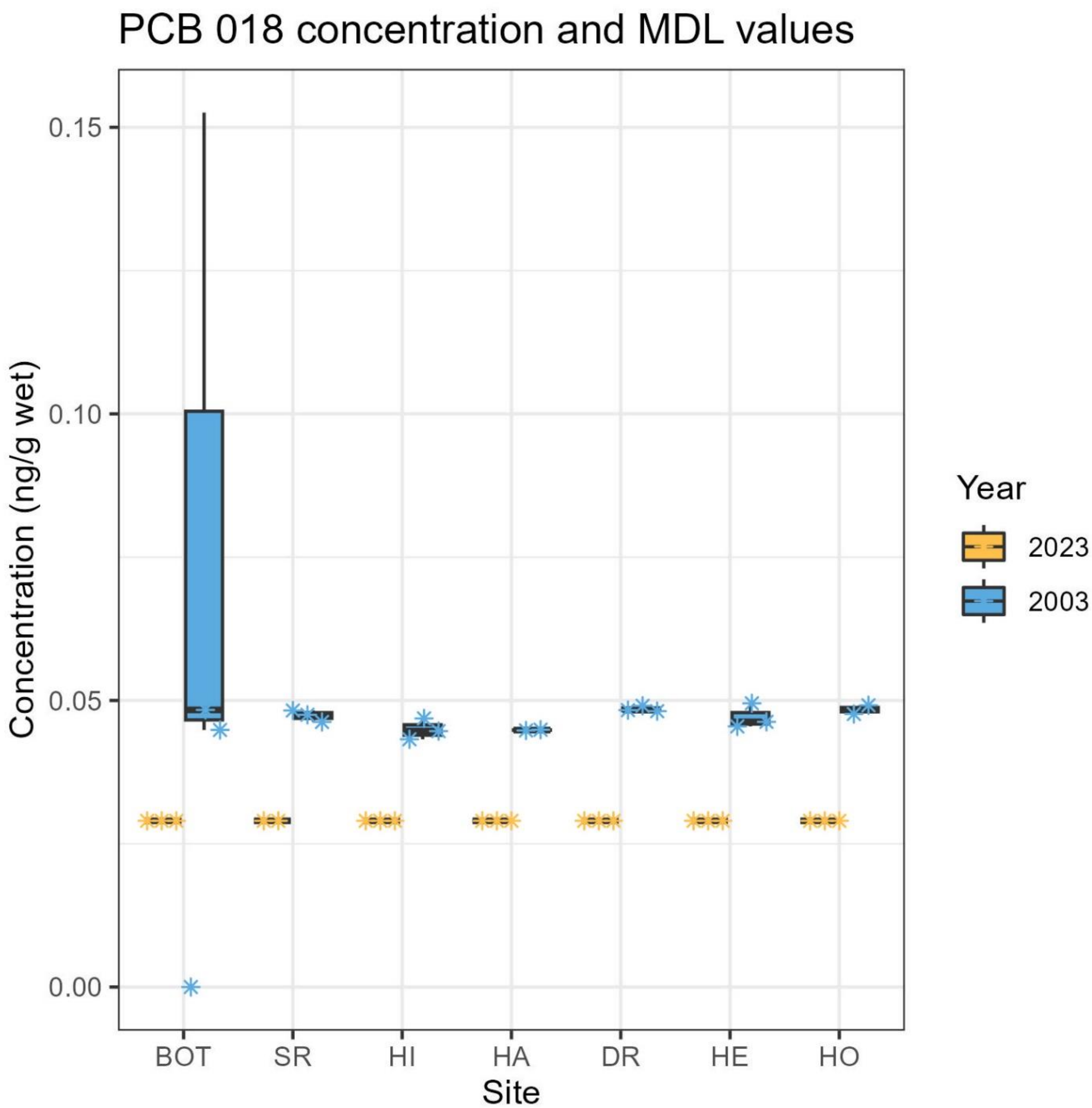

PCB 066 concentration and MDL values
Concentration (ng/g wet)
0.4
0.2
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

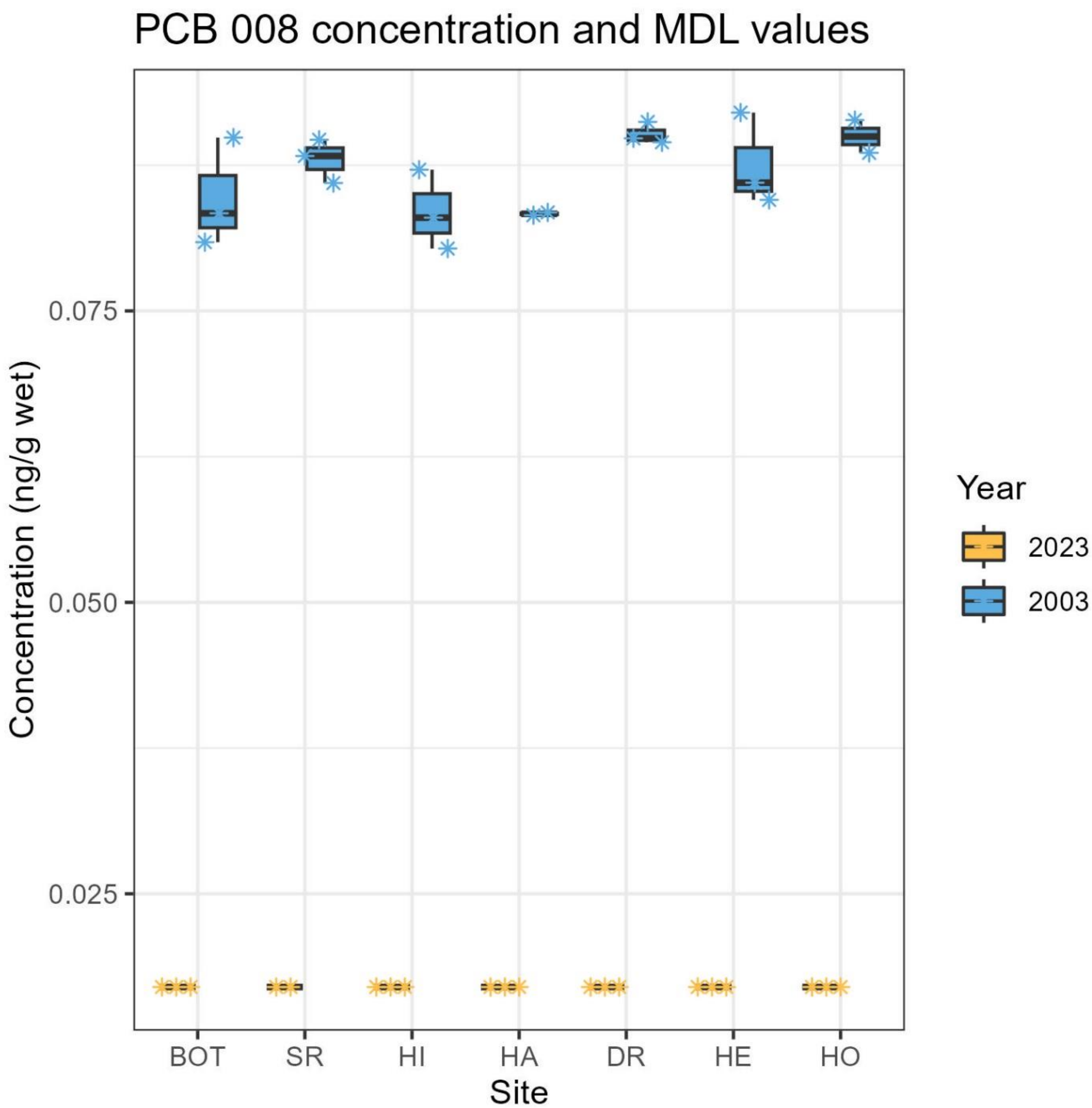

PCB 052 concentration and MDL values
Concentration (ng/g wet)
0.6
0.4
0.2
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

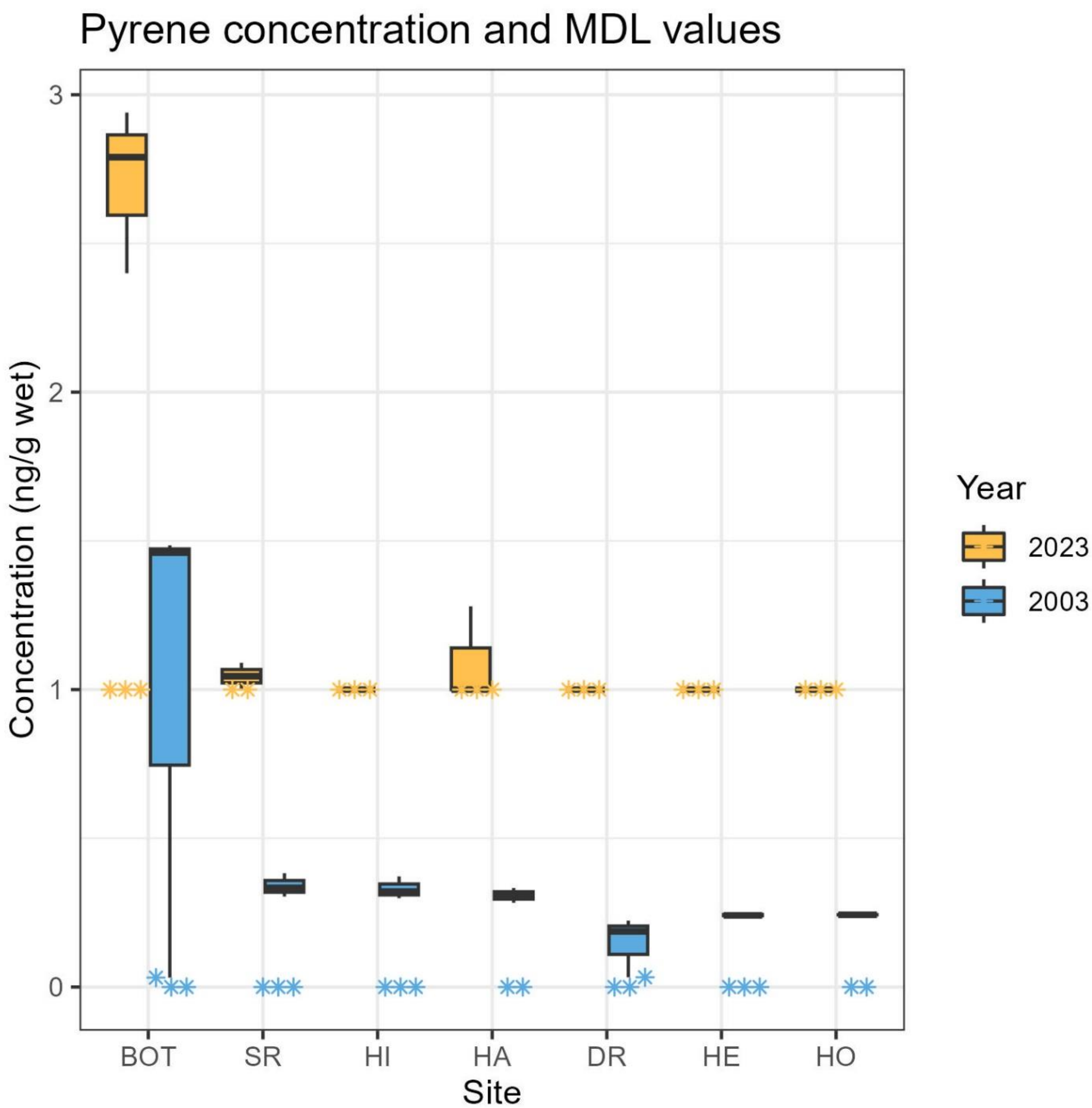

PCB 049 concentration and MDL values
0.8
0.6
0.4
0.2
0.0
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


PCB 044 concentration and MDL values
Concentration (ng/g wet)
0.5
0.4
0.3
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

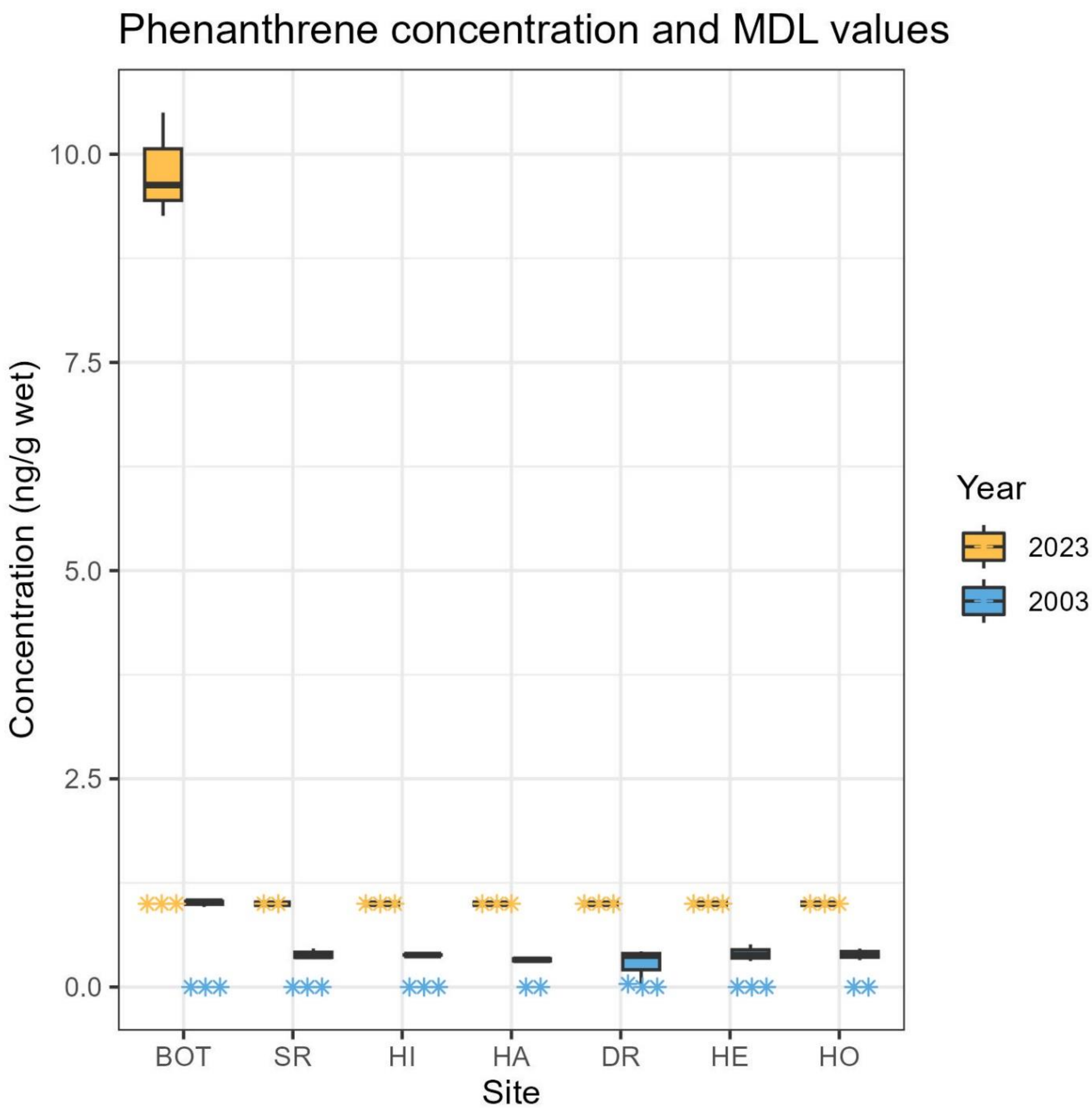

PCB 028 concentration and MDL values
Concentration (ng/g wet)
0.3
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

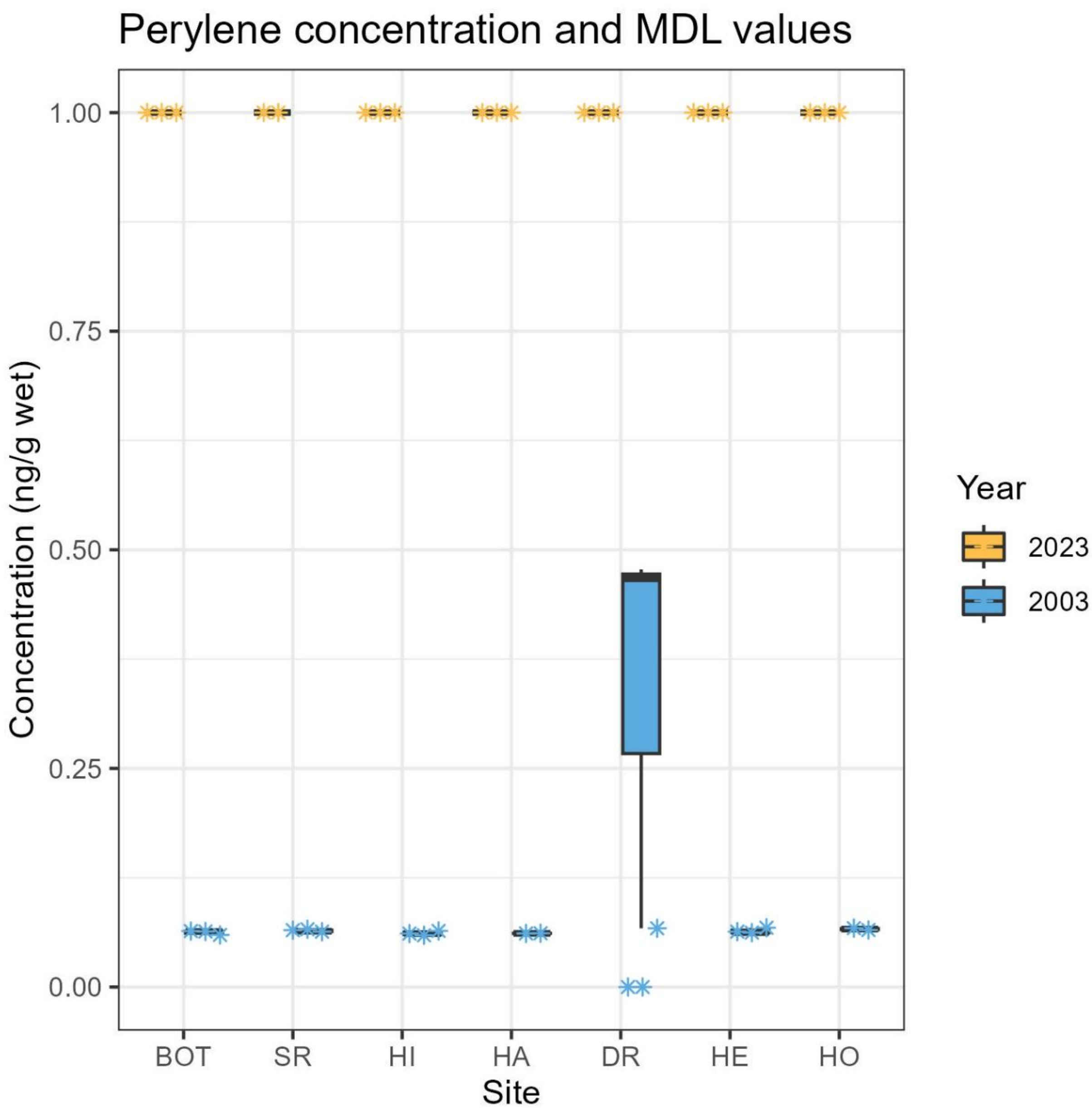

PCB 018 concentration and MDL values
0.15
0.10
0.05
0.00
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

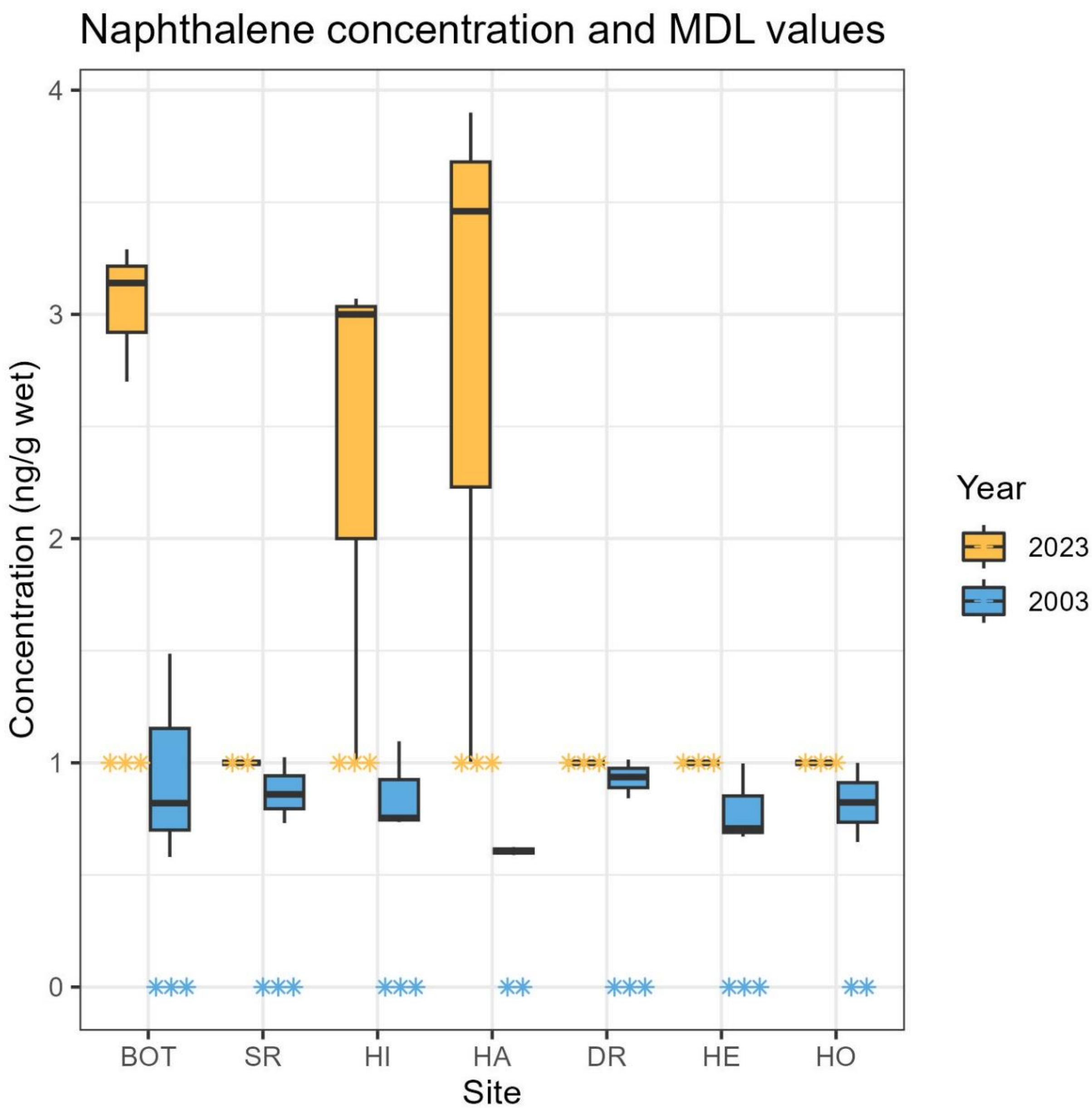

PCB 008 concentration and MDL values
Concentration (ng/g wet)
0.075
0.050
0.025
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

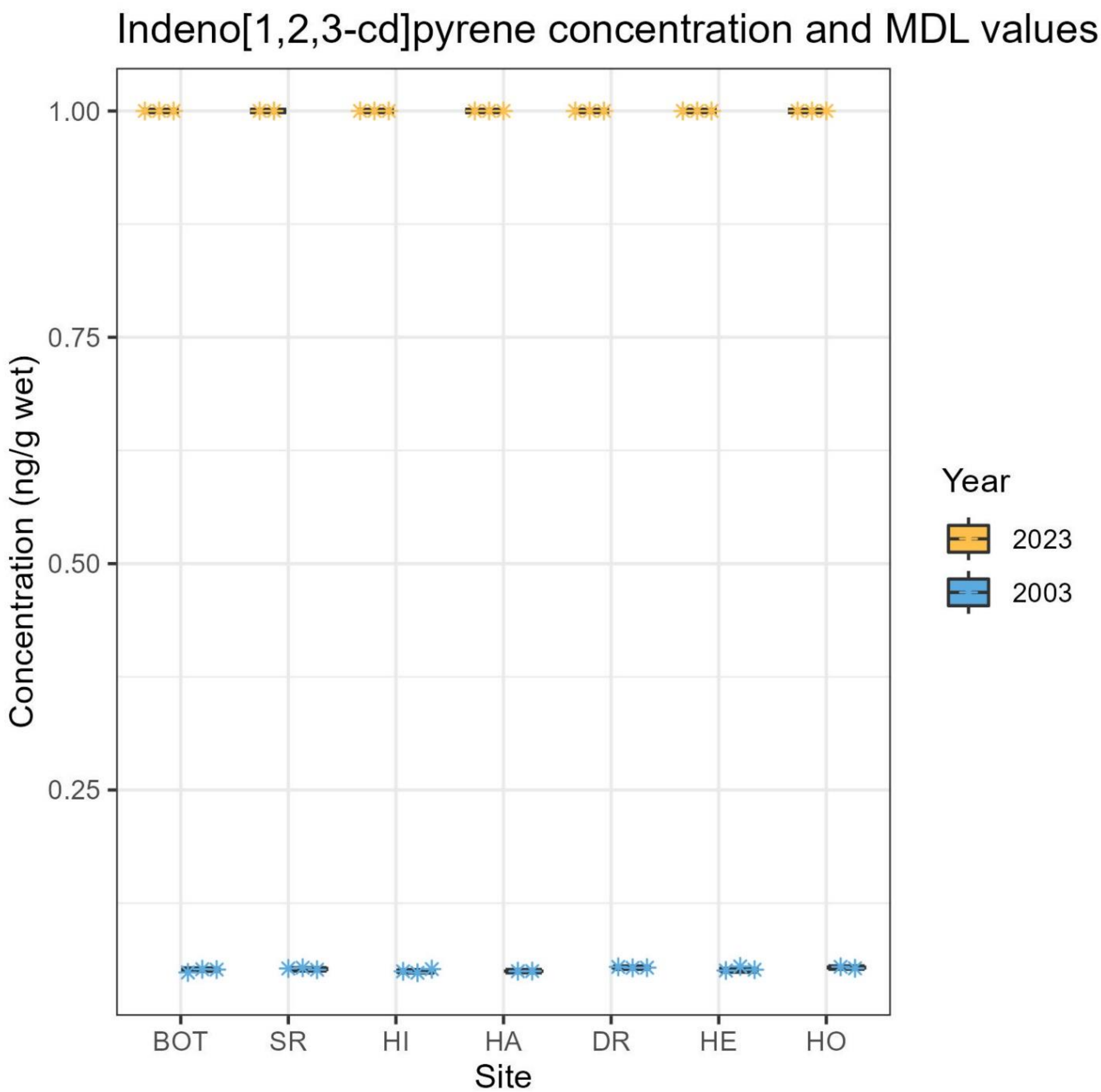


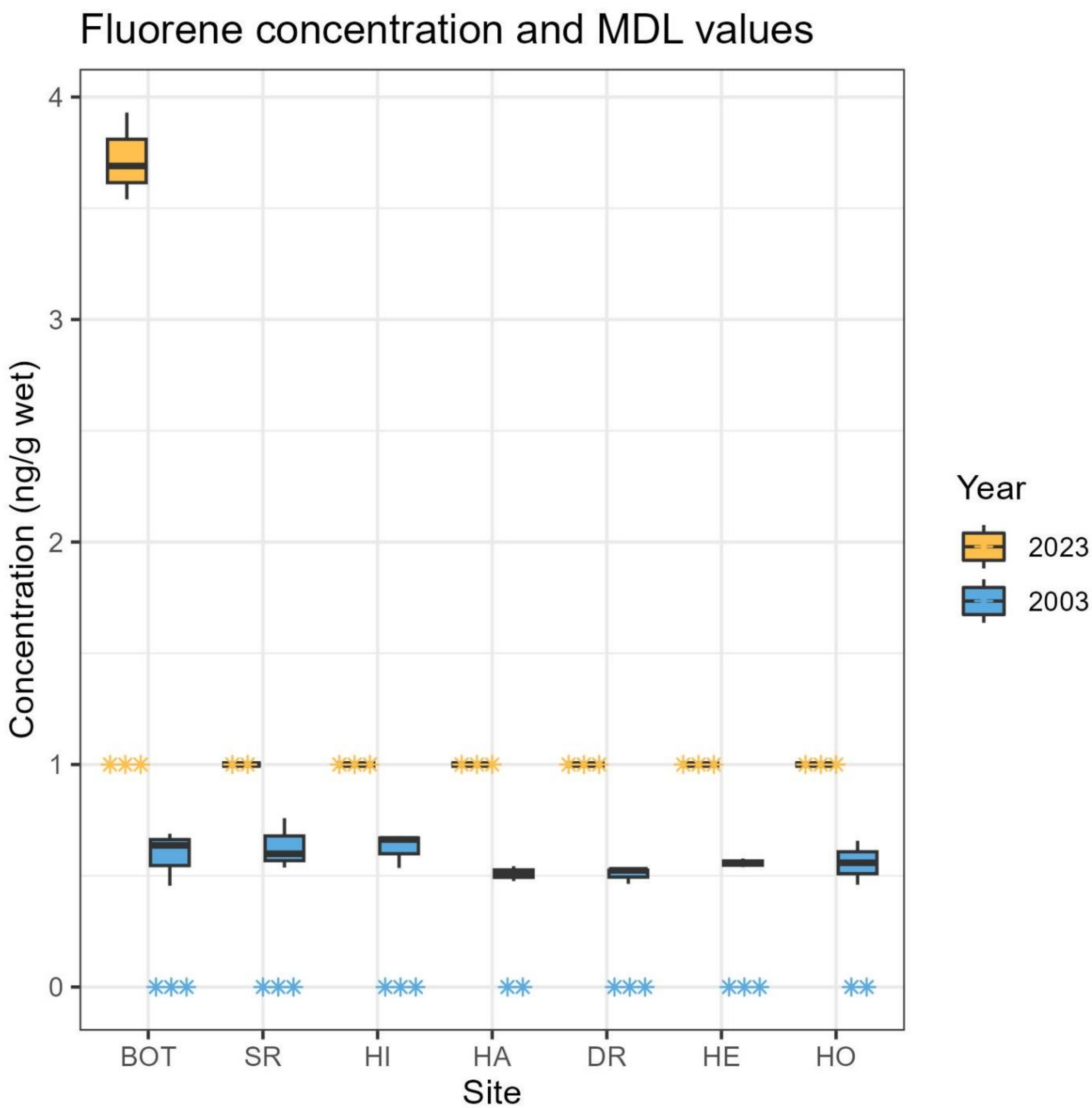
Pyrene concentration and MDL values
Concentration (ng/g wet)
3
2
1
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

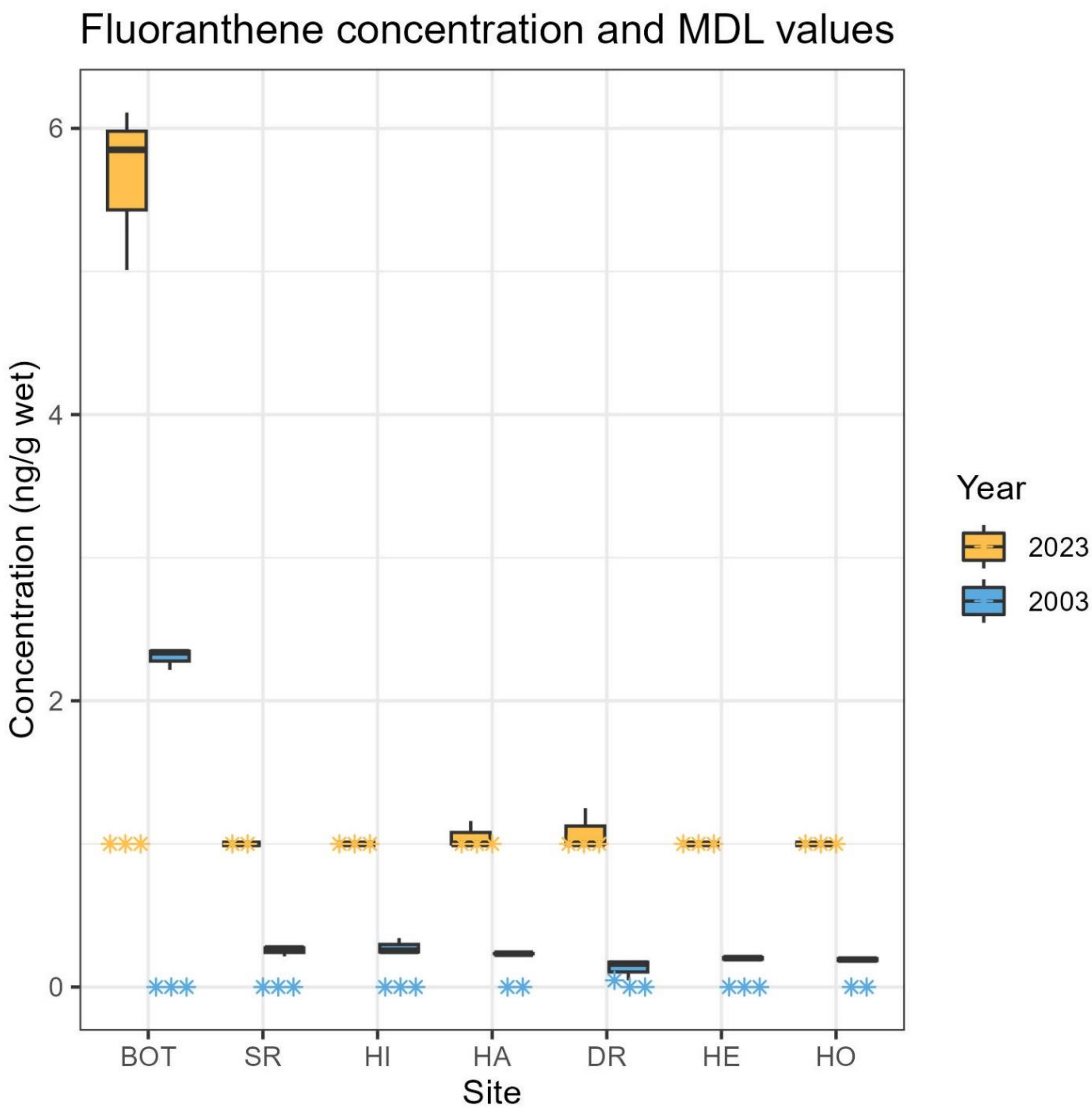

Phenanthrene concentration and MDL values
Concentration (ng/g wet)
10.0
7.5
5.0
2.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

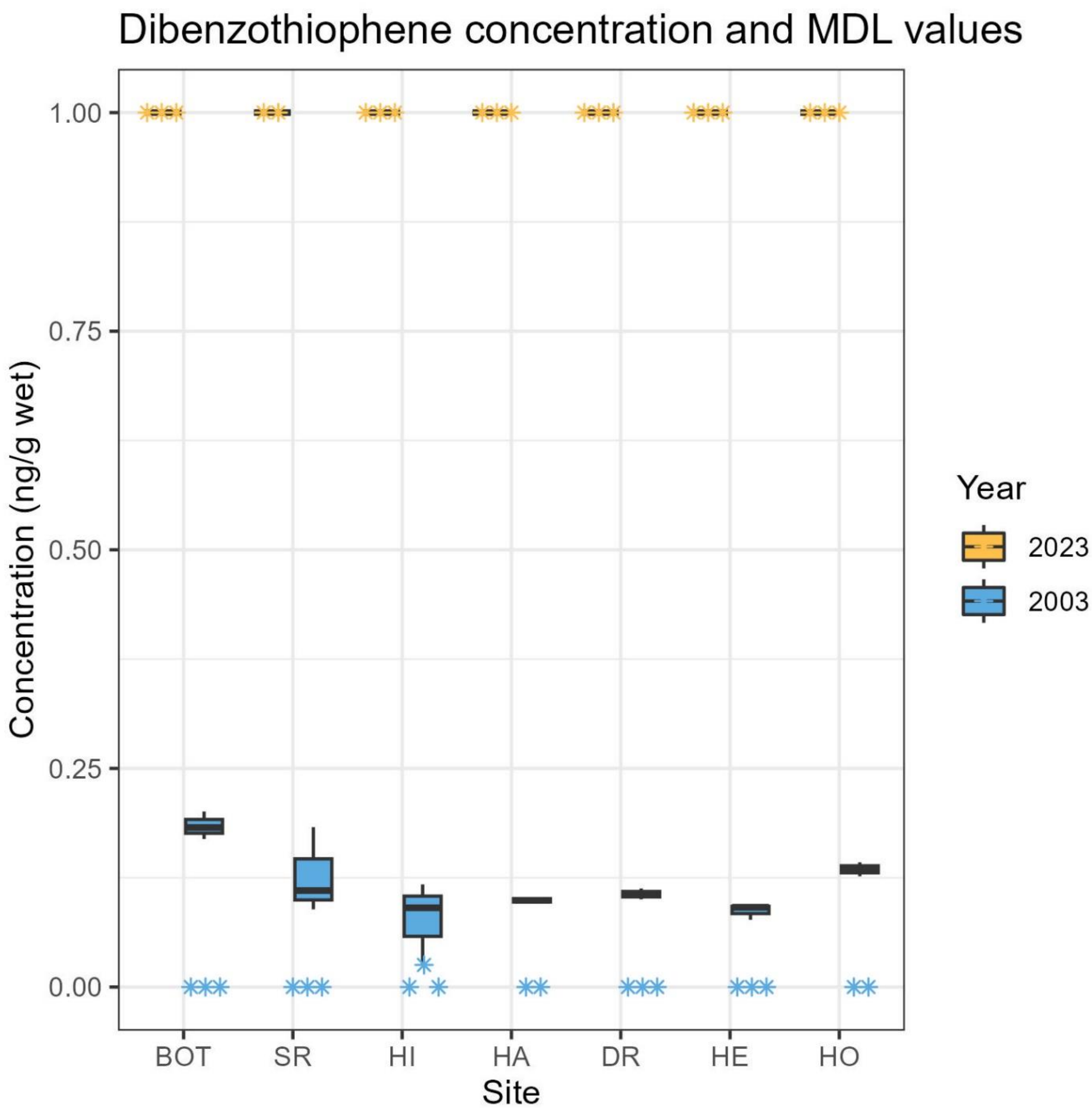

Perylene concentration and MDL values
Concentration (ng/g wet)
1.00
0.75
0.50
0.25
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

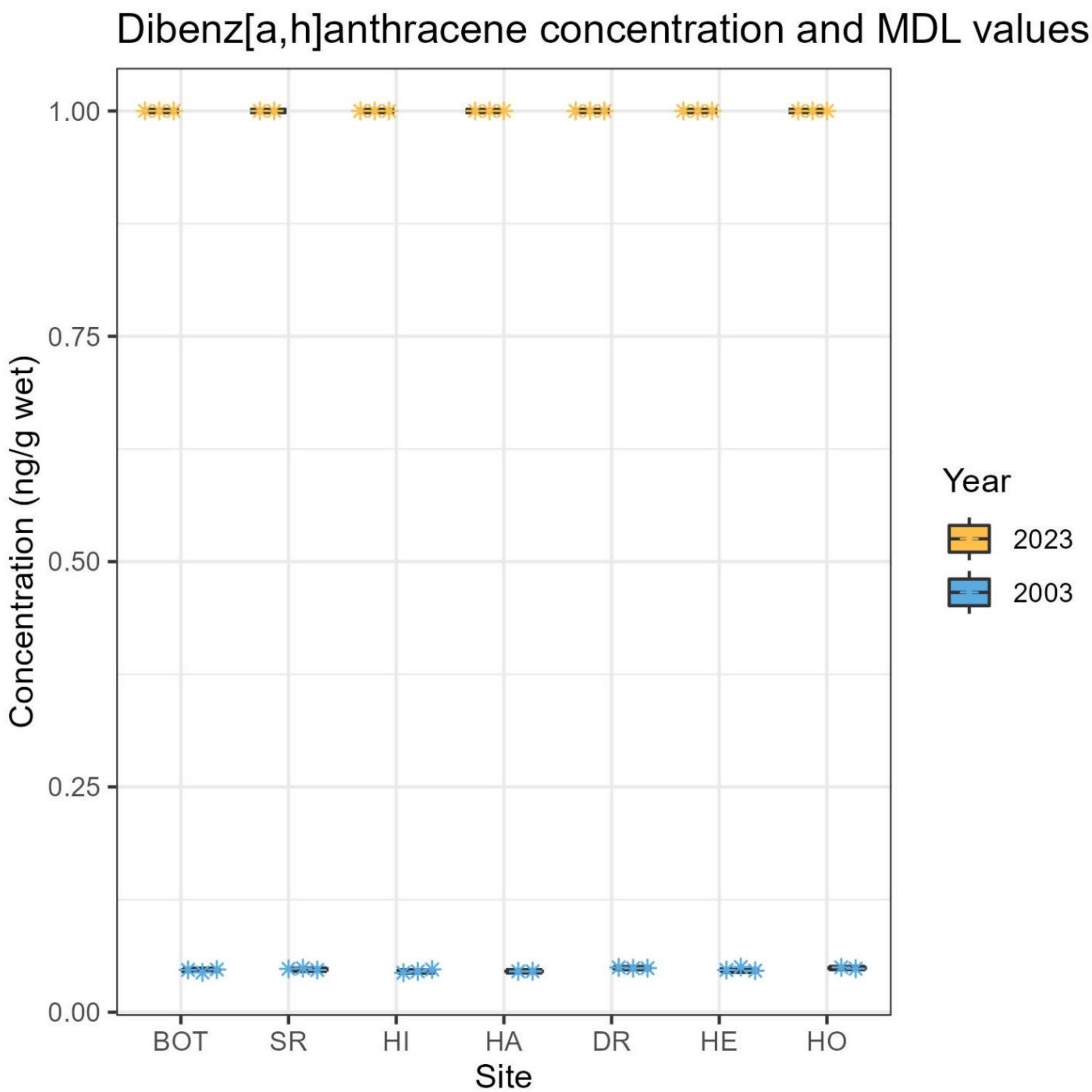

Naphthalene concentration and MDL values
Concentration (ng/g wet)
0
1
2
3
4
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

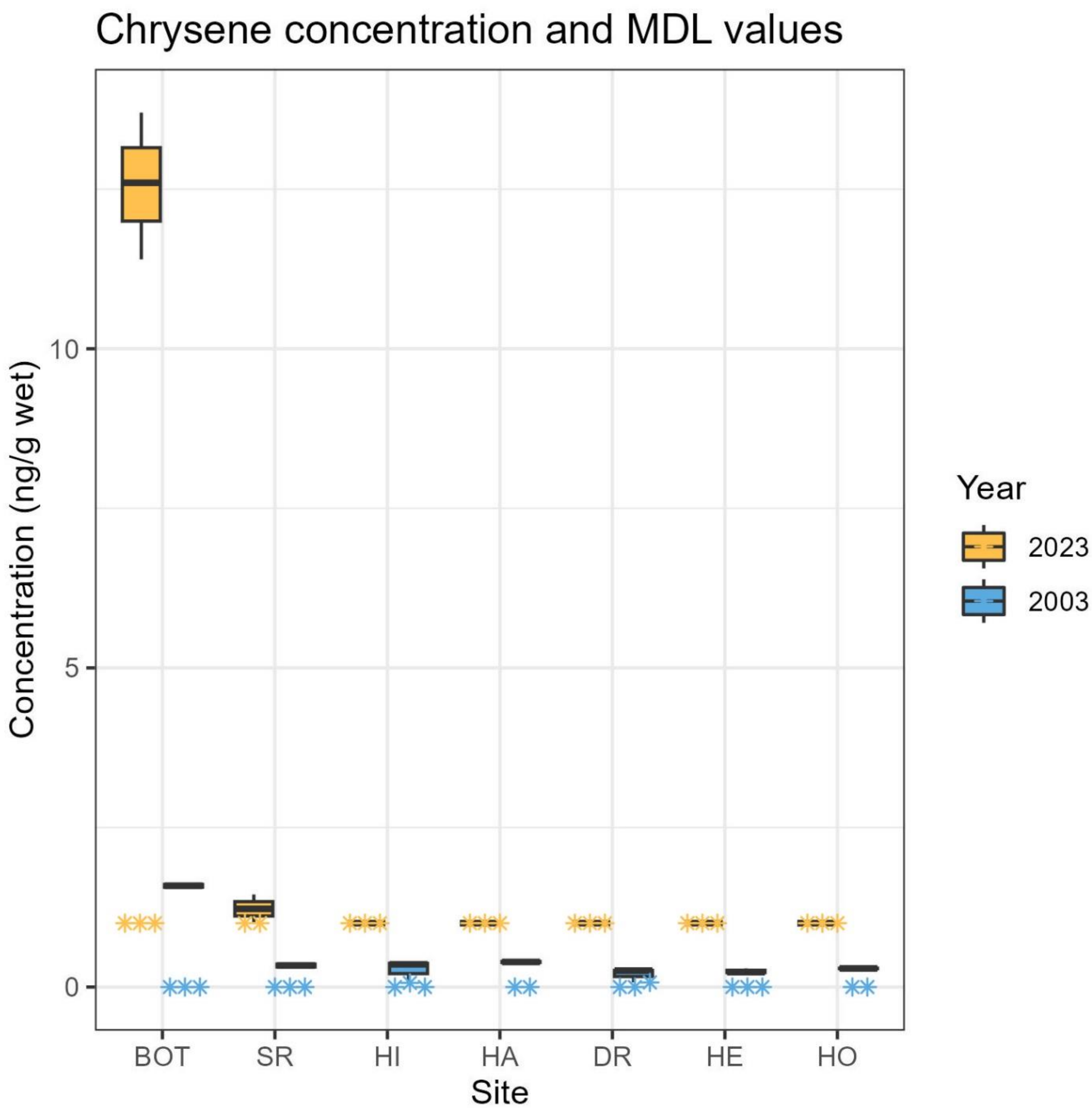

Indeno[1,2,3-cd]pyrene concentration and MDL values
1.00
0.75
0.50
0.25
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

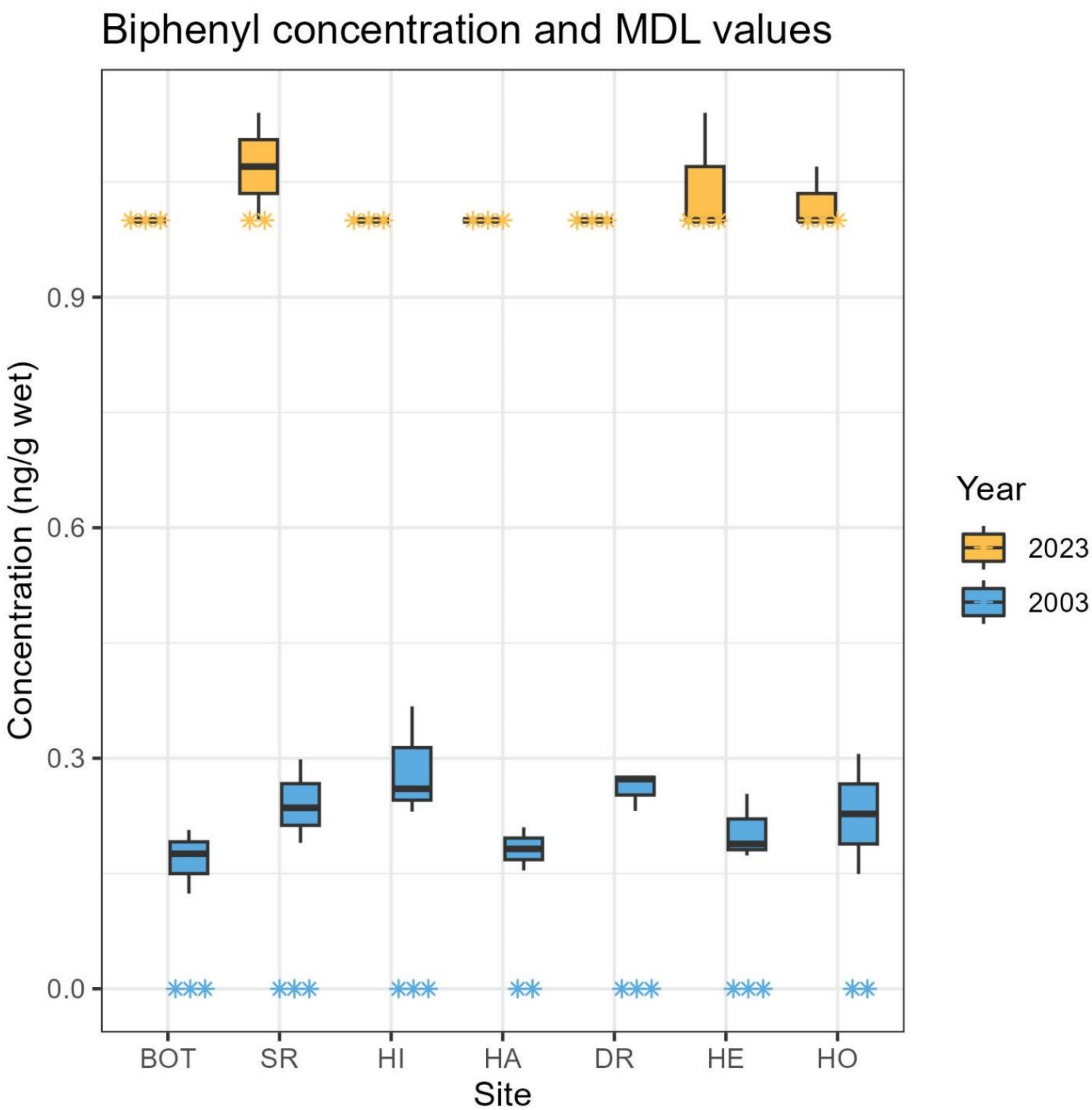

Fluorene concentration and MDL values
Concentration (ng/g wet)
4
3
2
1
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

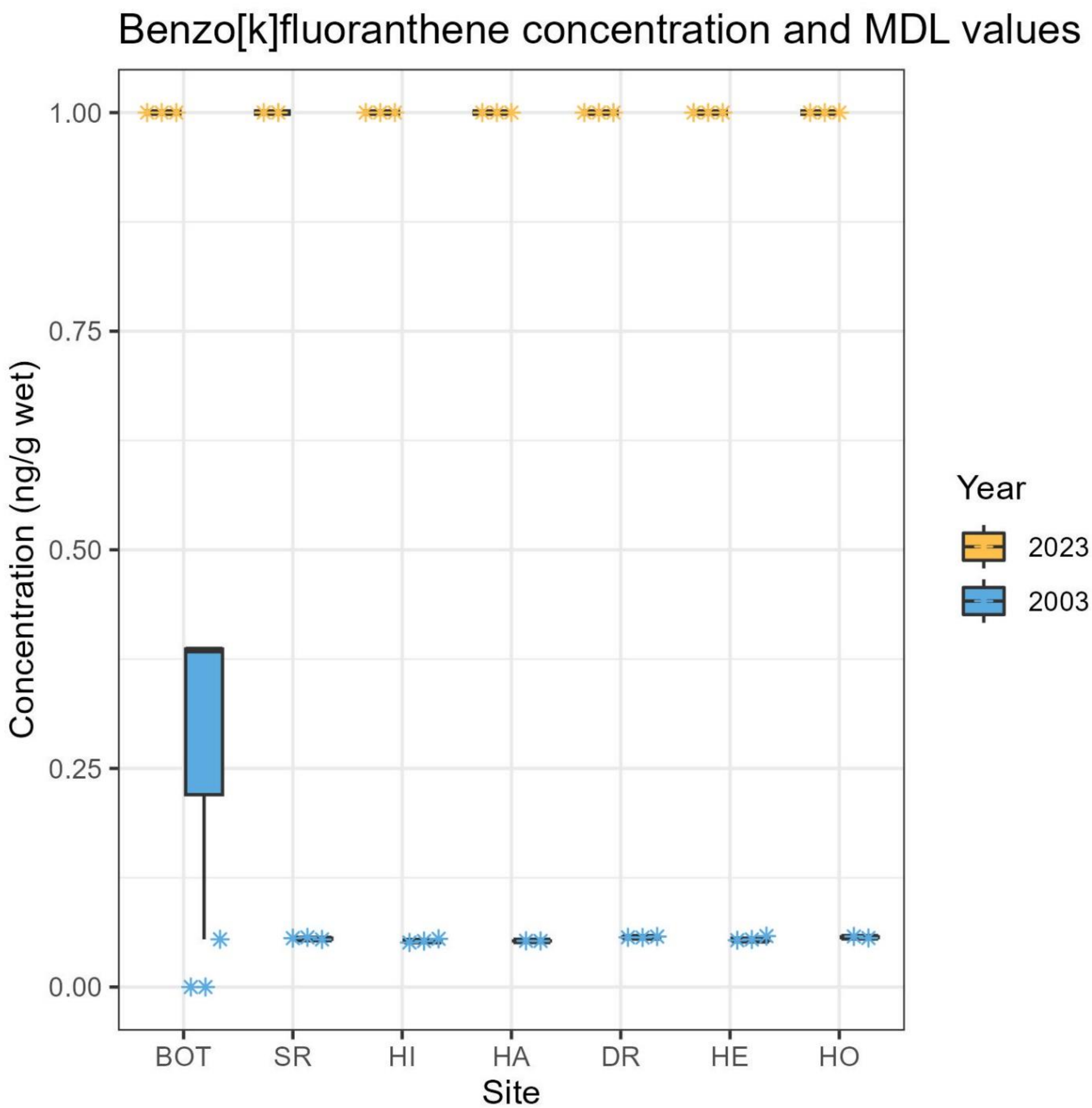

Fluoranthene concentration and MDL values
Concentration (ng/g wet)
6
4
2
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

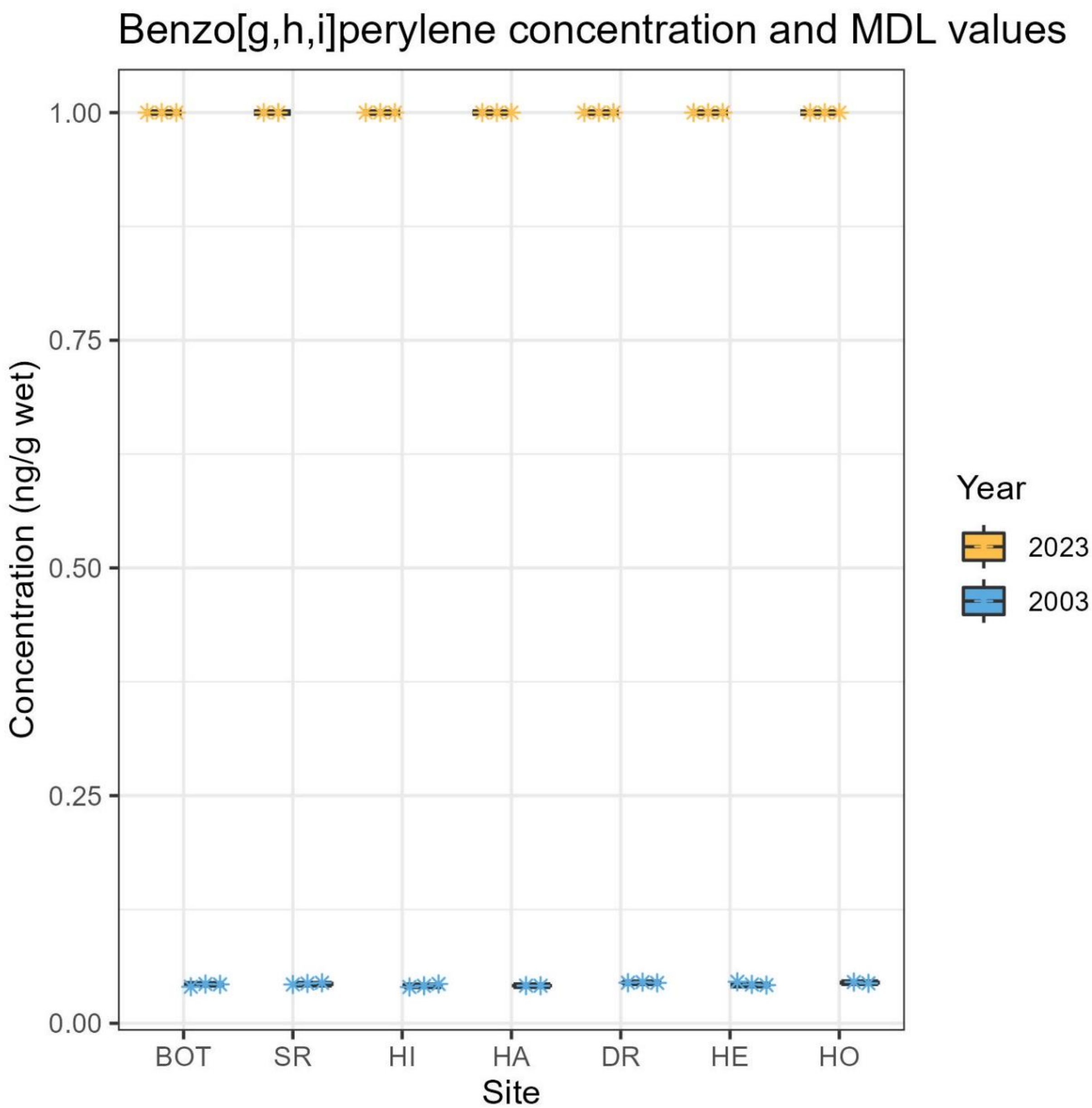

Dibenzothiophene concentration and MDL values
Concentration (ng/g wet)
1.00
0.75
0.50
0.25
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

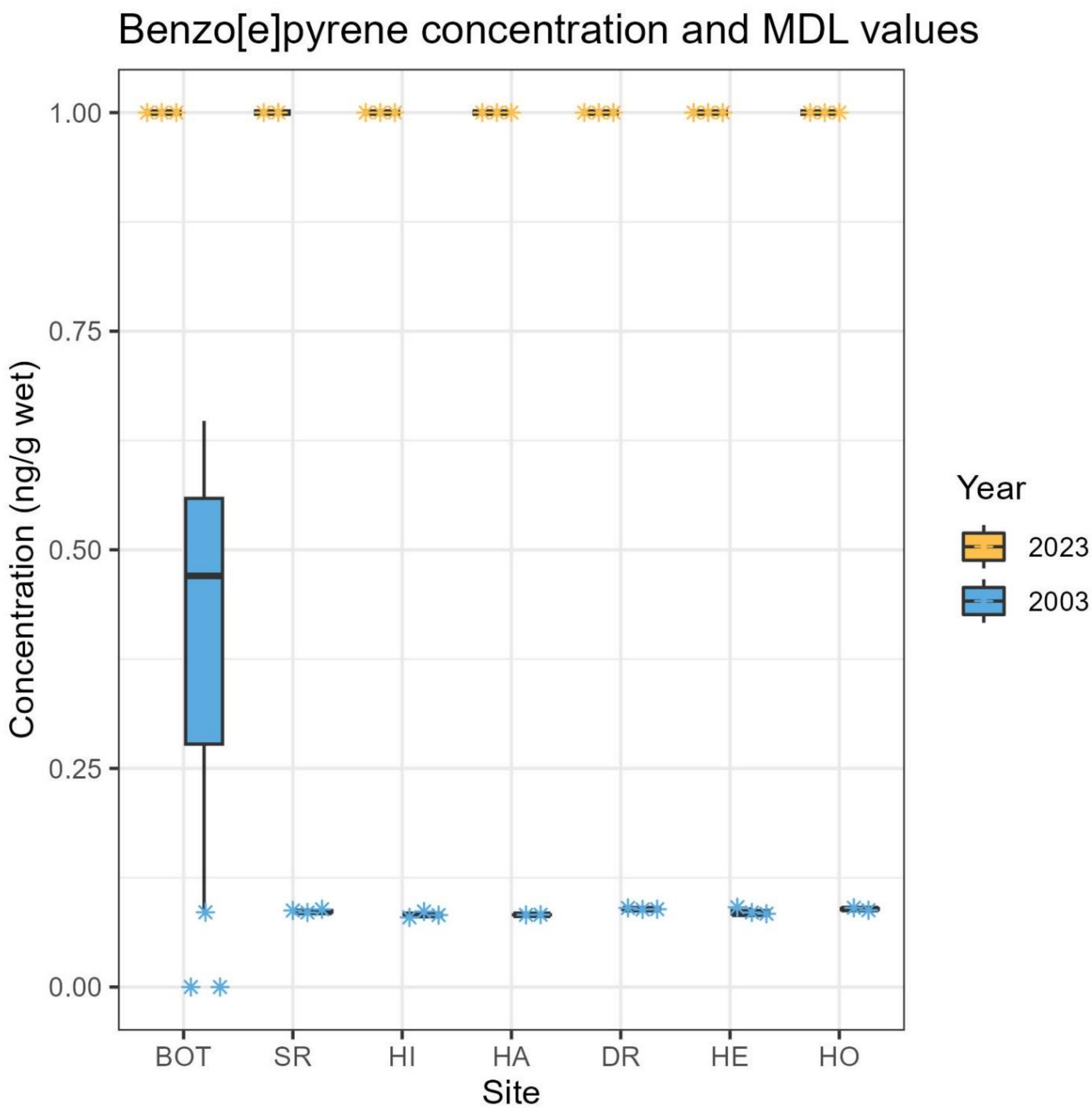

Dibenz[a,h]anthracene concentration and MDL values
Concentration (ng/g wet)
1.00
0.75
0.50
0.25
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

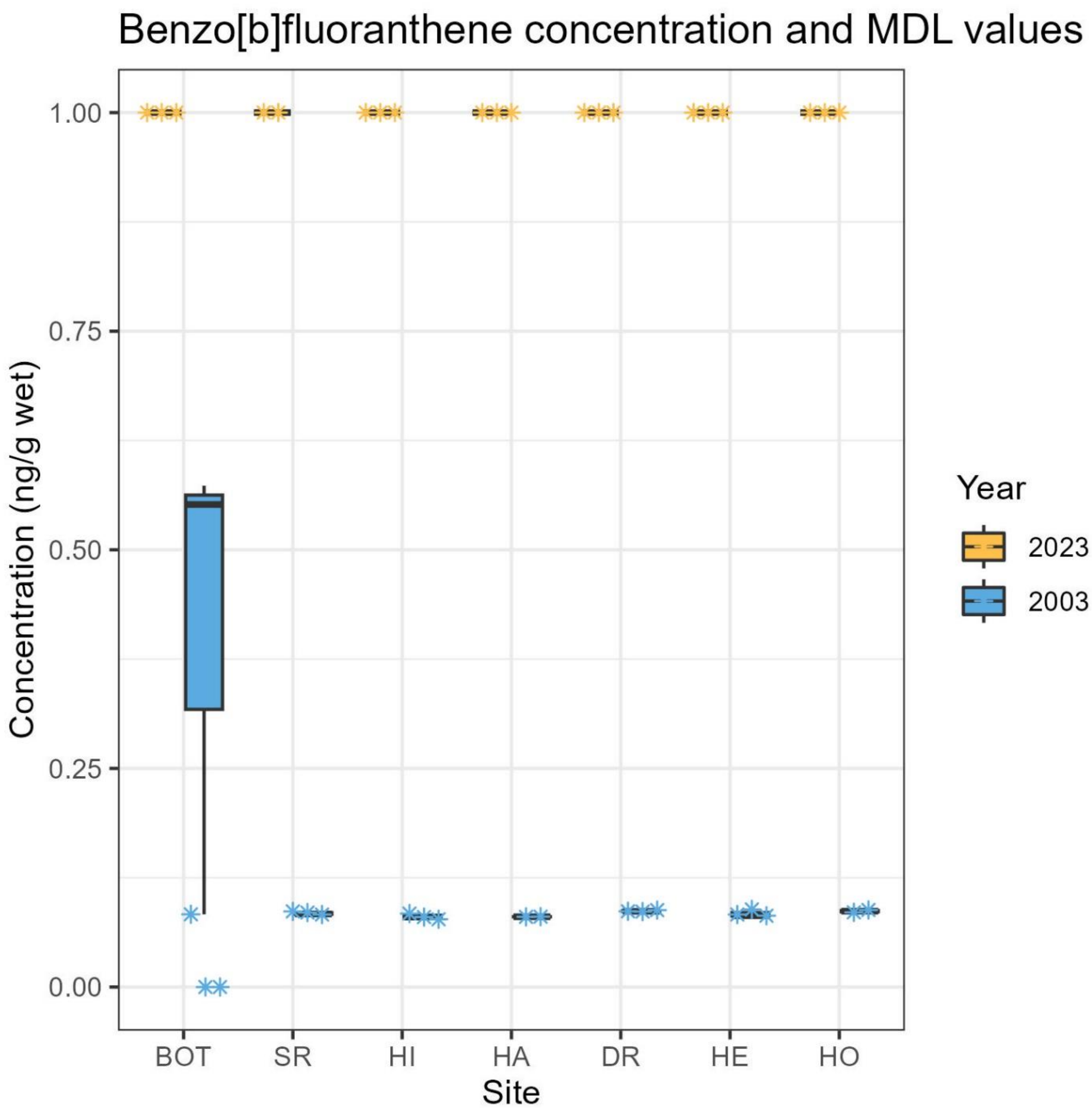

Chrysene concentration and MDL values
Concentration (ng/g wet)
10
5
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

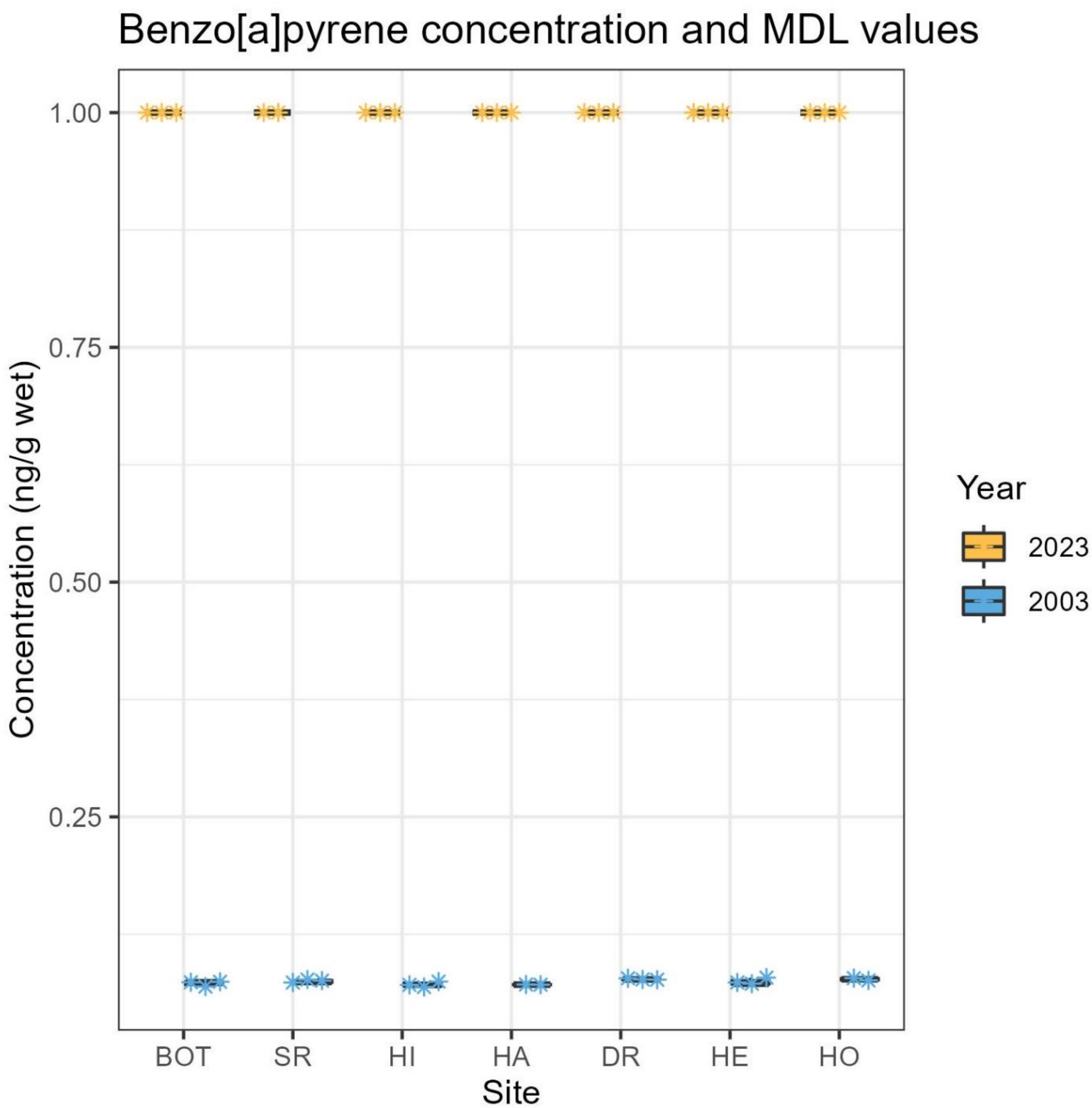

Biphenyl concentration and MDL values
Concentration (ng/g wet)
0.9
0.6
0.3
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Benzo[k]fluoranthene concentration and MDL values
Concentration (ng/g wet)
1.00
0.75
0.50
0.25
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Benzo[g,h,i]perylene concentration and MDL values
Concentration (ng/g wet)
1.00
0.75
0.50
0.25
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

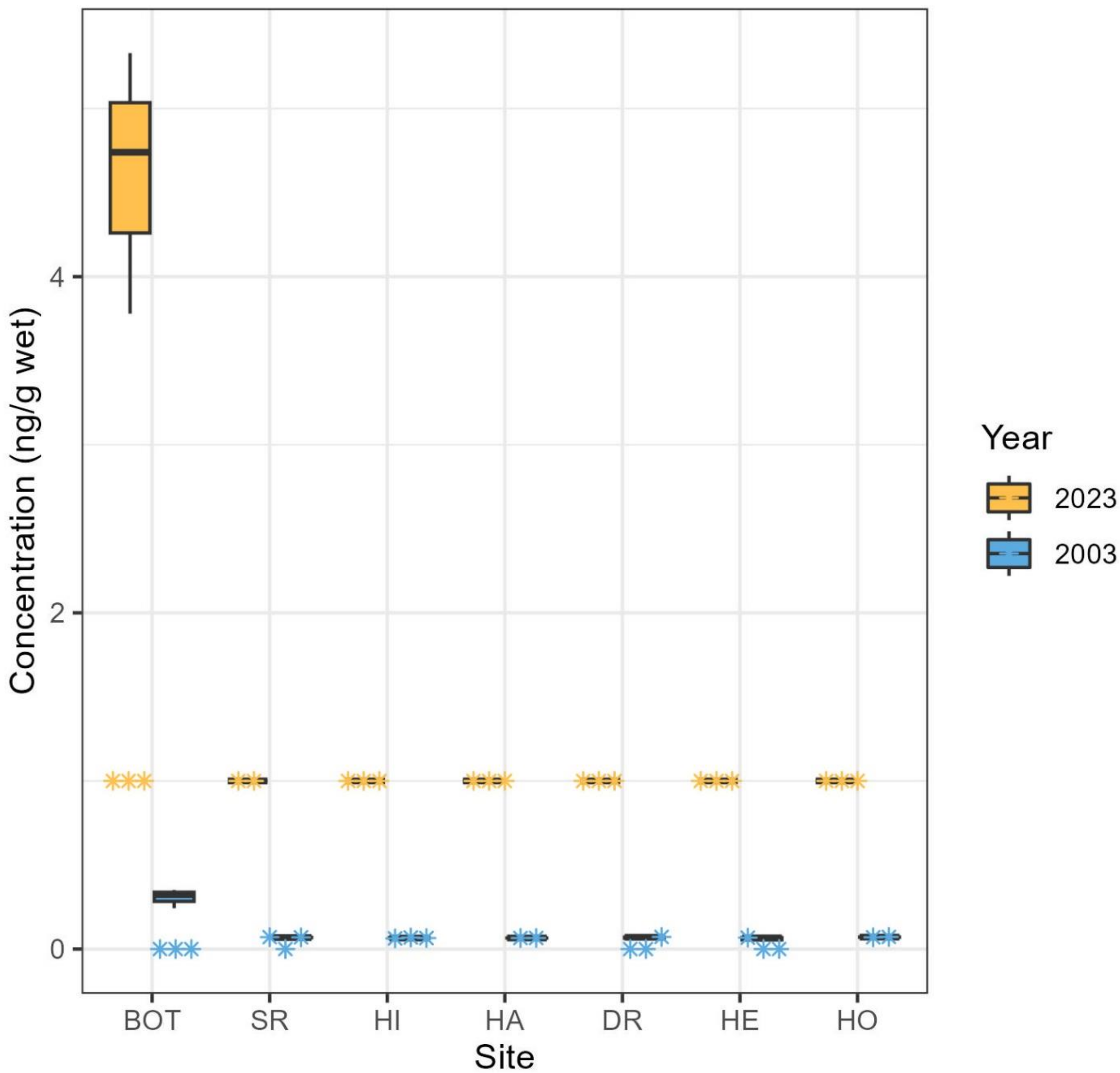

Benzo[e]pyrene concentration and MDL values
1.00
0.75
0.50
0.25
0.00
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

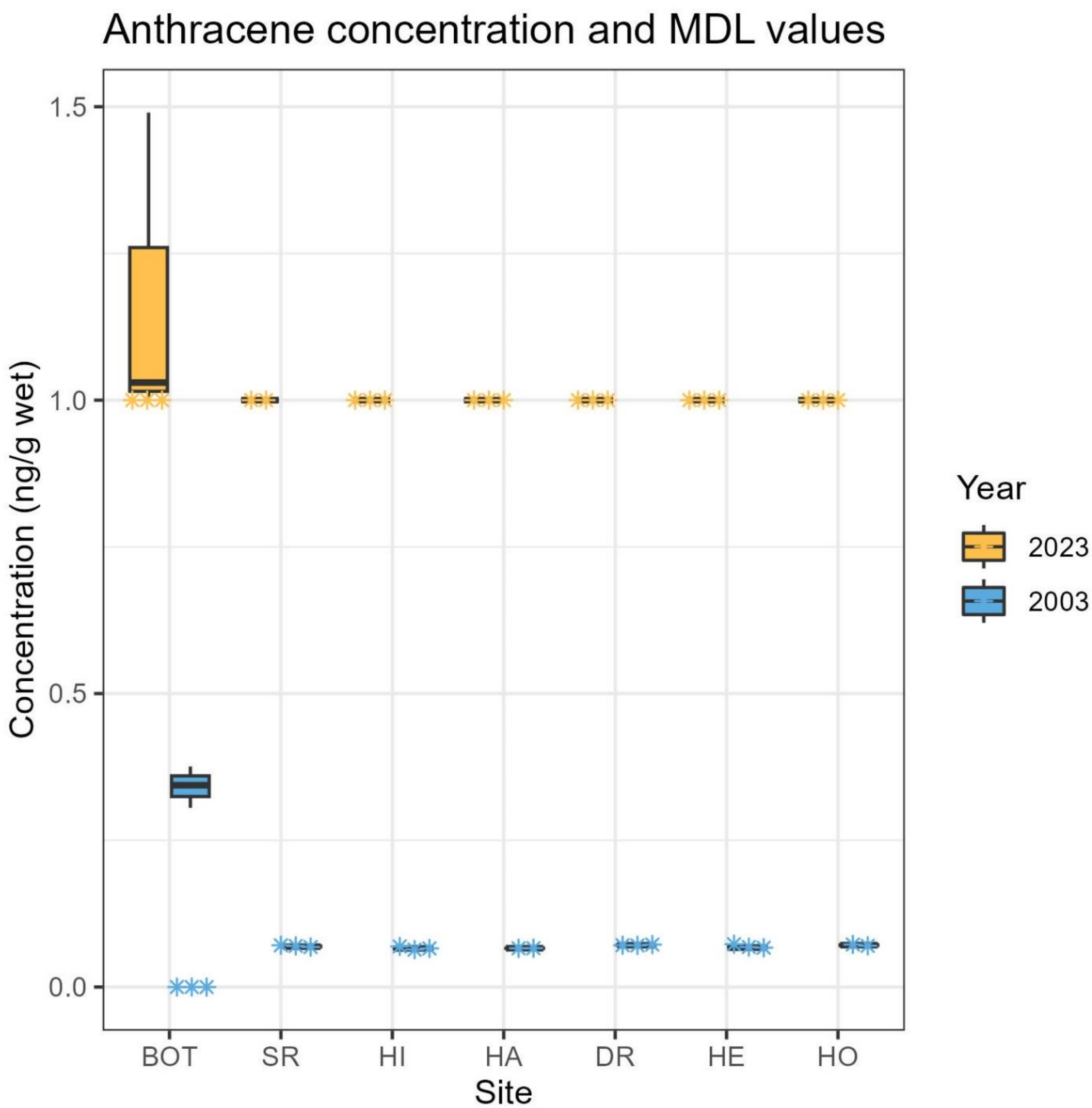

Benzo[b]fluoranthene concentration and MDL values
Concentration (ng/g wet)
1.00
0.75
0.50
0.25
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

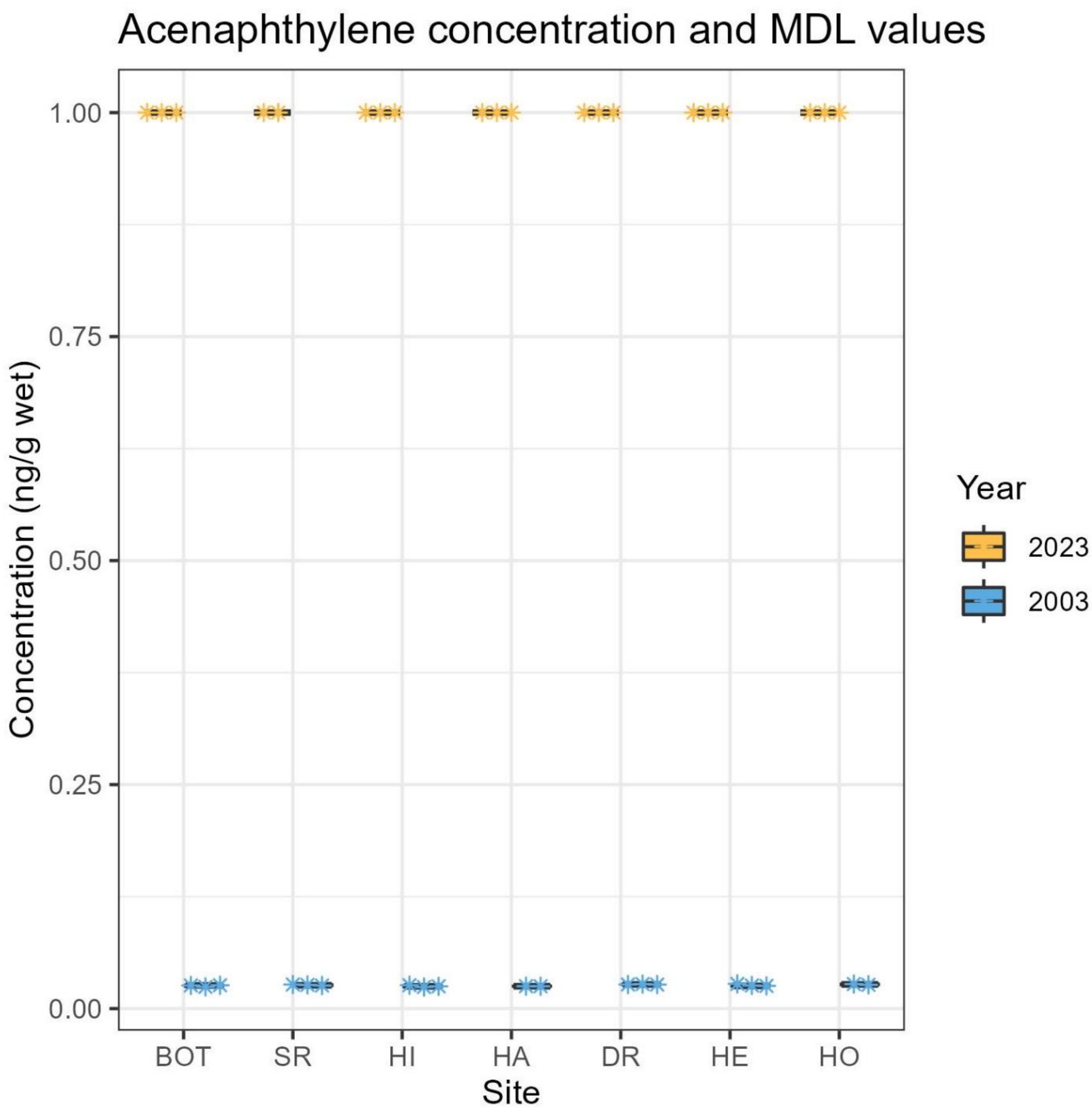


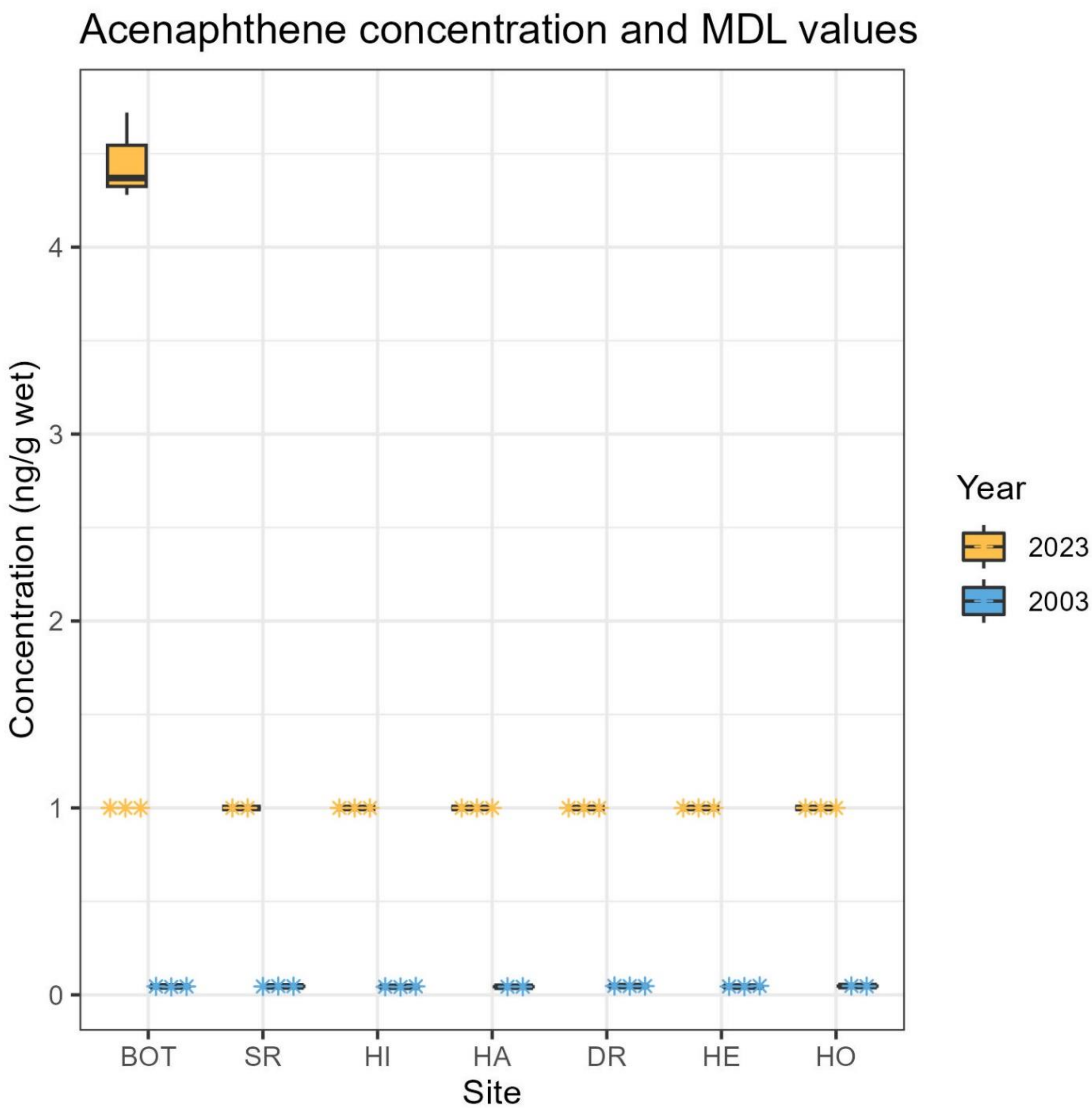
Benzo[a]pyrene concentration and MDL values
1.00
0.75
0.50
0.25
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

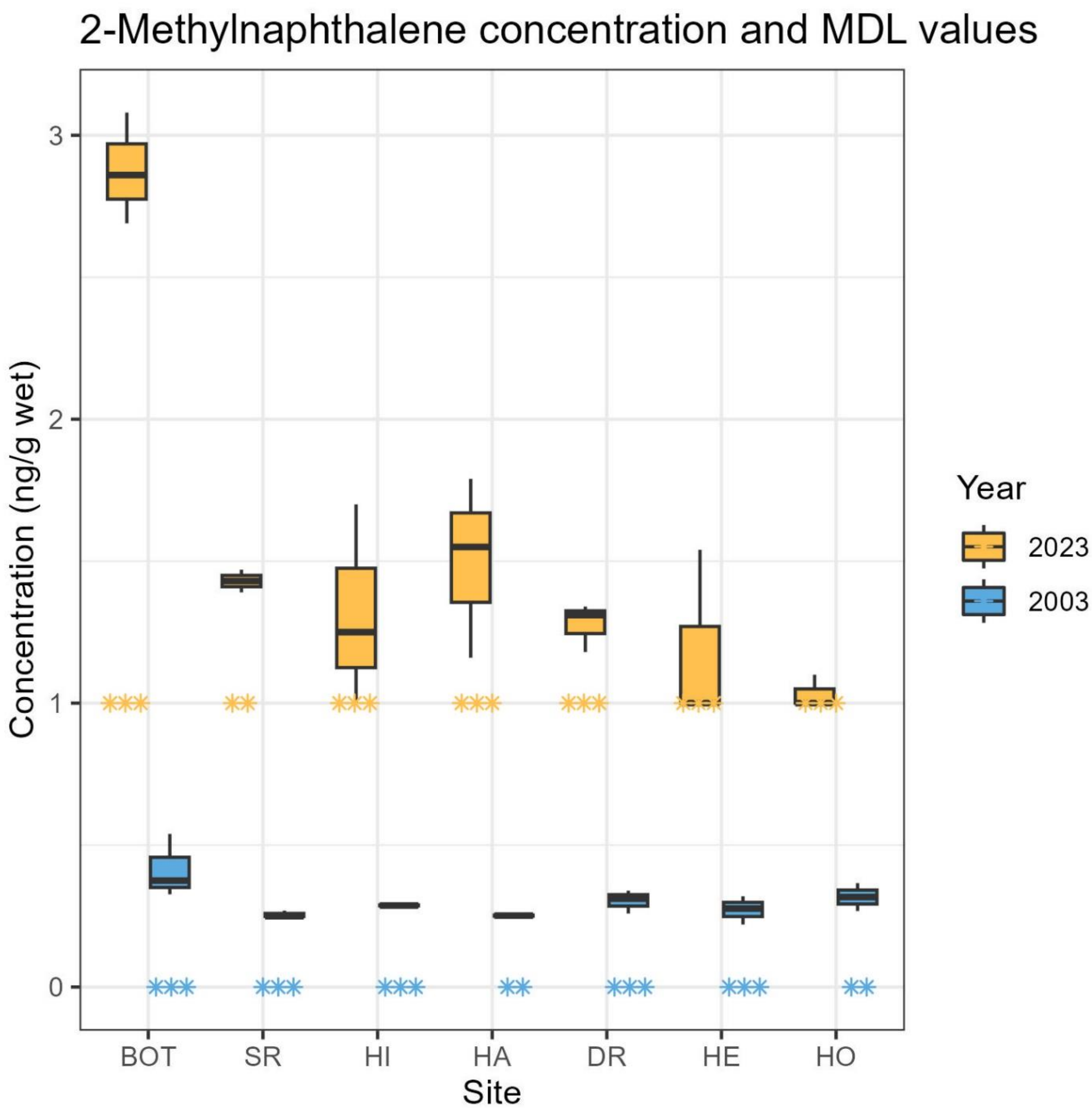
Benz[a]anthracene concentration and MDL values

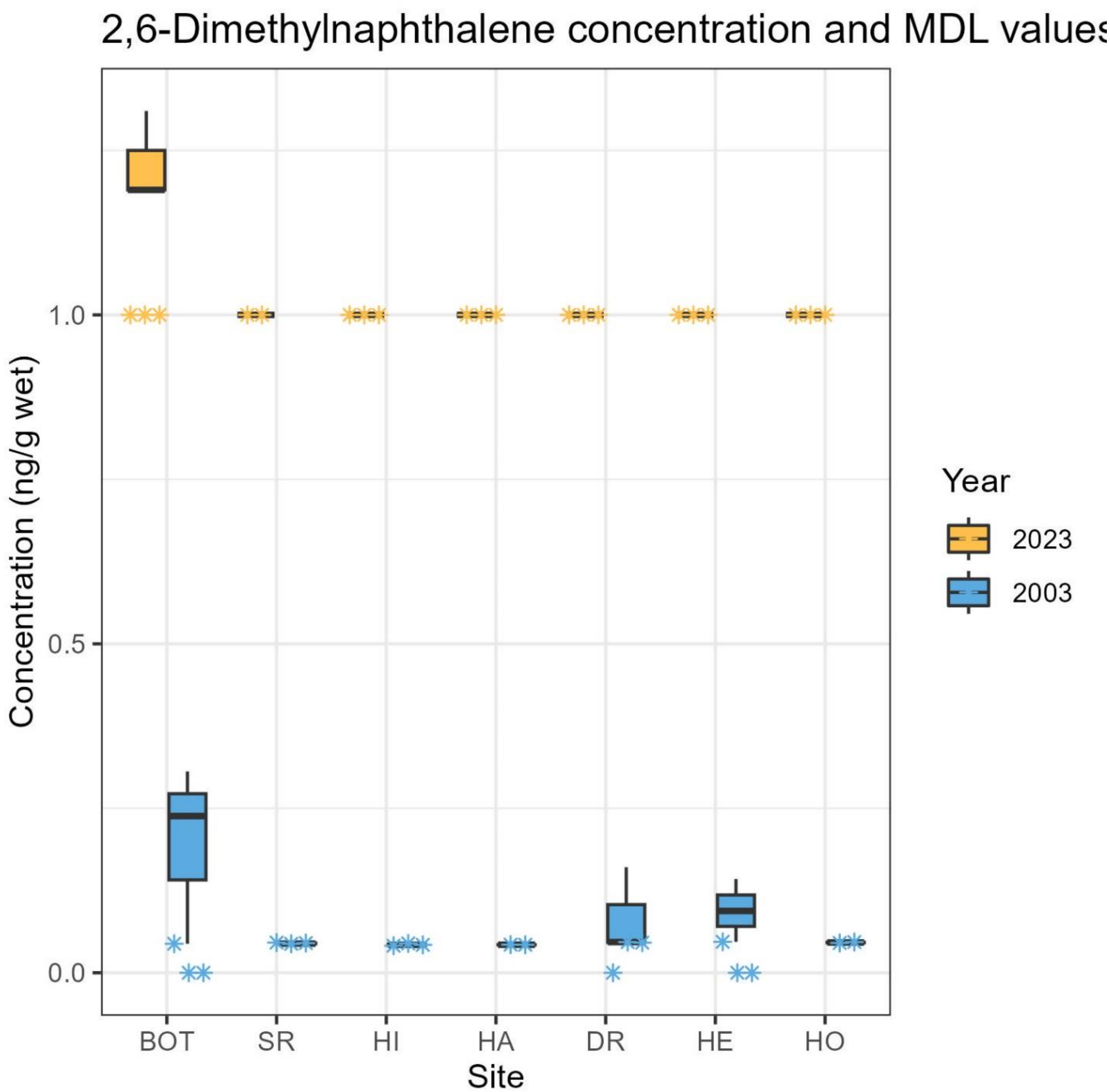


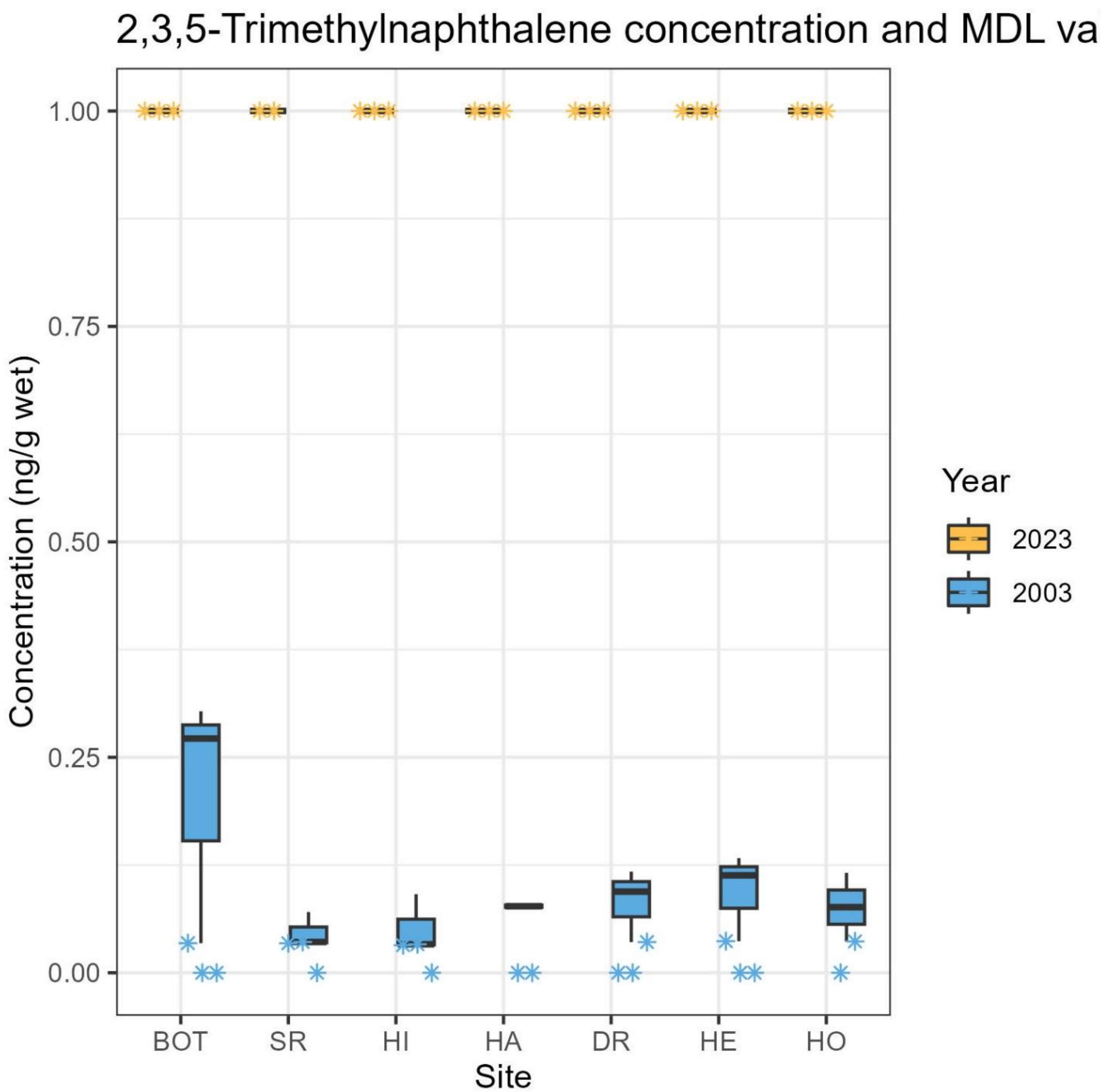

Anthracene concentration and MDL values
Concentration (ng/g wet)
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Acenaphthylene concentration and MDL values
Concentration (ng/g wet)
1.00
0.75
0.50
0.25
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

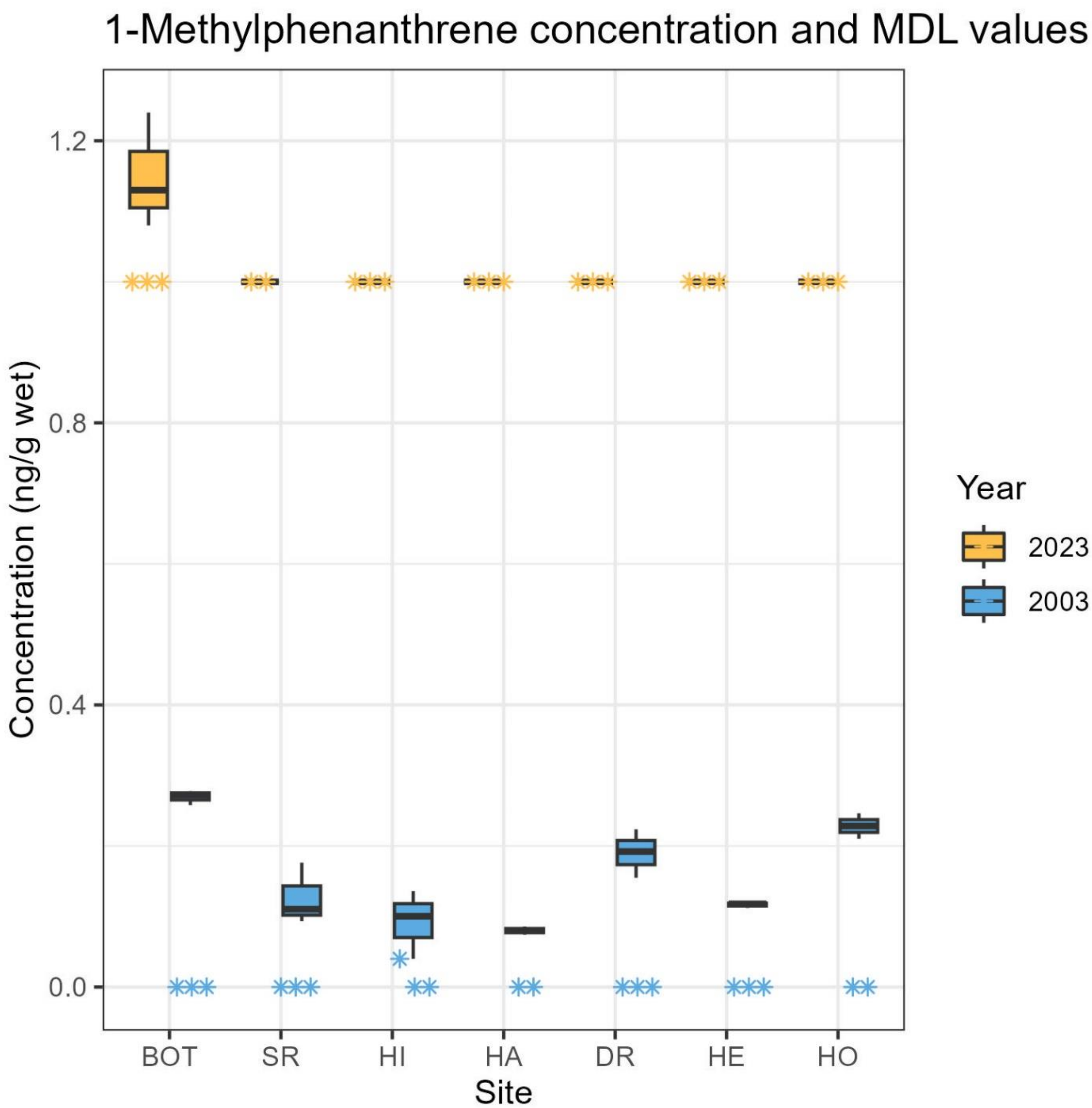

Acenaphthene concentration and MDL values
Concentration (ng/g wet)
4
3
2
1
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

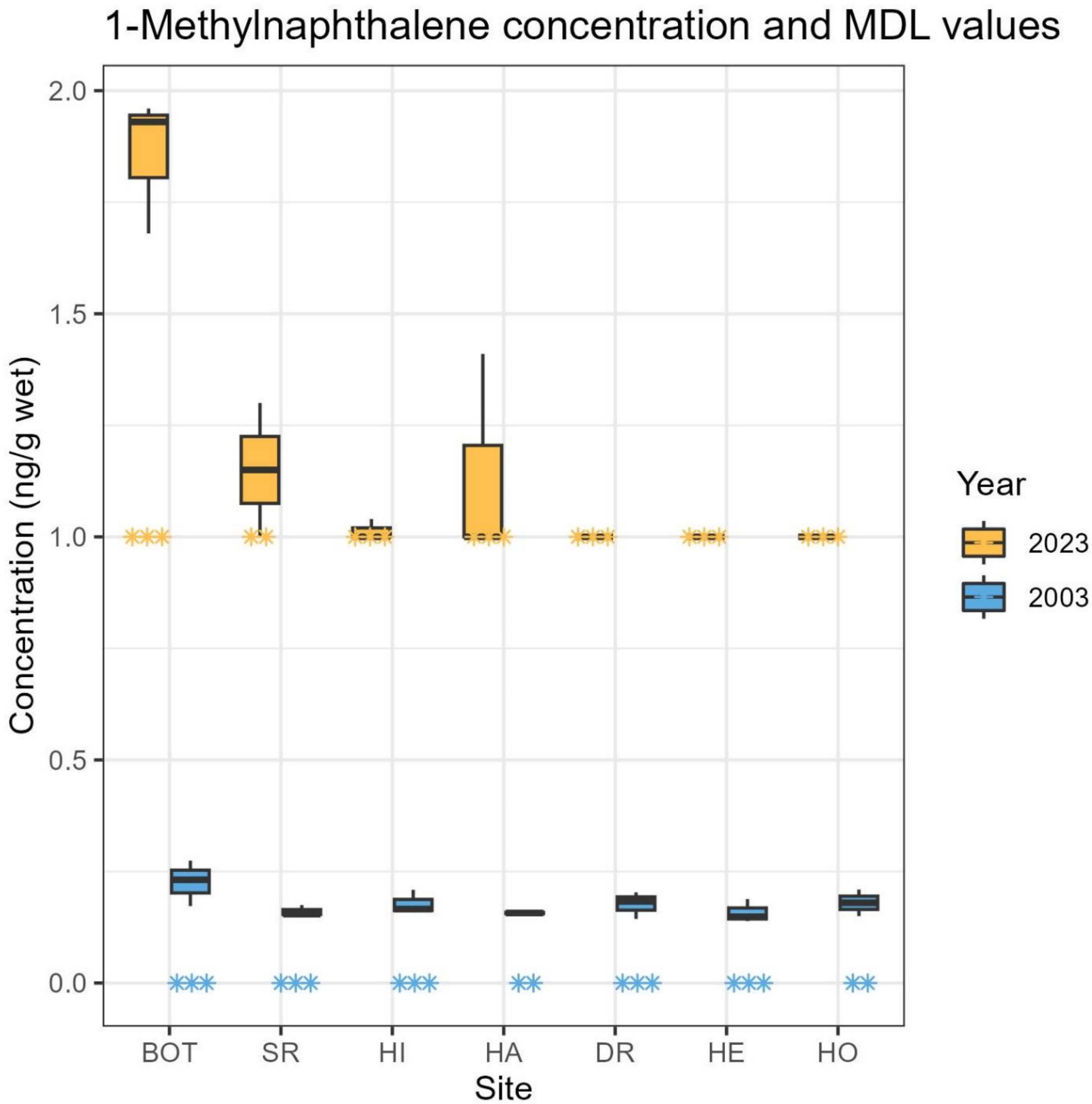

2-Methylnaphthalene concentration and MDL values
Concentration (ng/g wet)
3
2
1
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

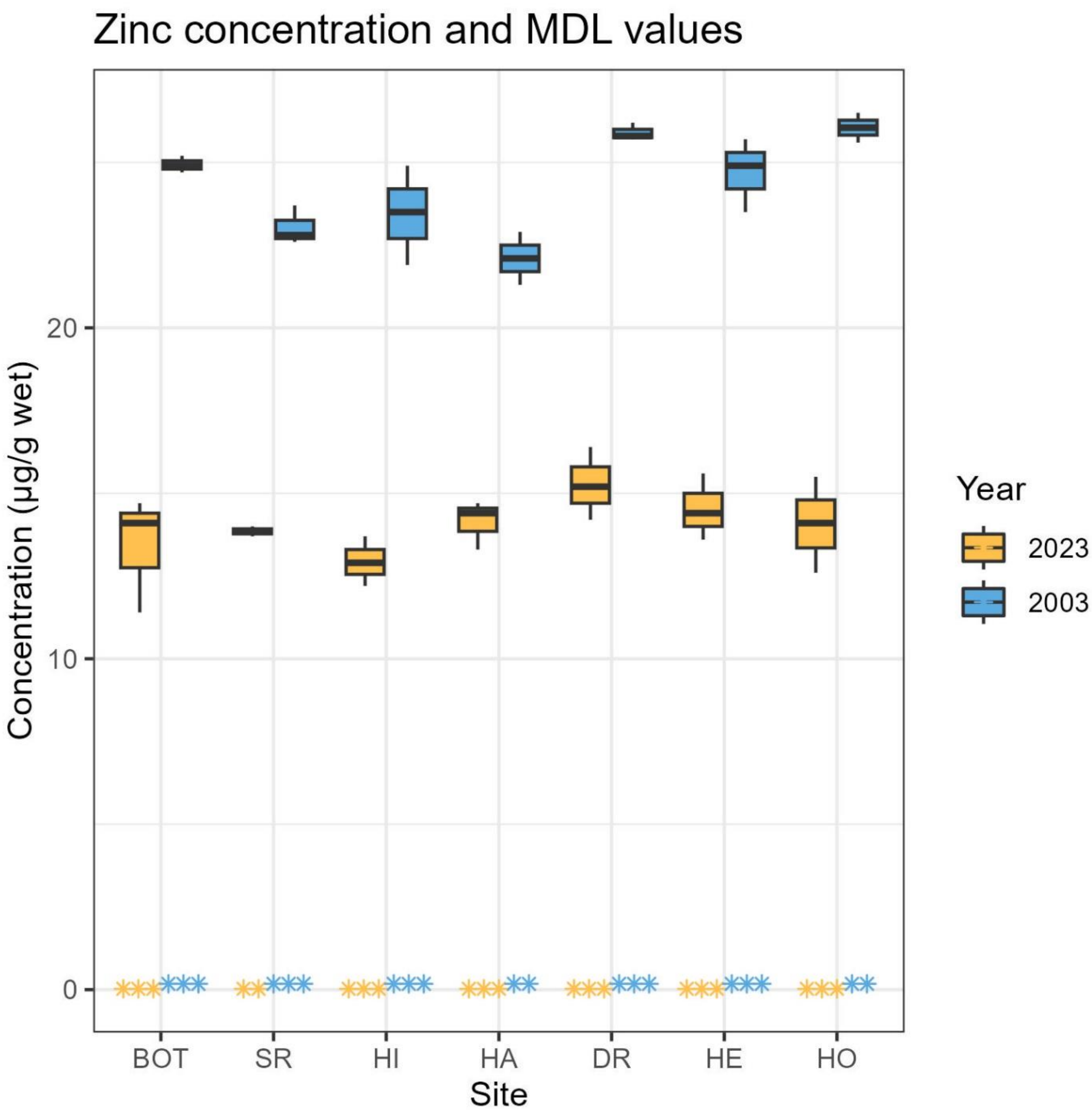

2,6-Dimethylnaphthalene concentration and MDL values
Concentration (ng/g wet)
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

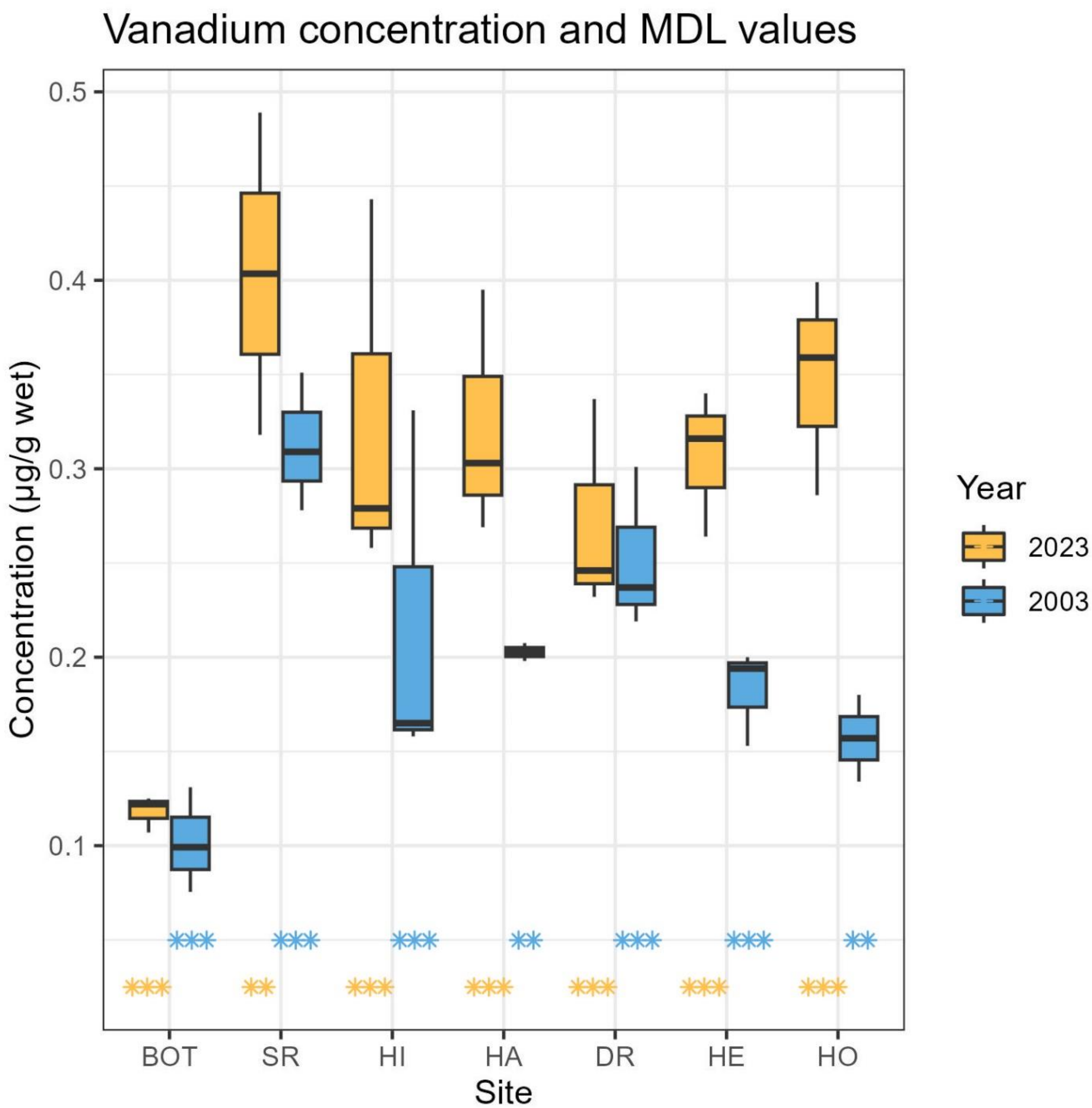


2,3,5-Trimethylnaphthalene concentration and MDL val
Concentration (ng/g wet)
1.00
0.75
0.50
0.25
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

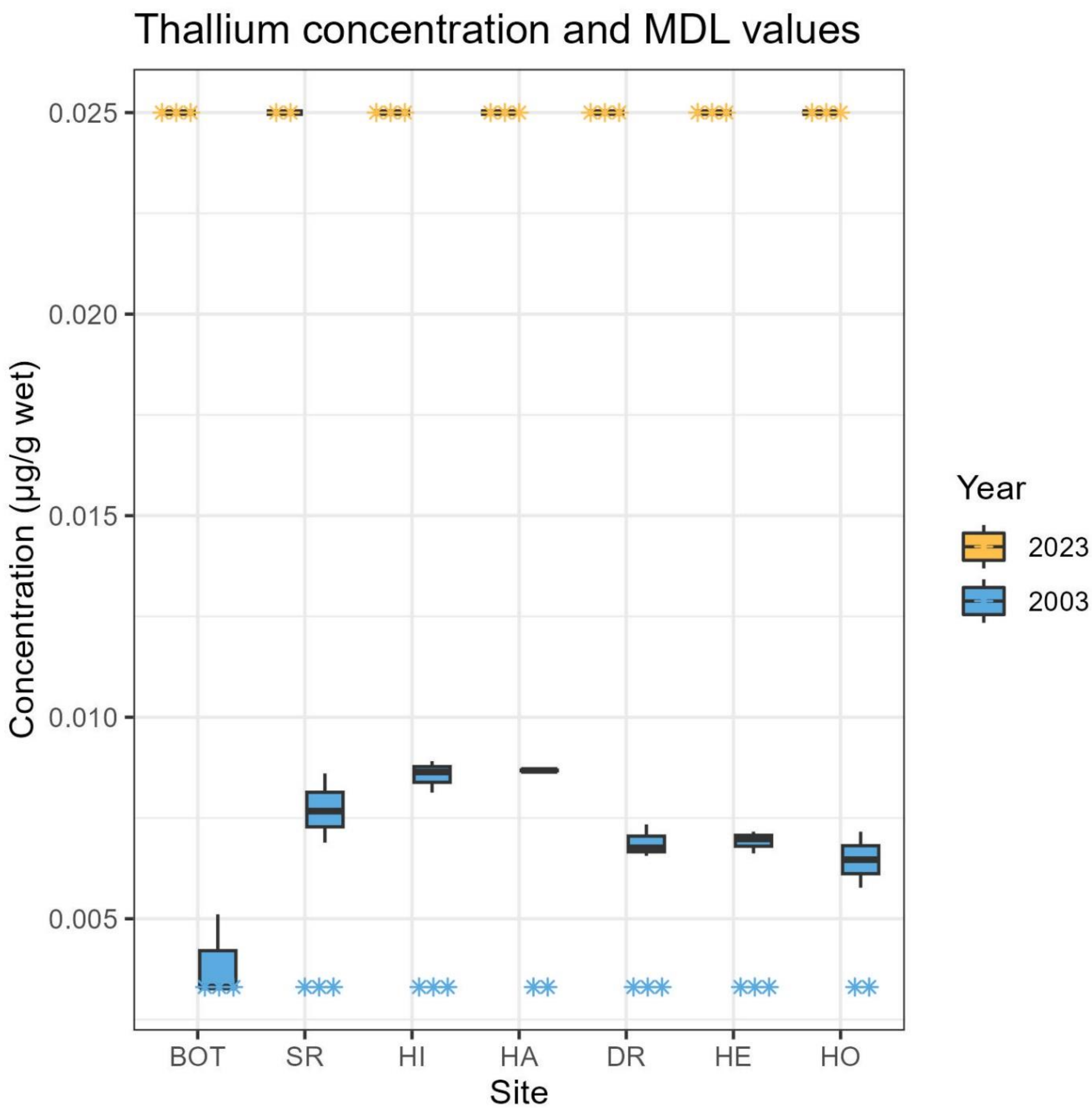

1-Methylphenanthrene concentration and MDL values
Concentration (ng/g wet)
1.2
0.8
0.4
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


1-Methylnaphthalene concentration and MDL values
Concentration (ng/g wet)
2.0
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

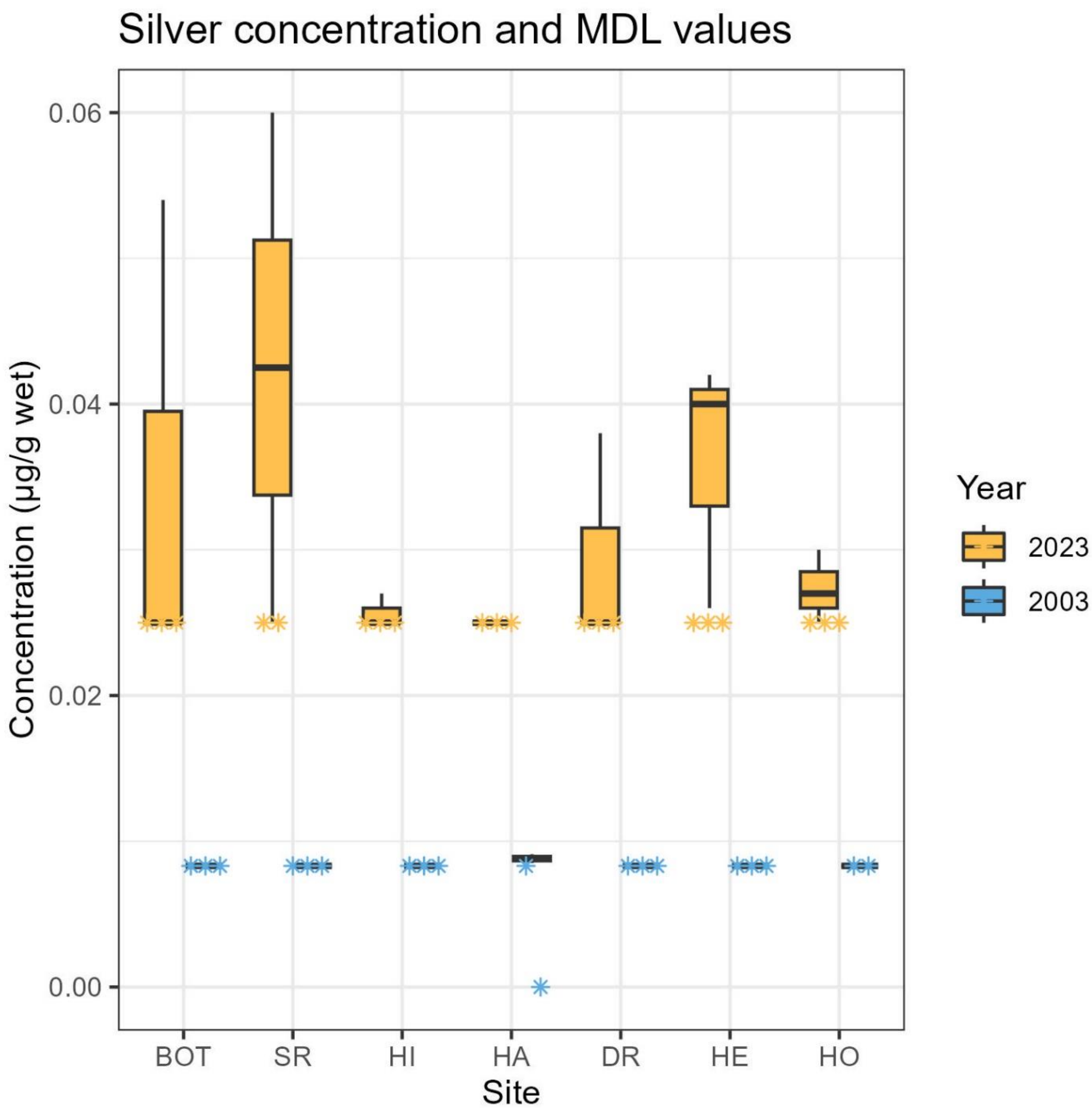

Zinc concentration and MDL values
Concentration (µg/g wet)
20
10
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

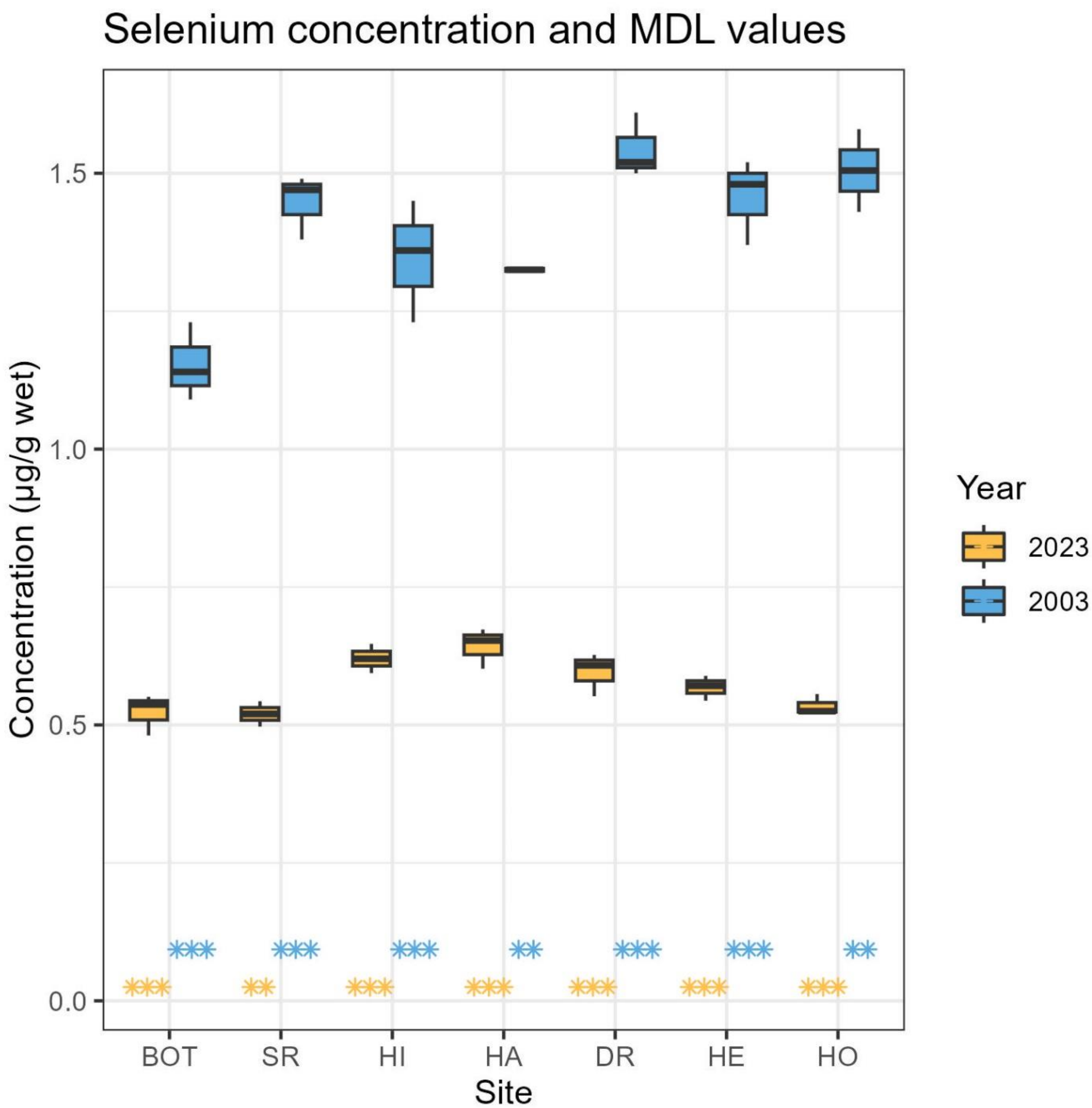


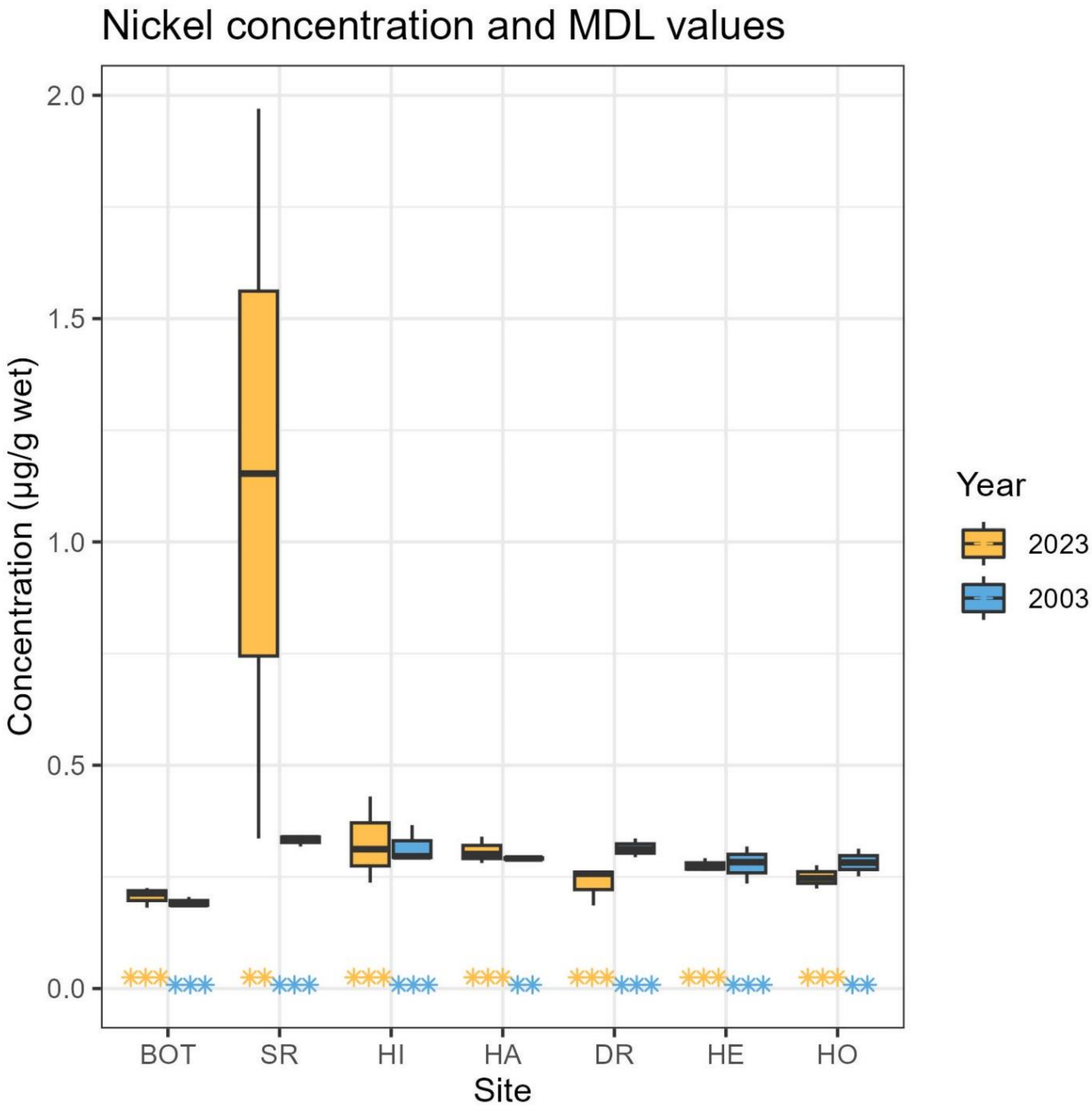
Vanadium concentration and MDL values
Concentration (µg/g wet)
0.5
0.4
0.3
0.2
0.1
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003



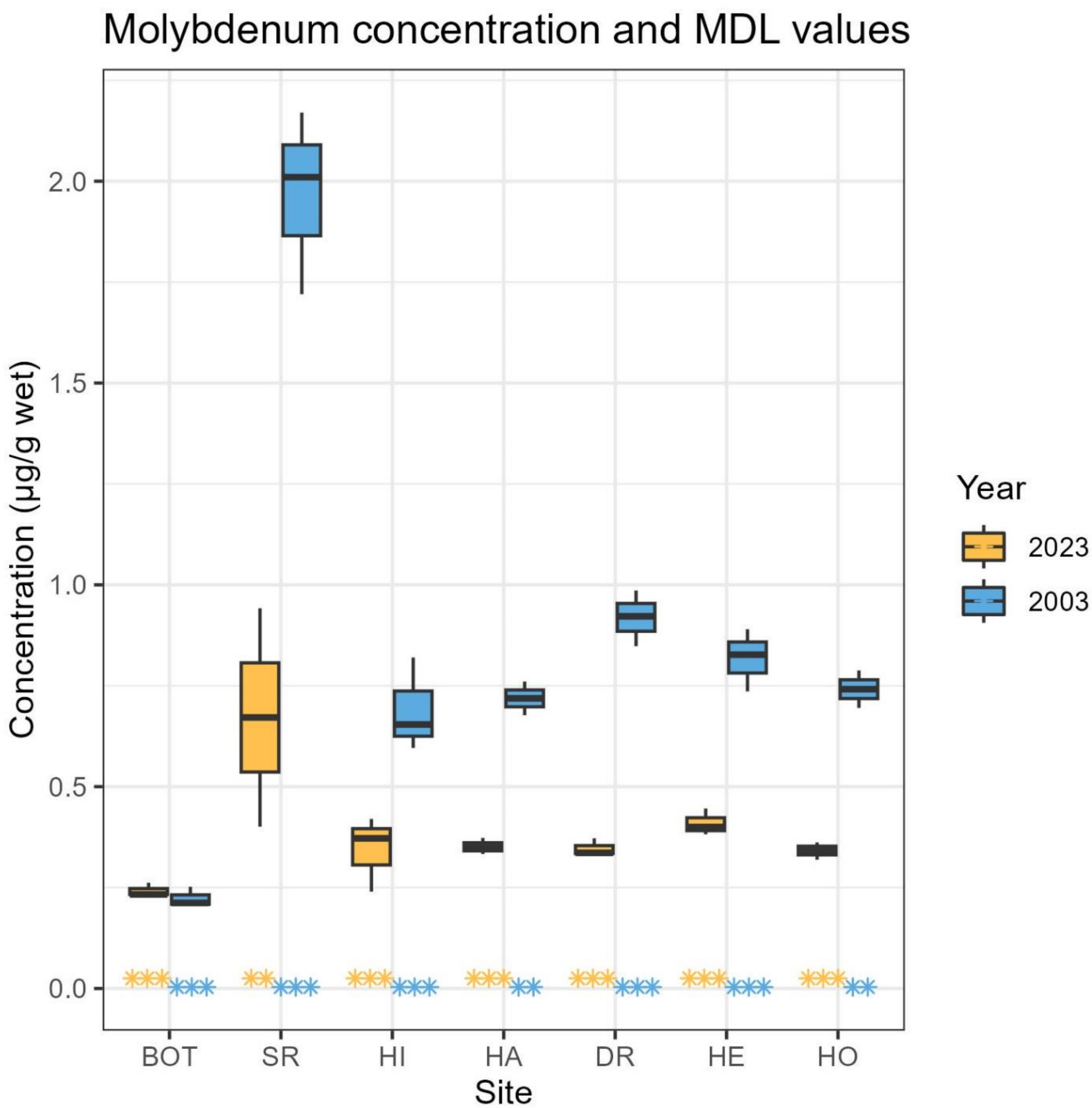
Thallium concentration and MDL values
Concentration (µg/g wet)
0.025
0.020
0.015
0.010
0.005
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

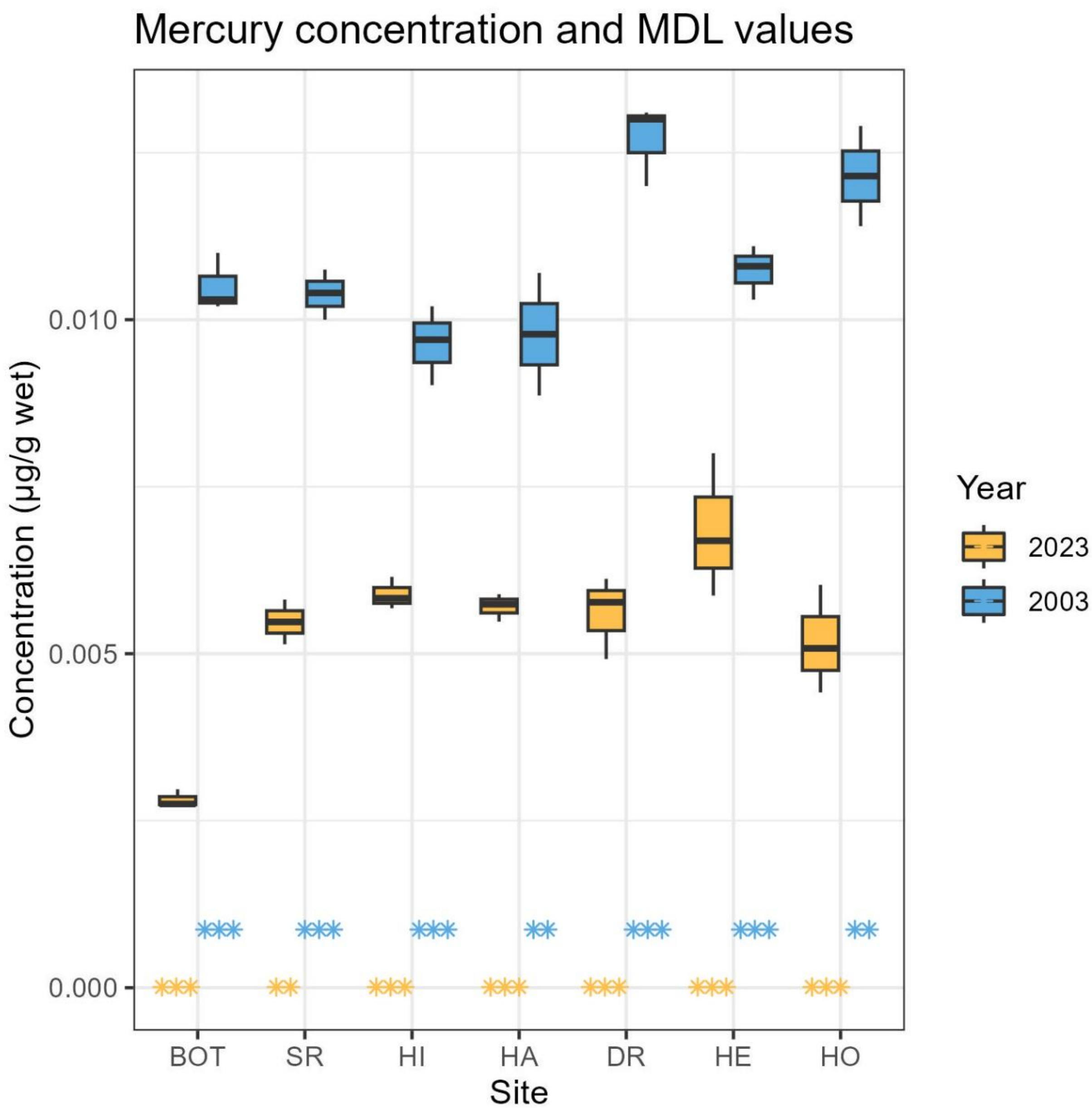

Silver concentration and MDL values
Concentration (µg/g wet)
0.06
0.04
0.02
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Selenium concentration and MDL values
Concentration (µg/g wet)
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

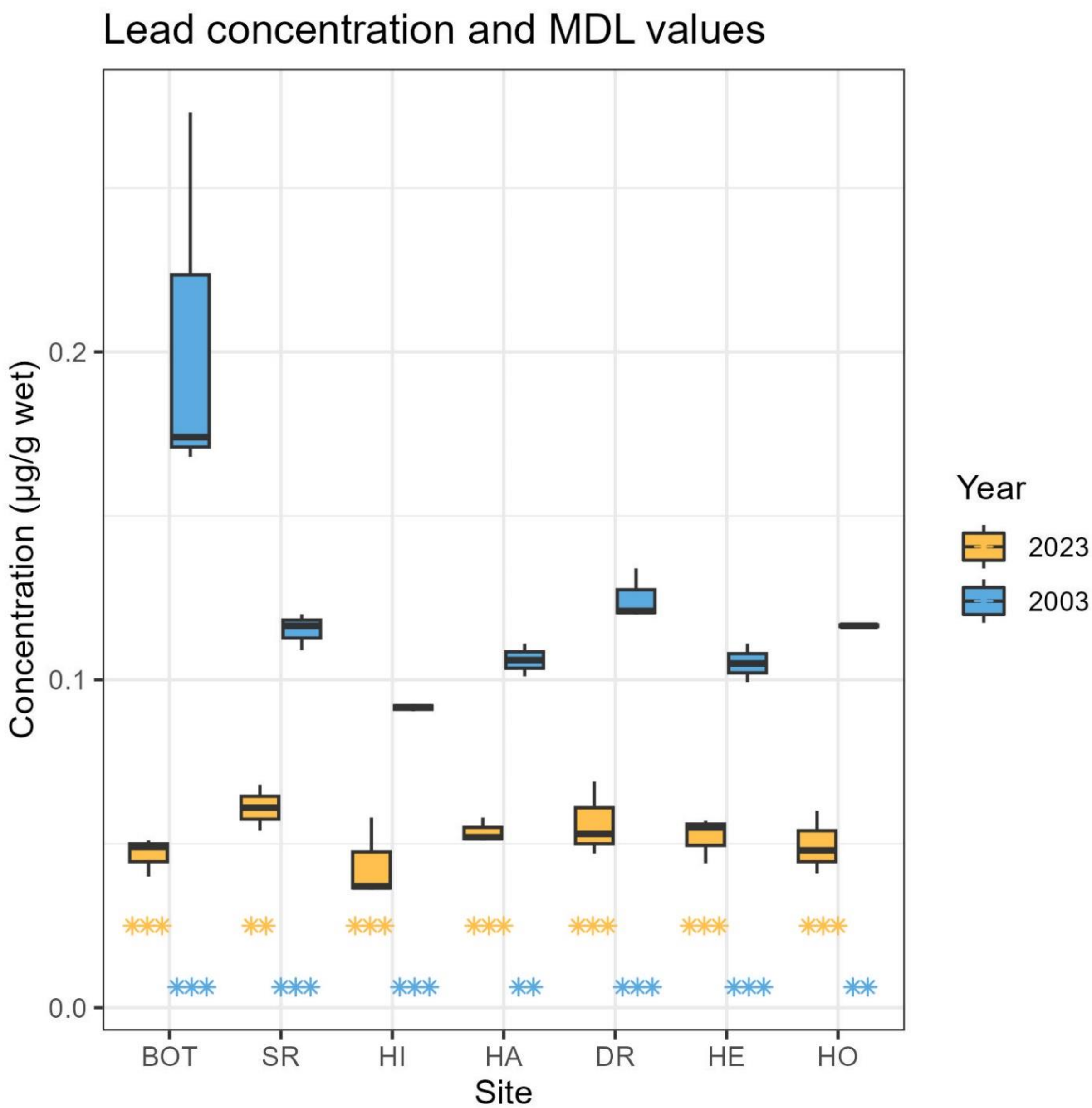


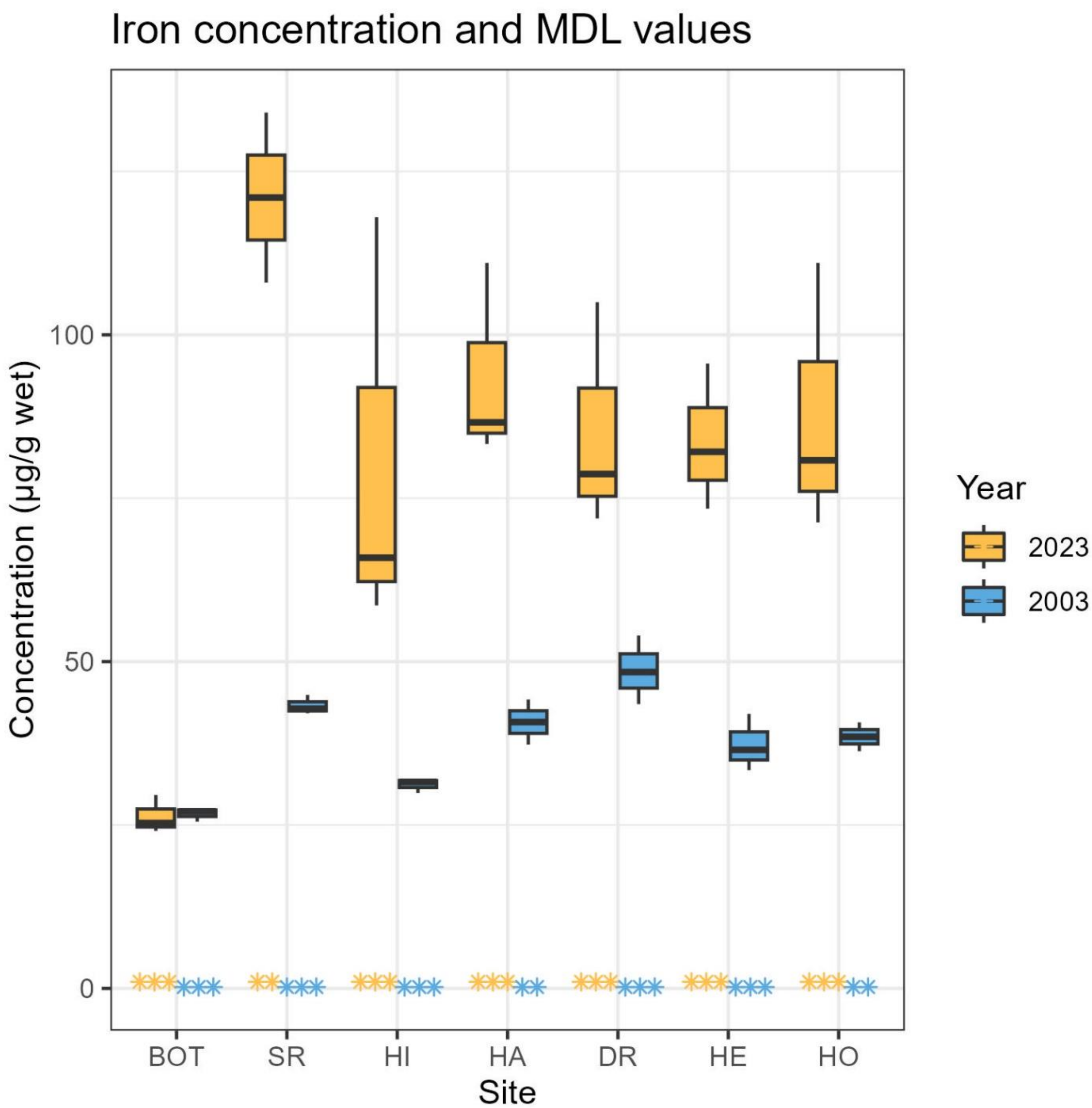
Nickel concentration and MDL values
Concentration (µg/g wet)
2.0
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

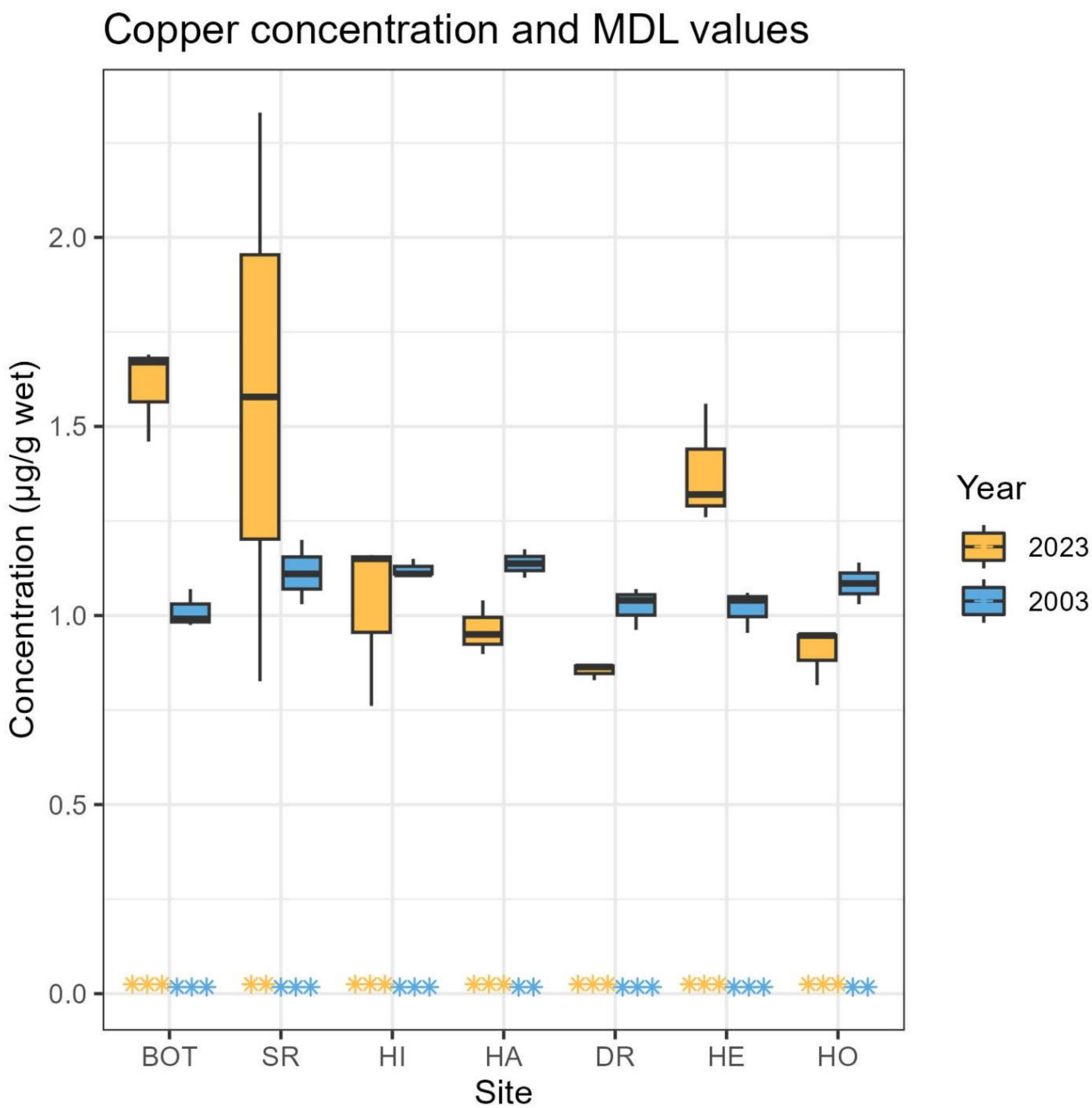

Molybdenum concentration and MDL values
Concentration (µg/g wet)
2.0
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

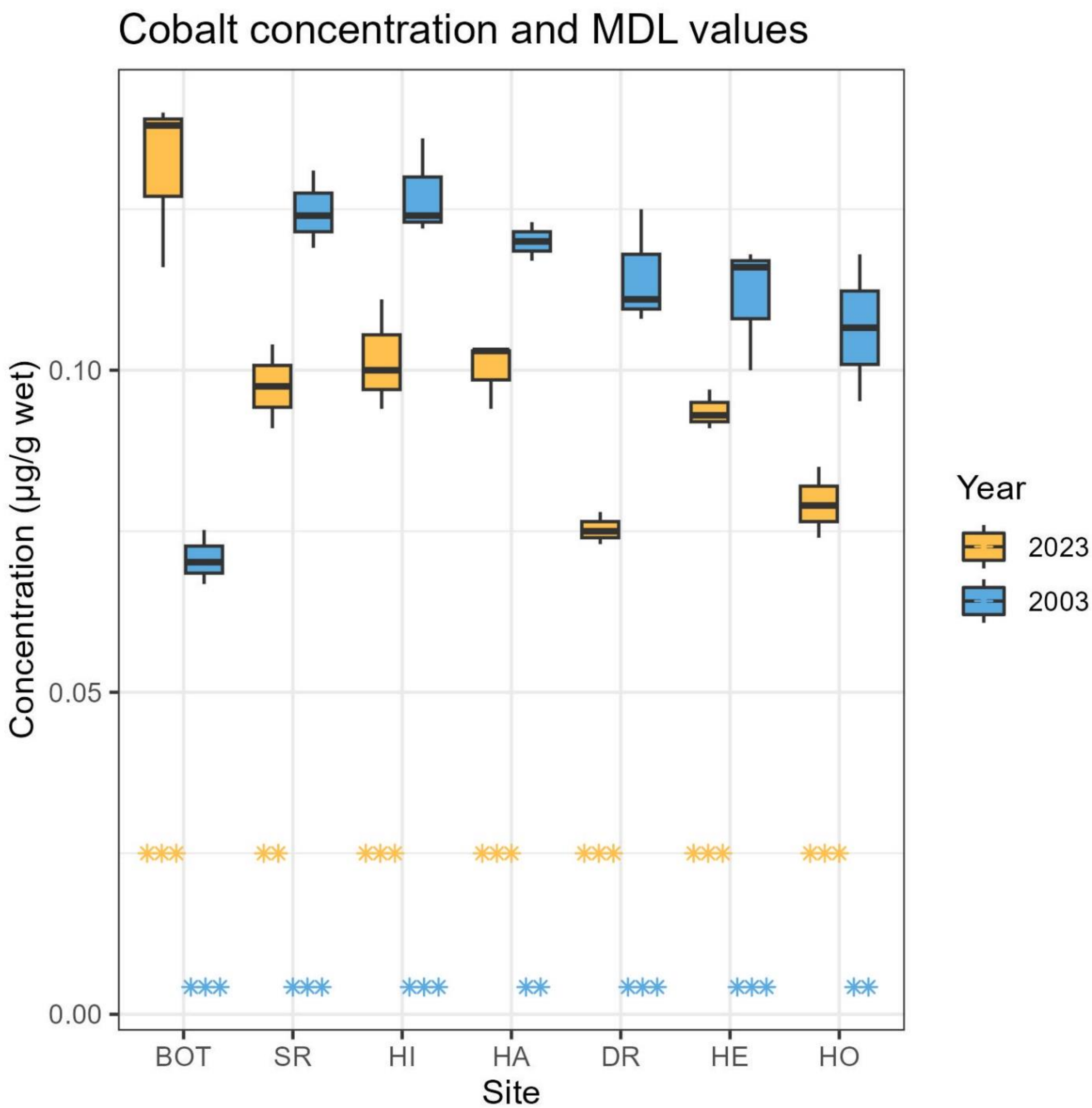


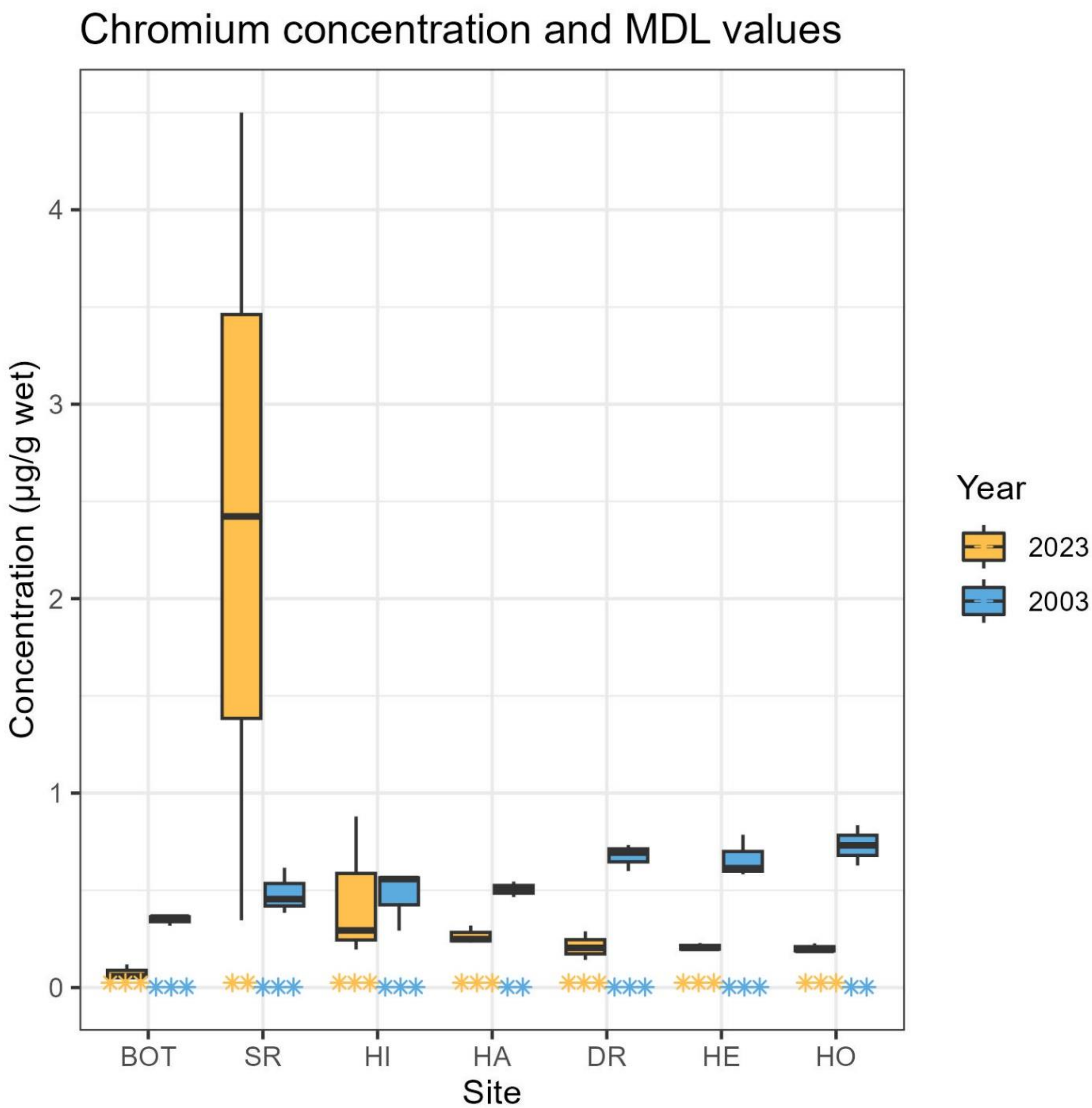
Mercury concentration and MDL values
Concentration (µg/g wet)
0.010
0.005
0.000
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Lead concentration and MDL values
Concentration (µg/g wet)
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

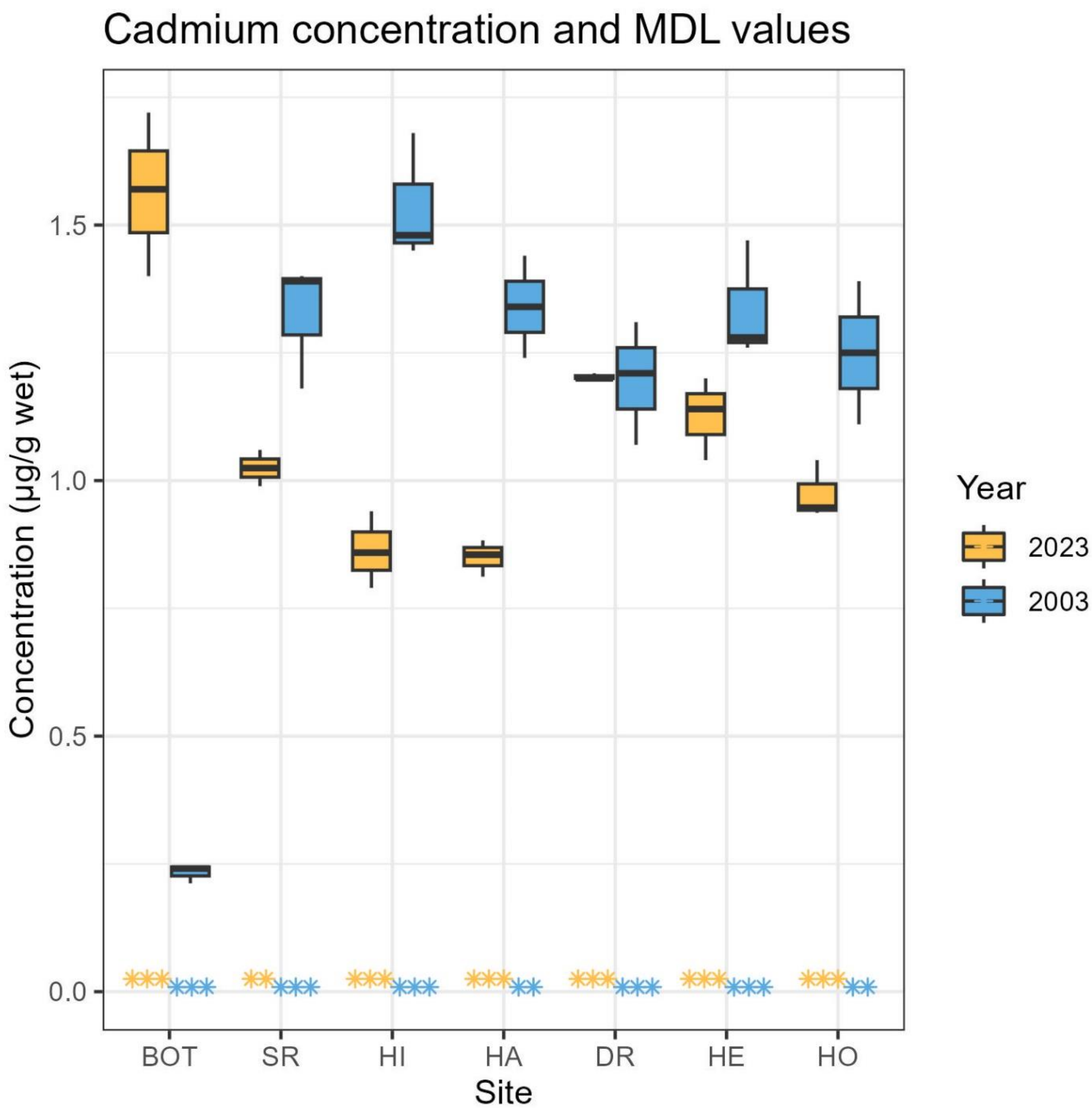

Iron concentration and MDL values
Concentration (µg/g wet)
100
50
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

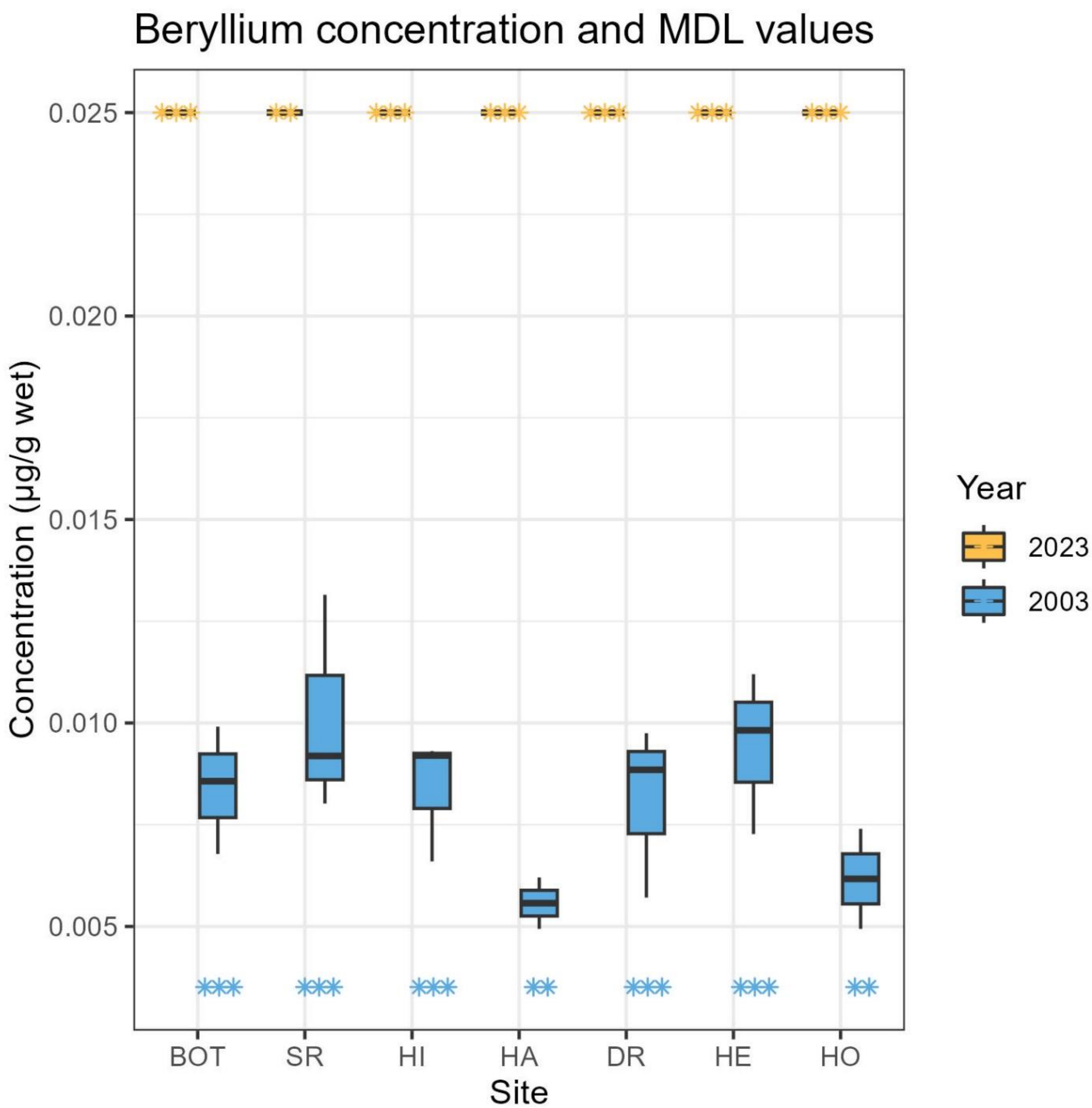

Copper concentration and MDL values
Concentration (µg/g wet)
2.0
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

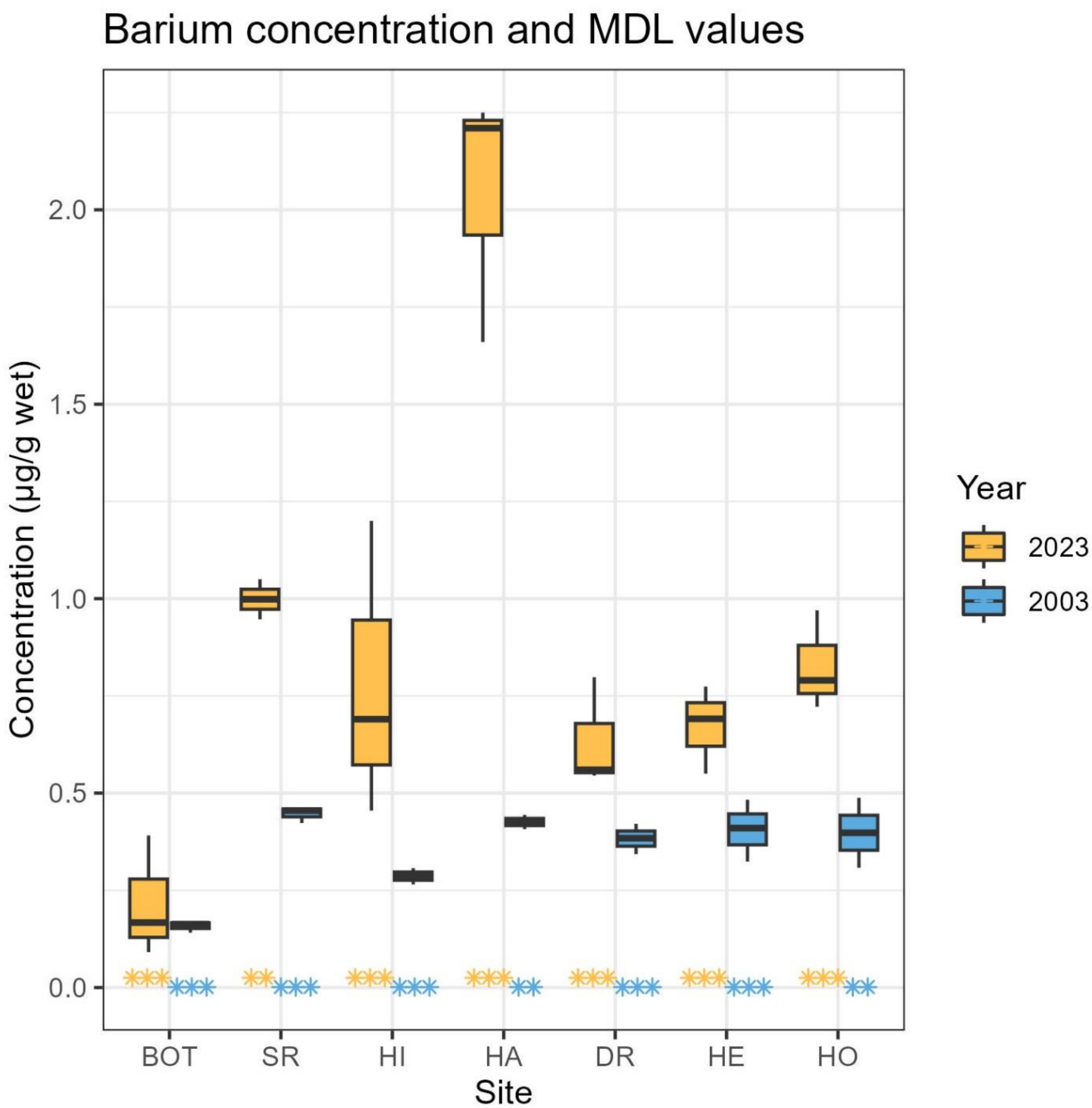

Cobalt concentration and MDL values
Concentration (µg/g wet)
0.10
0.05
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

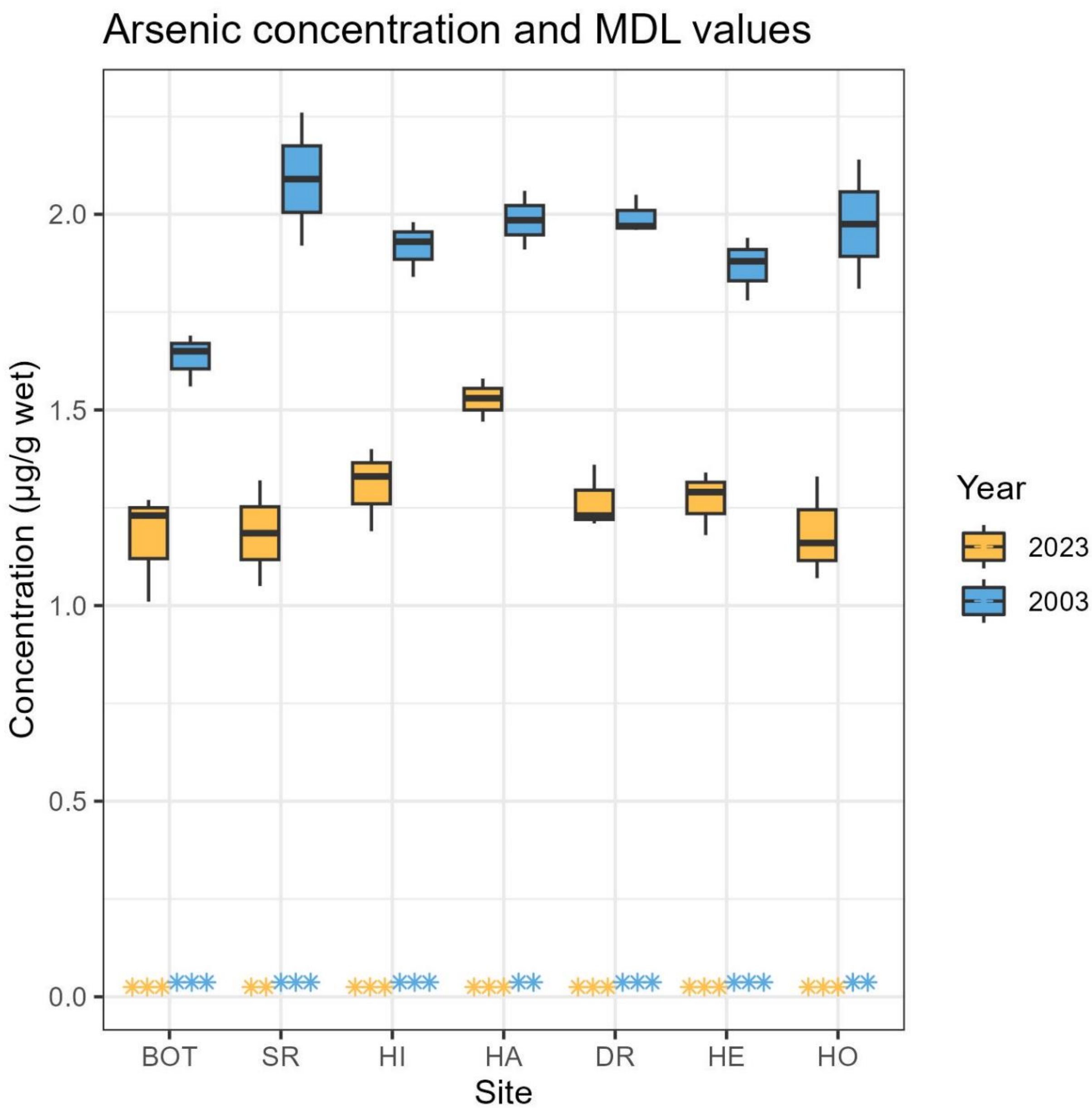


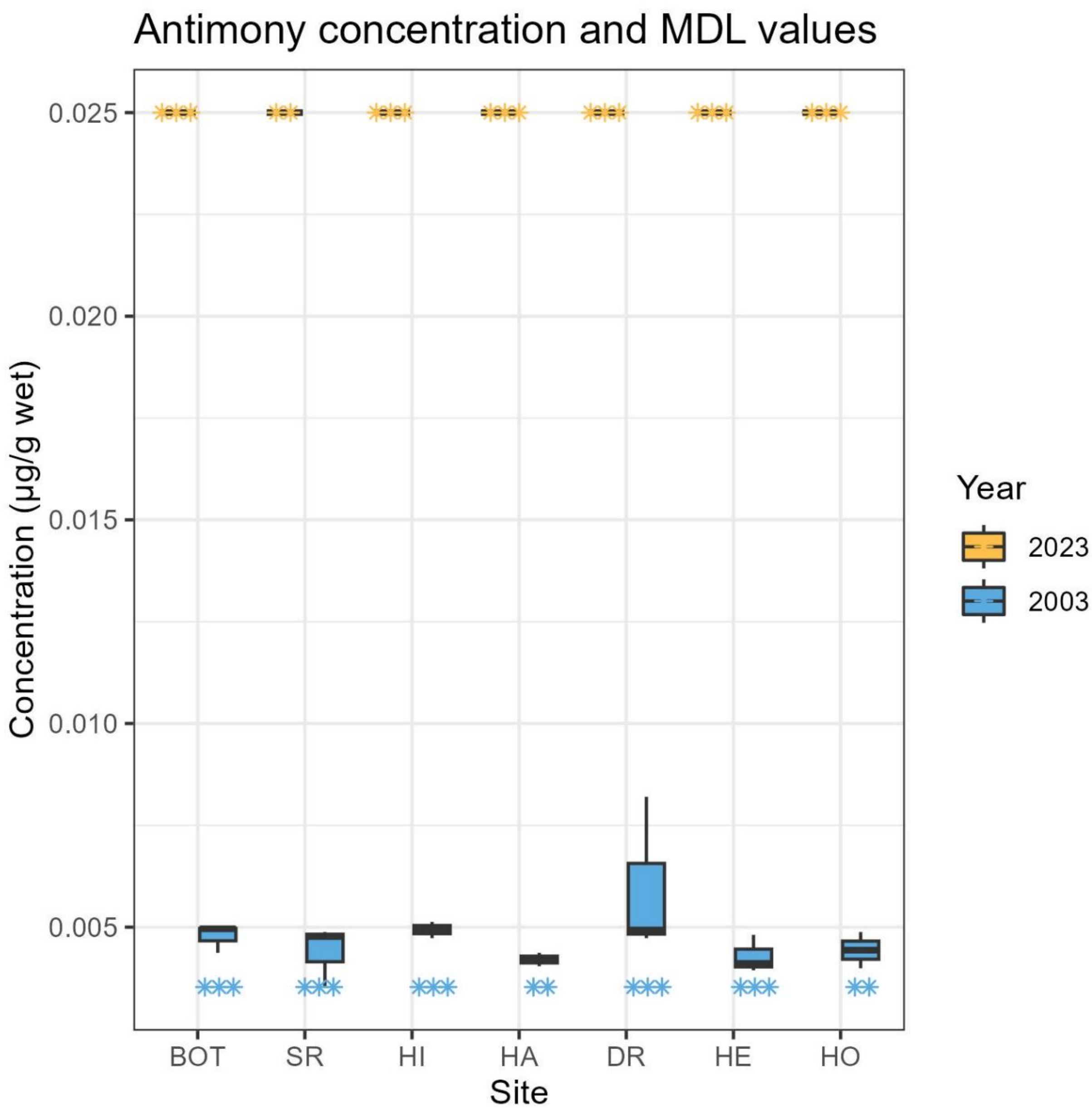
Chromium concentration and MDL values
Concentration (µg/g wet)
0
1
2
3
4
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

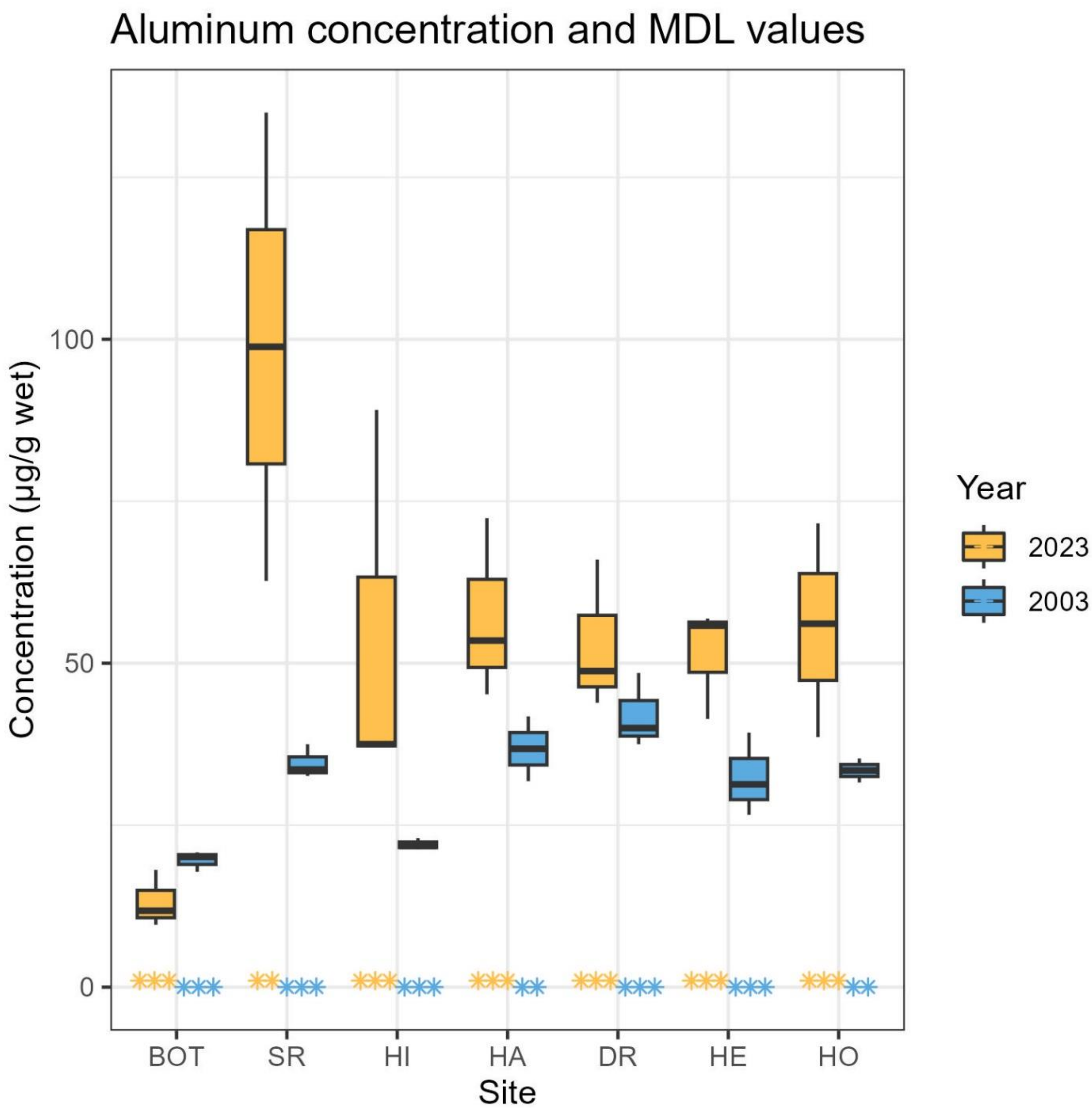

Cadmium concentration and MDL values
Concentration (µg/g wet)
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Beryllium concentration and MDL values
Concentration (µg/g wet)
0.025
0.020
0.015
0.010
0.005
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

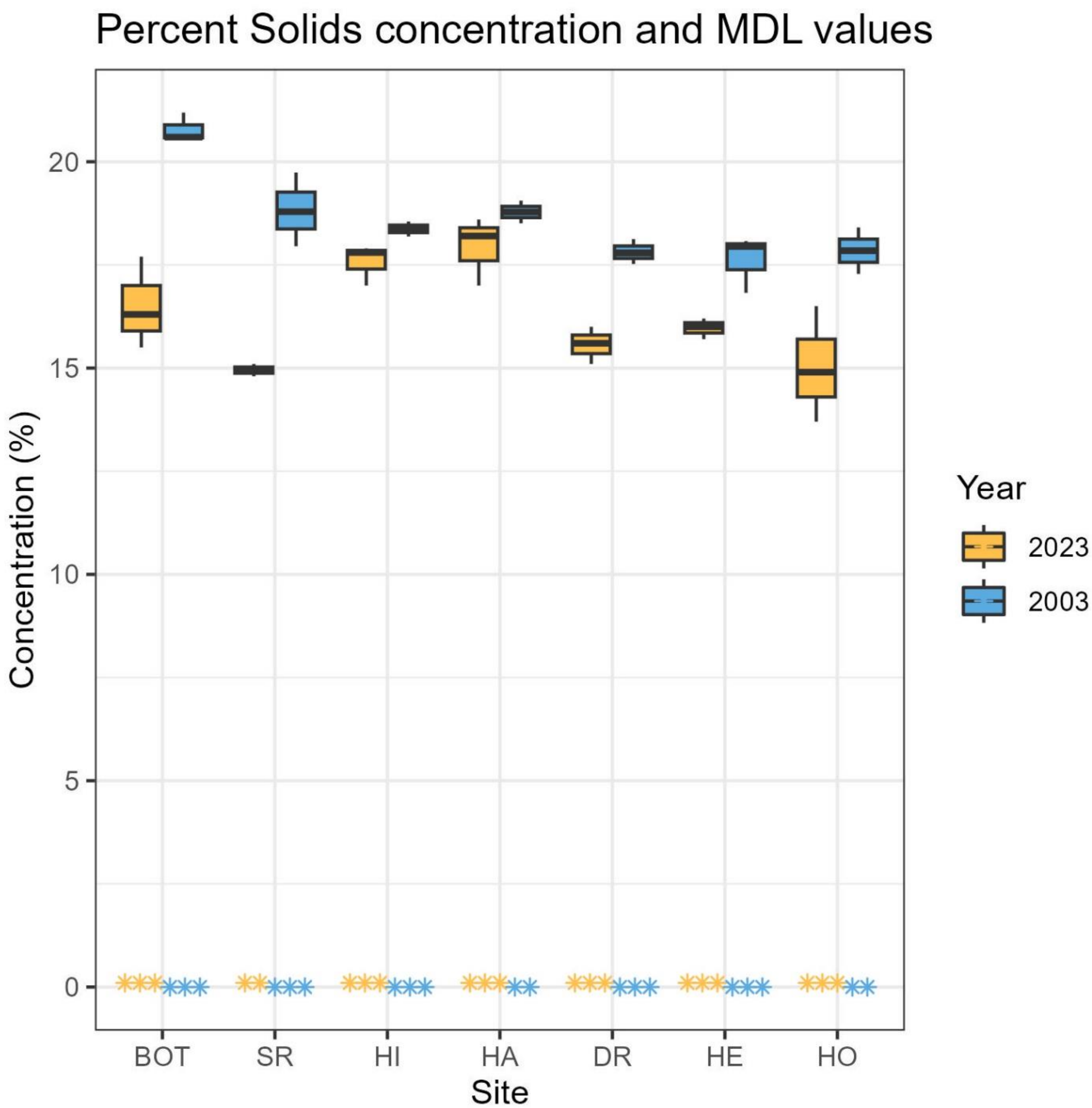

Barium concentration and MDL values
Concentration (µg/g wet)
2.0
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

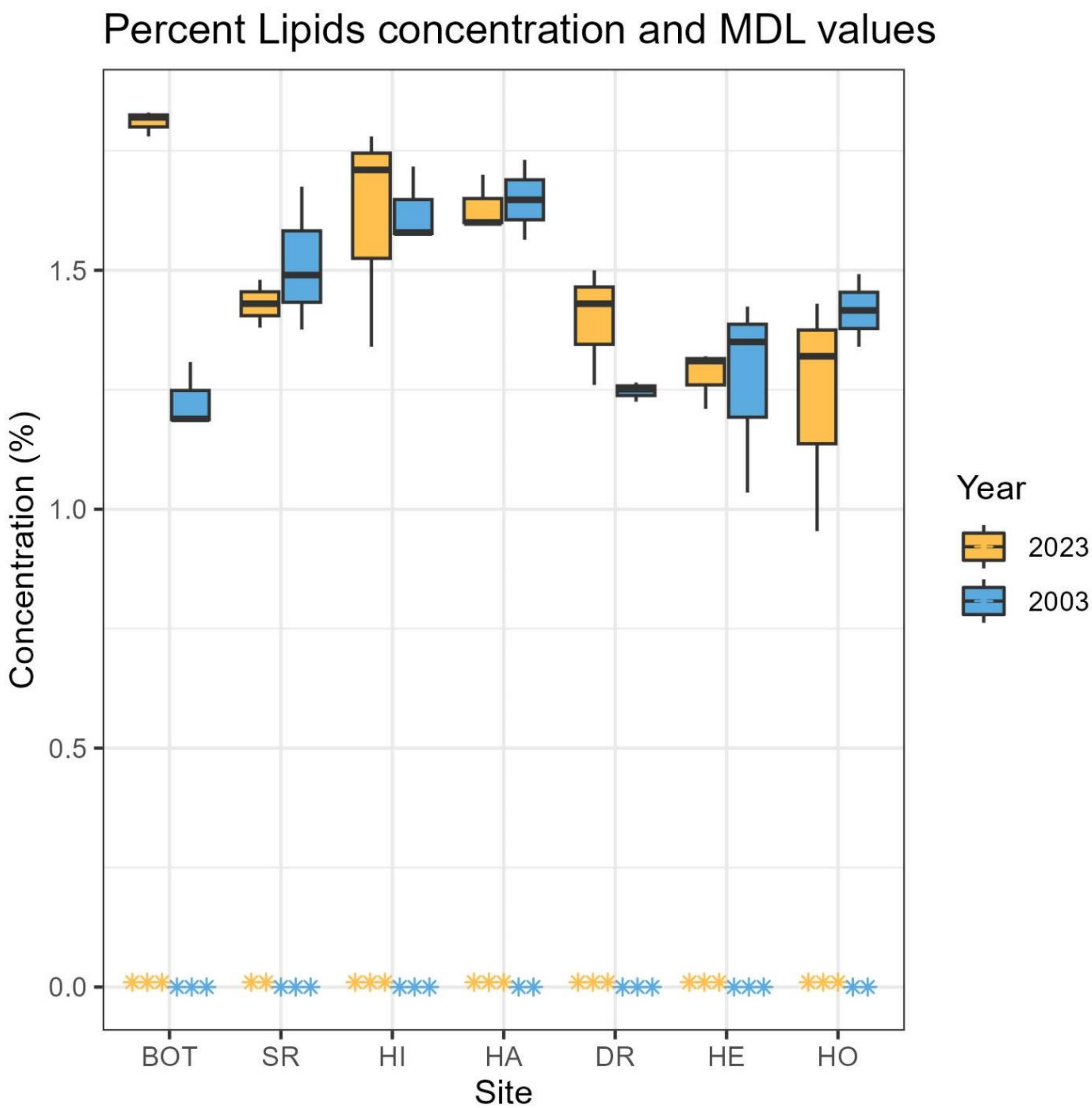

Arsenic concentration and MDL values
Concentration (µg/g wet)
2.0
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

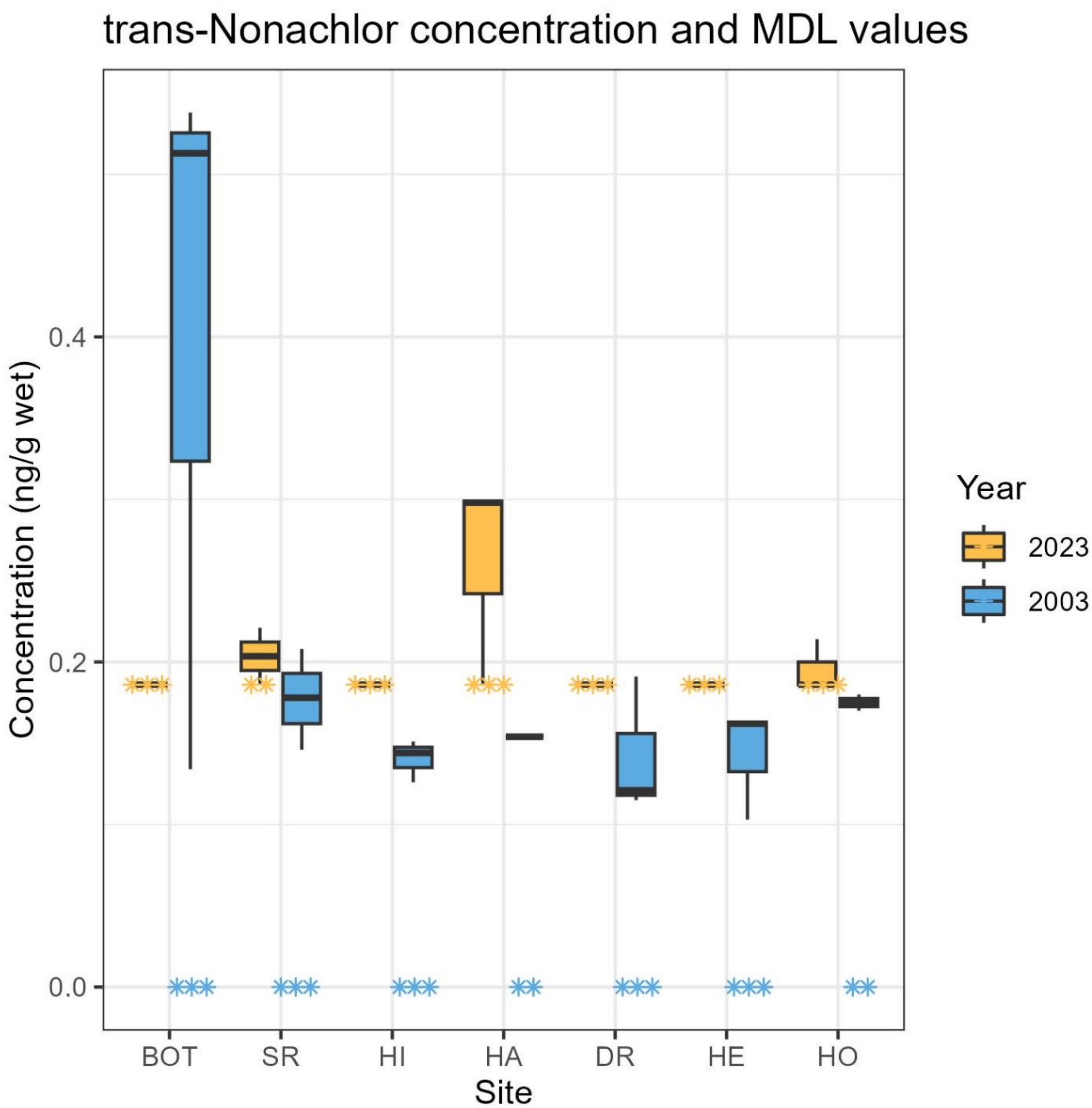

Antimony concentration and MDL values
Concentration (µg/g wet)
0.025
0.020
0.015
0.010
0.005
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

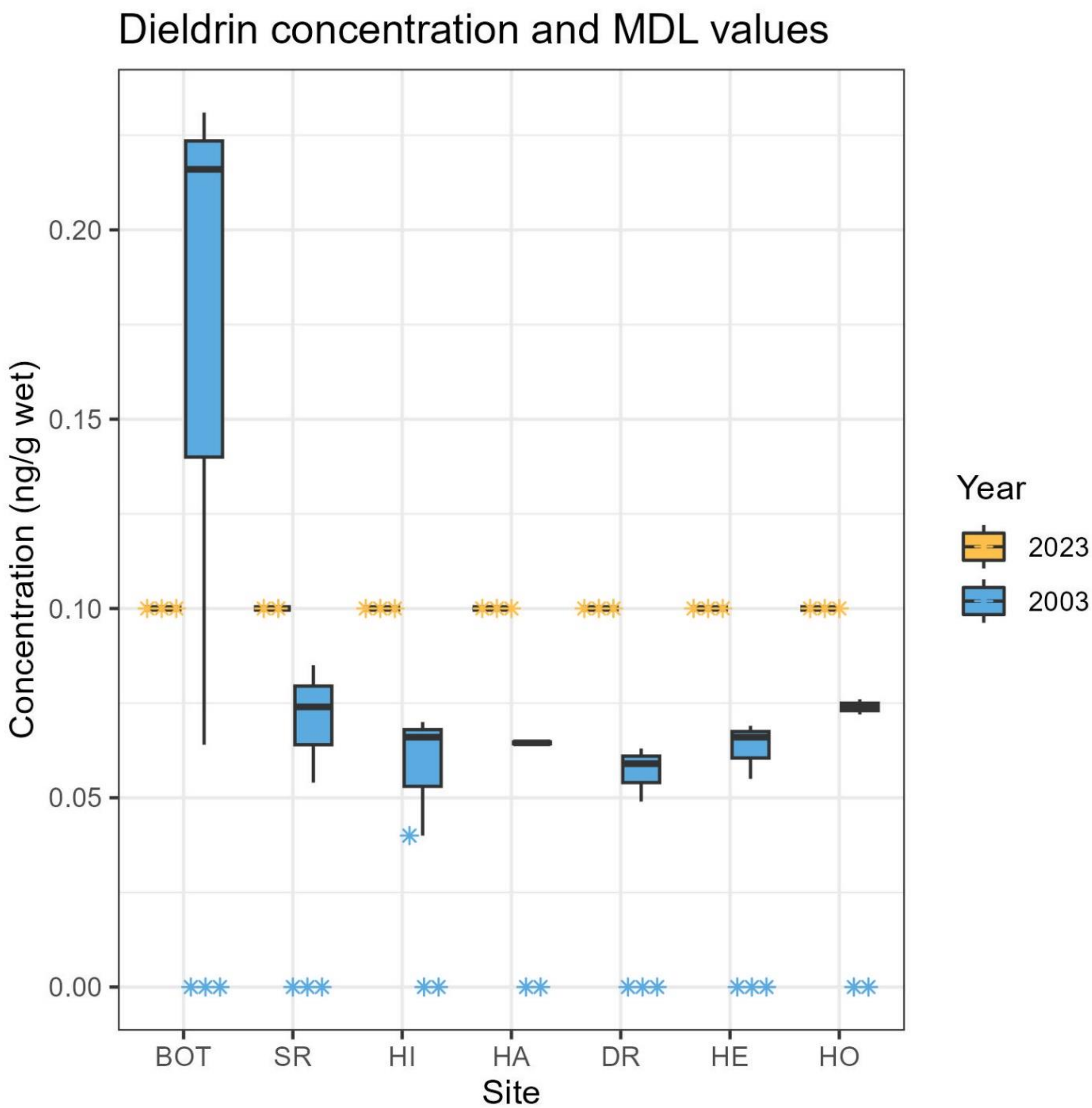


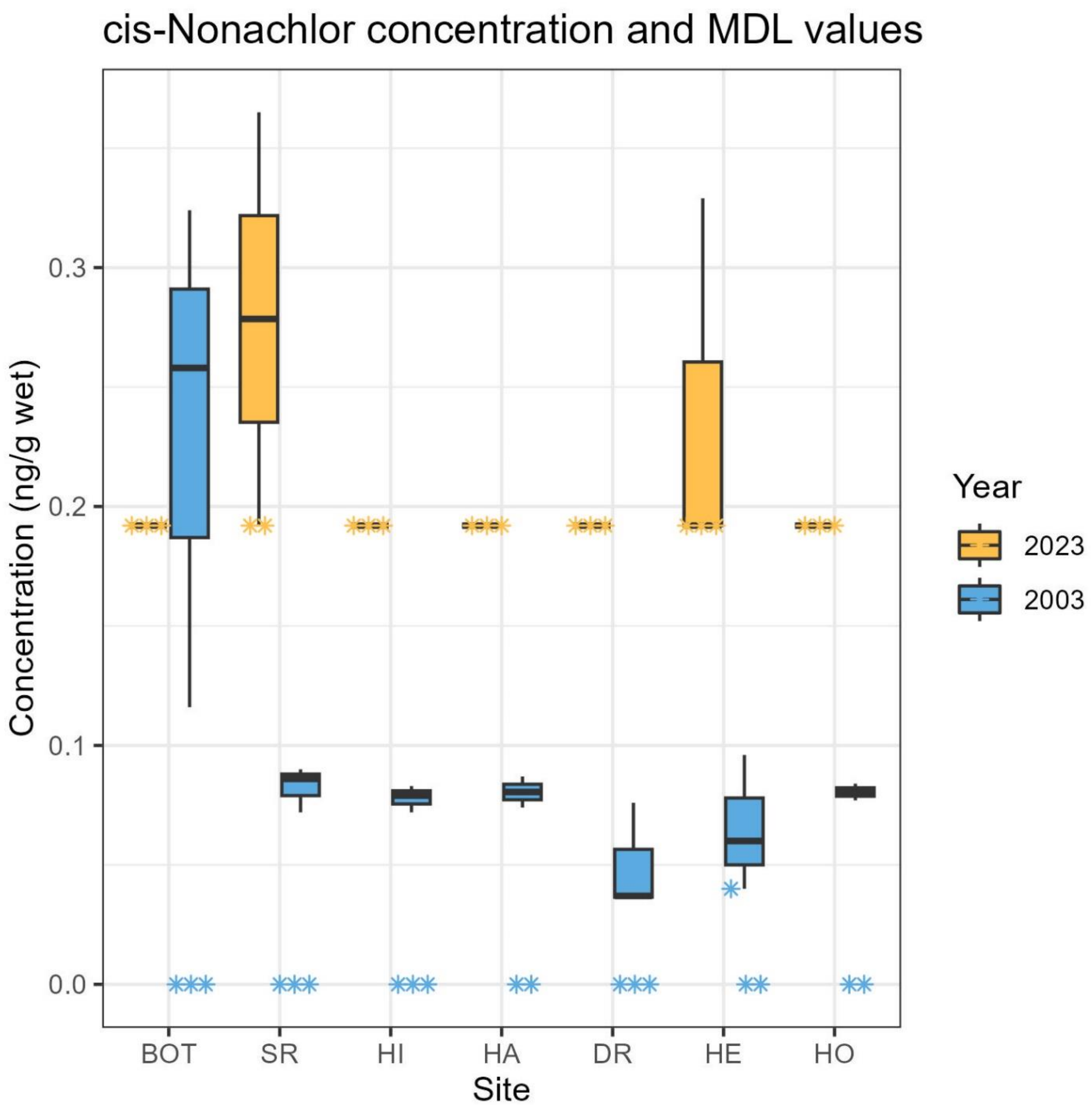
Aluminum concentration and MDL values
Concentration (µg/g wet)
100
50
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

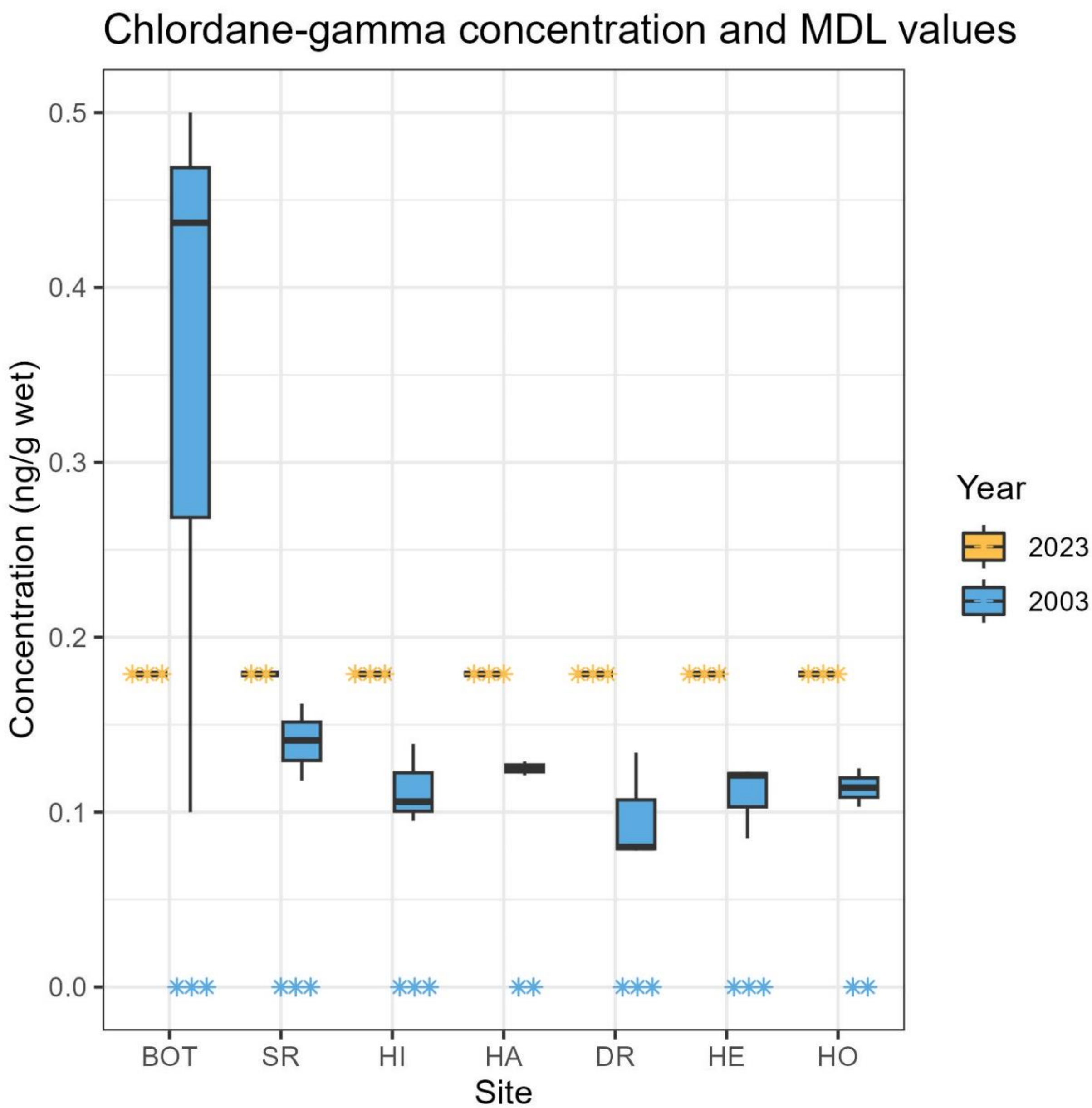

Percent Solids concentration and MDL values
Concentration (%)
20
15
10
5
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

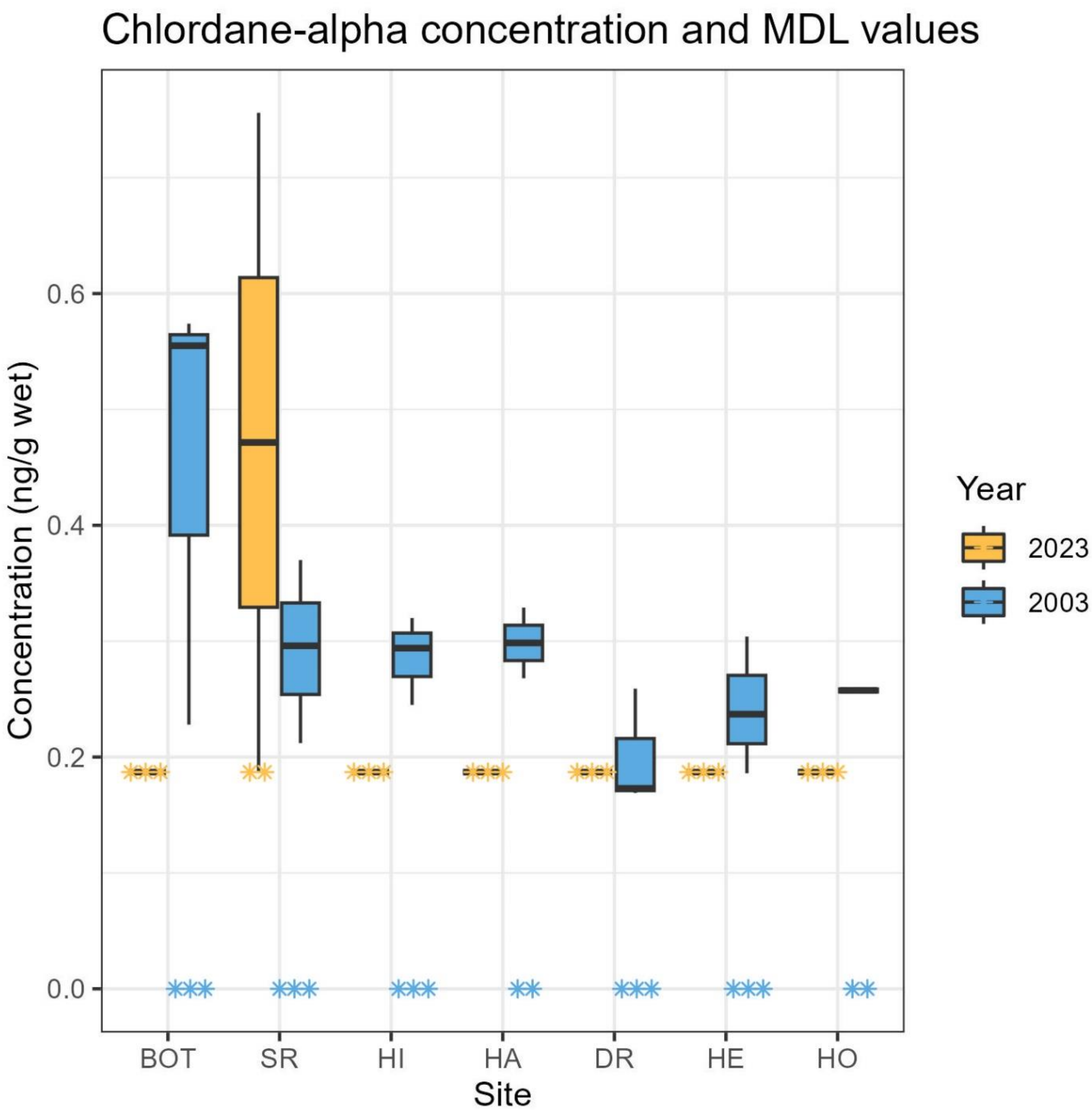

Percent Lipids concentration and MDL values
Concentration (%)
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

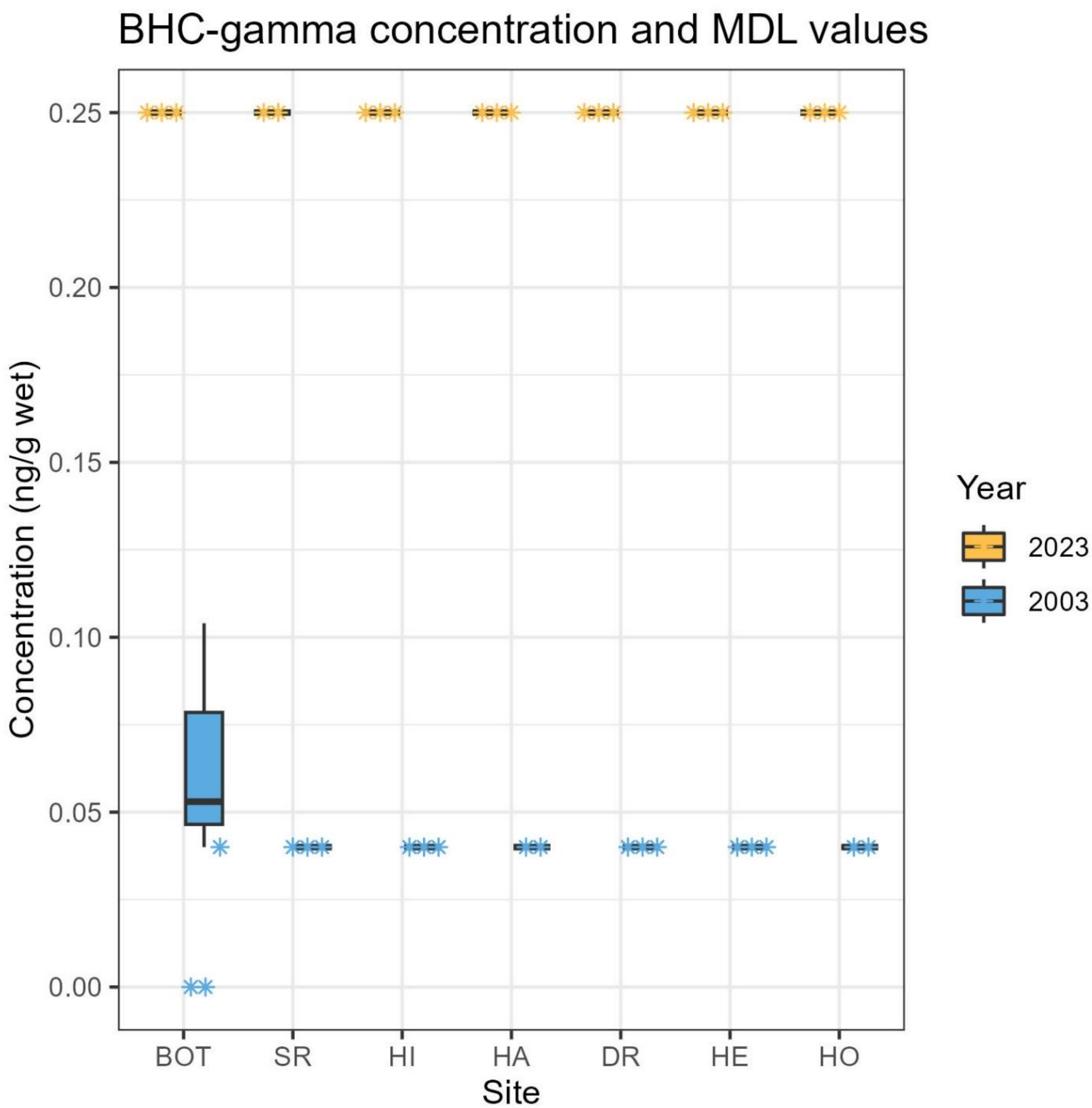

trans-Nonachlor concentration and MDL values
Concentration (ng/g wet)
0.4
0.2
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

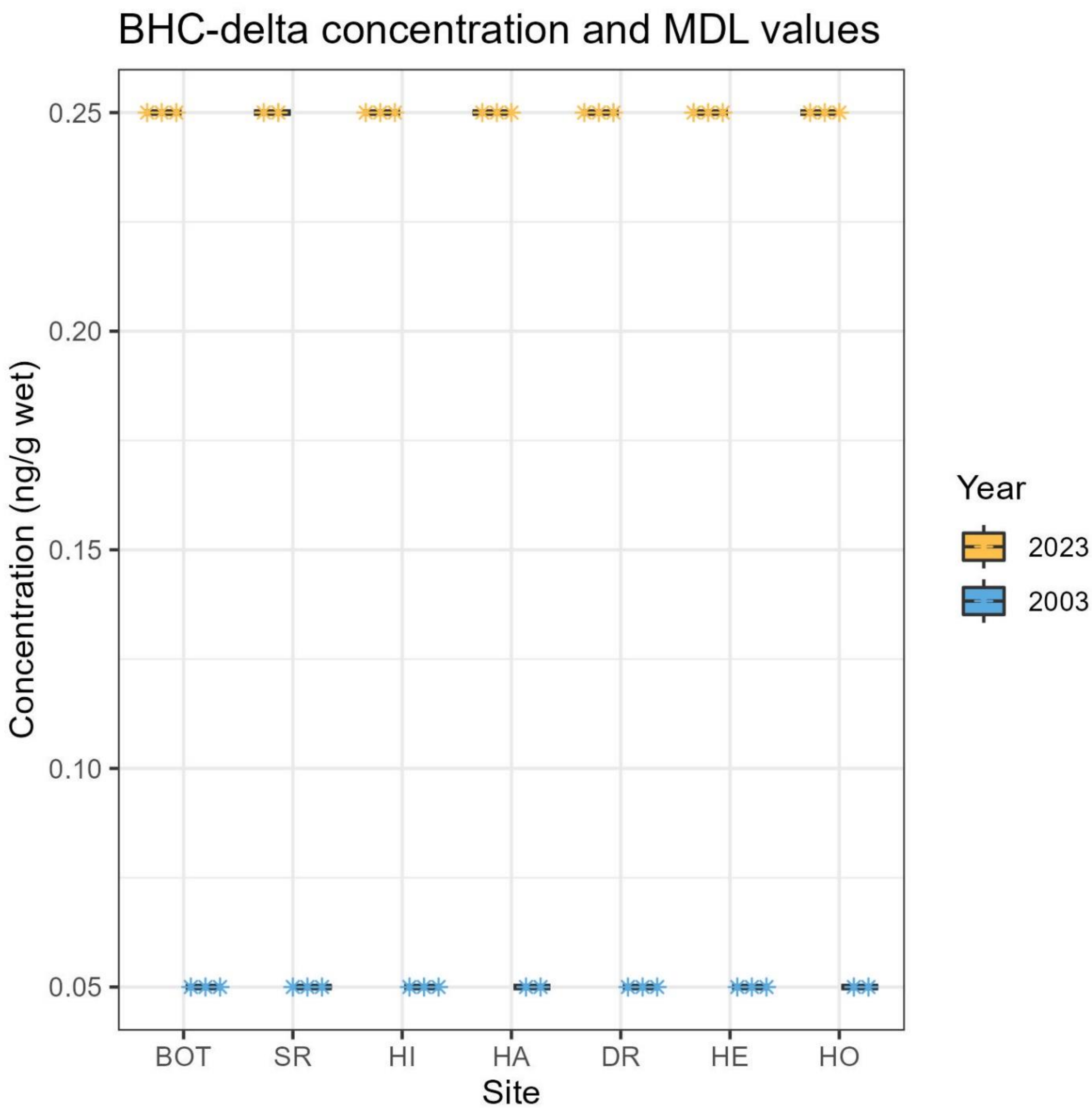

Dieldrin concentration and MDL values
Concentration (ng/g wet)
0.20
0.15
0.10
0.05
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

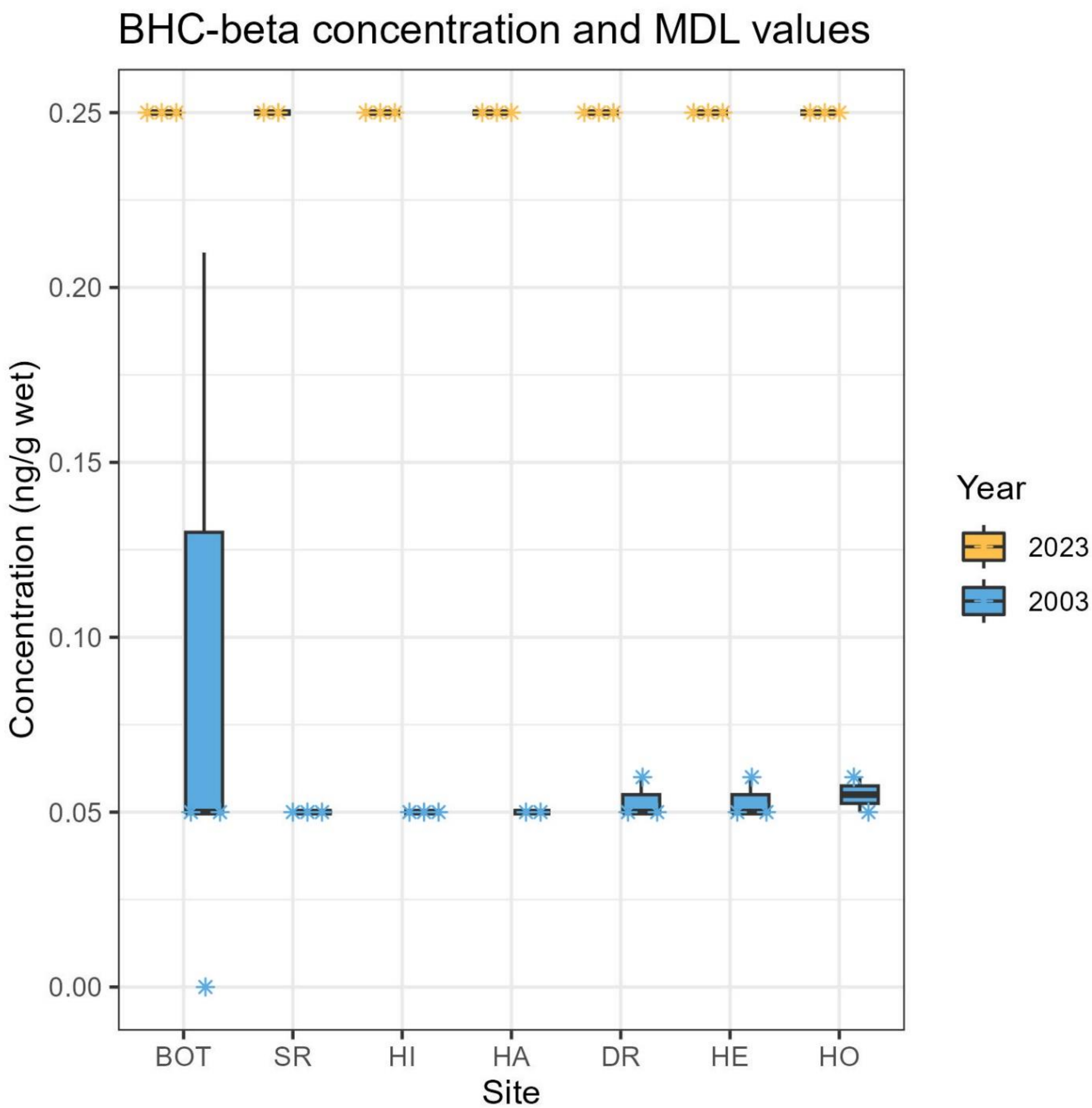

cis-Nonachlor concentration and MDL values
Concentration (ng/g wet)
0.3
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

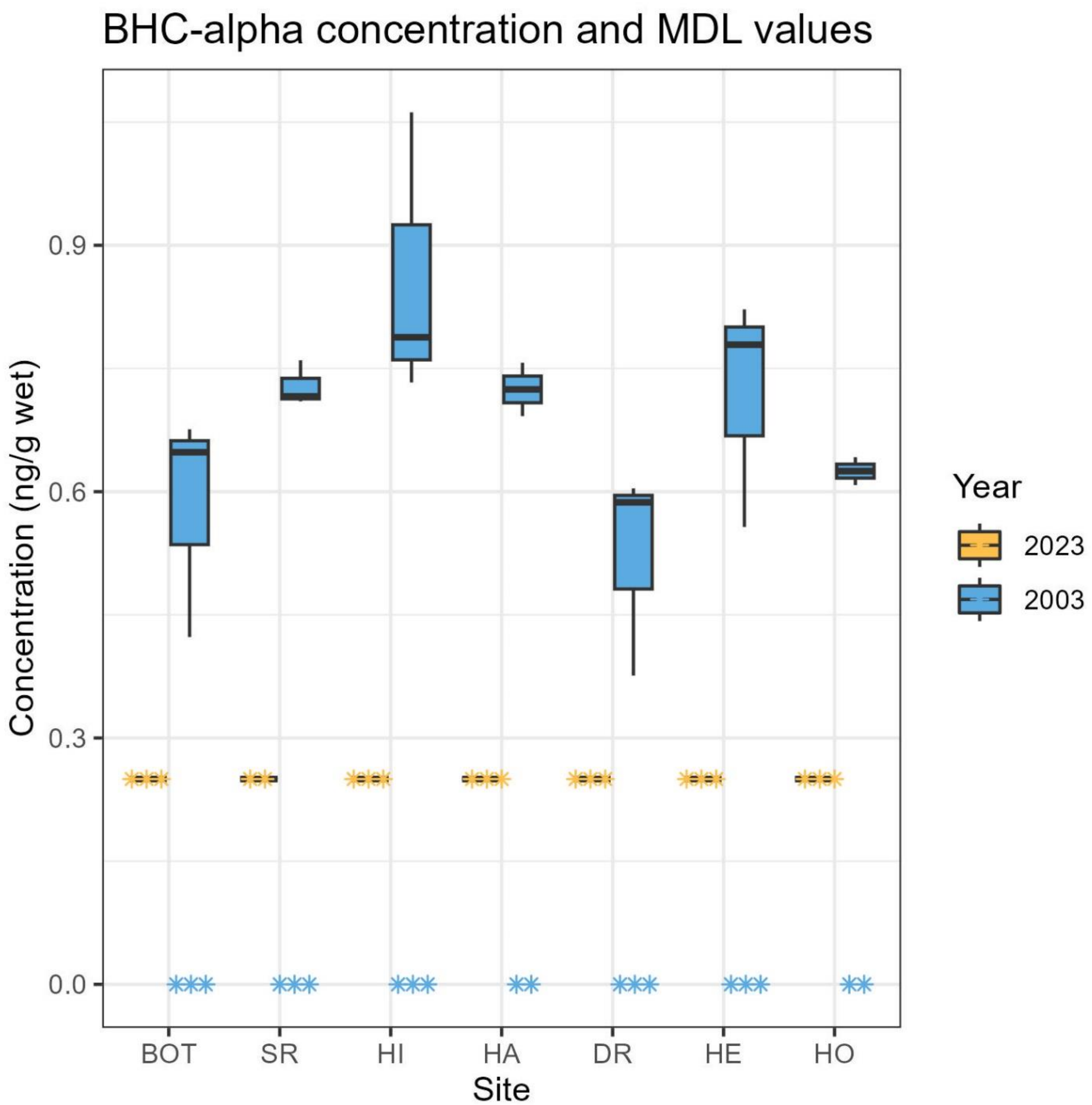

Chlordane-gamma concentration and MDL values
0.5
0.4
0.3
0.2
0.1
0.0
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

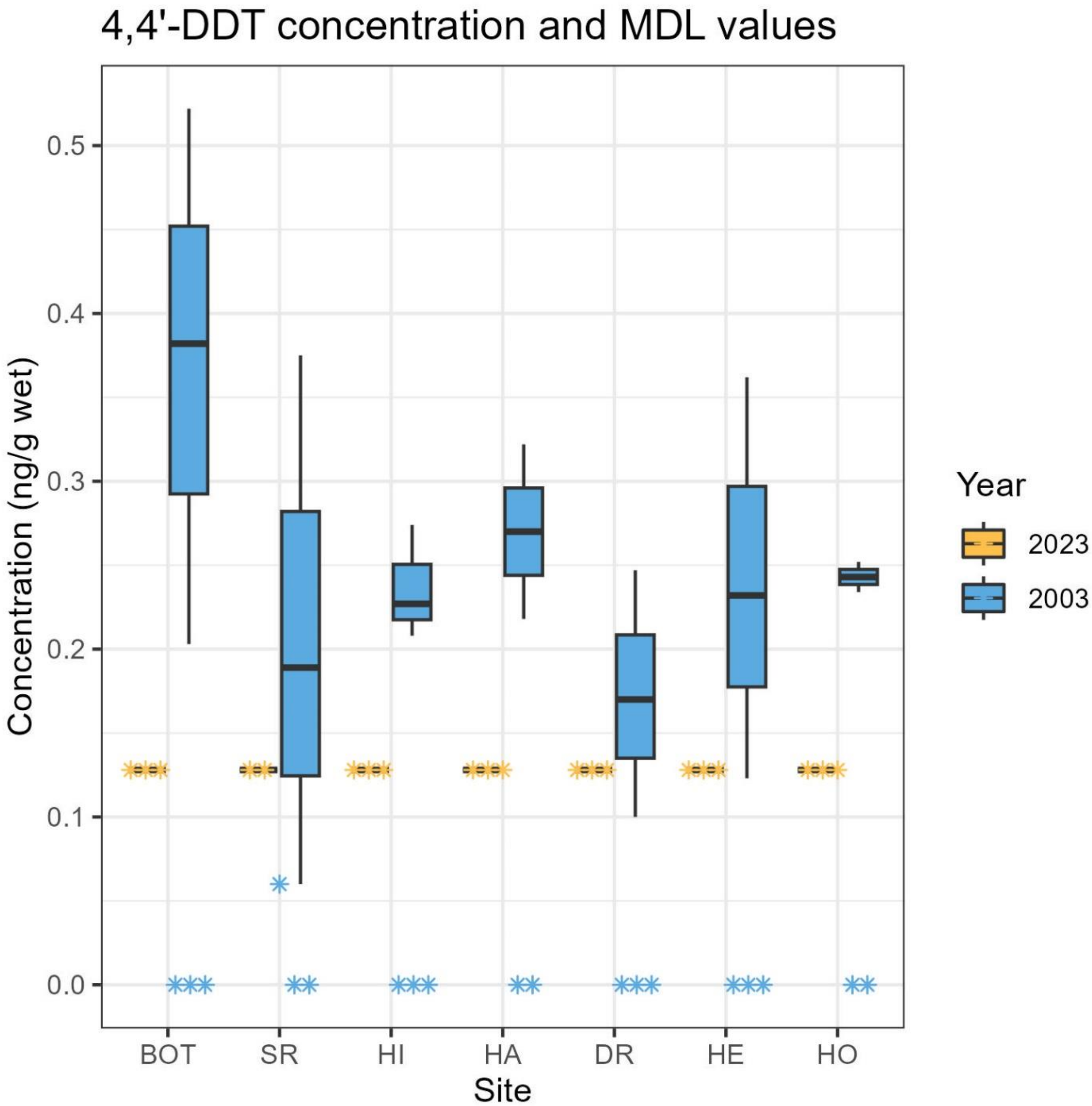

Chlordane-alpha concentration and MDL values
Concentration (ng/g wet)
0.6
0.4
0.2
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

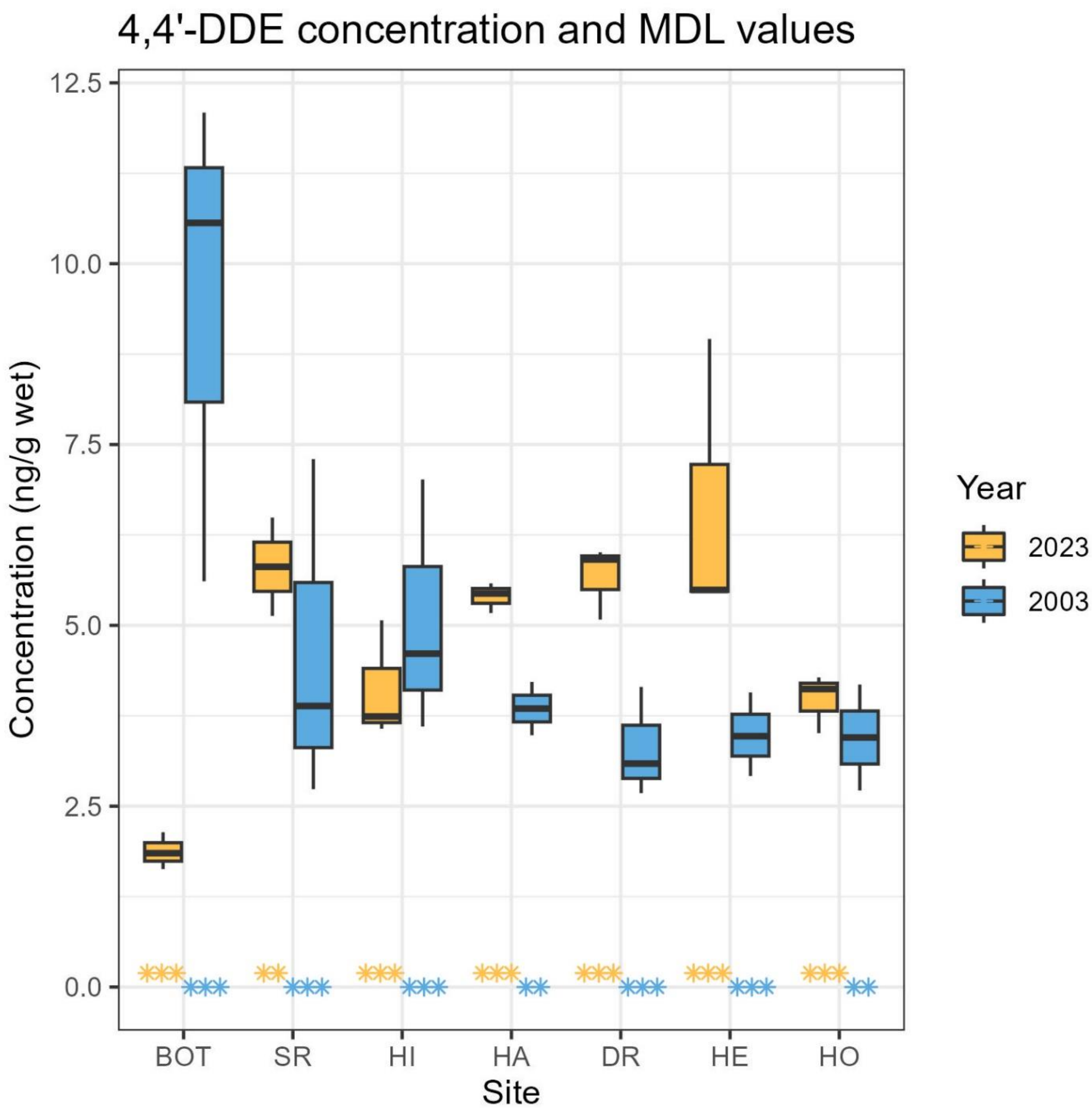

BHC-gamma concentration and MDL values
Concentration (ng/g wet)
0.25
0.20
0.15
0.10
0.05
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

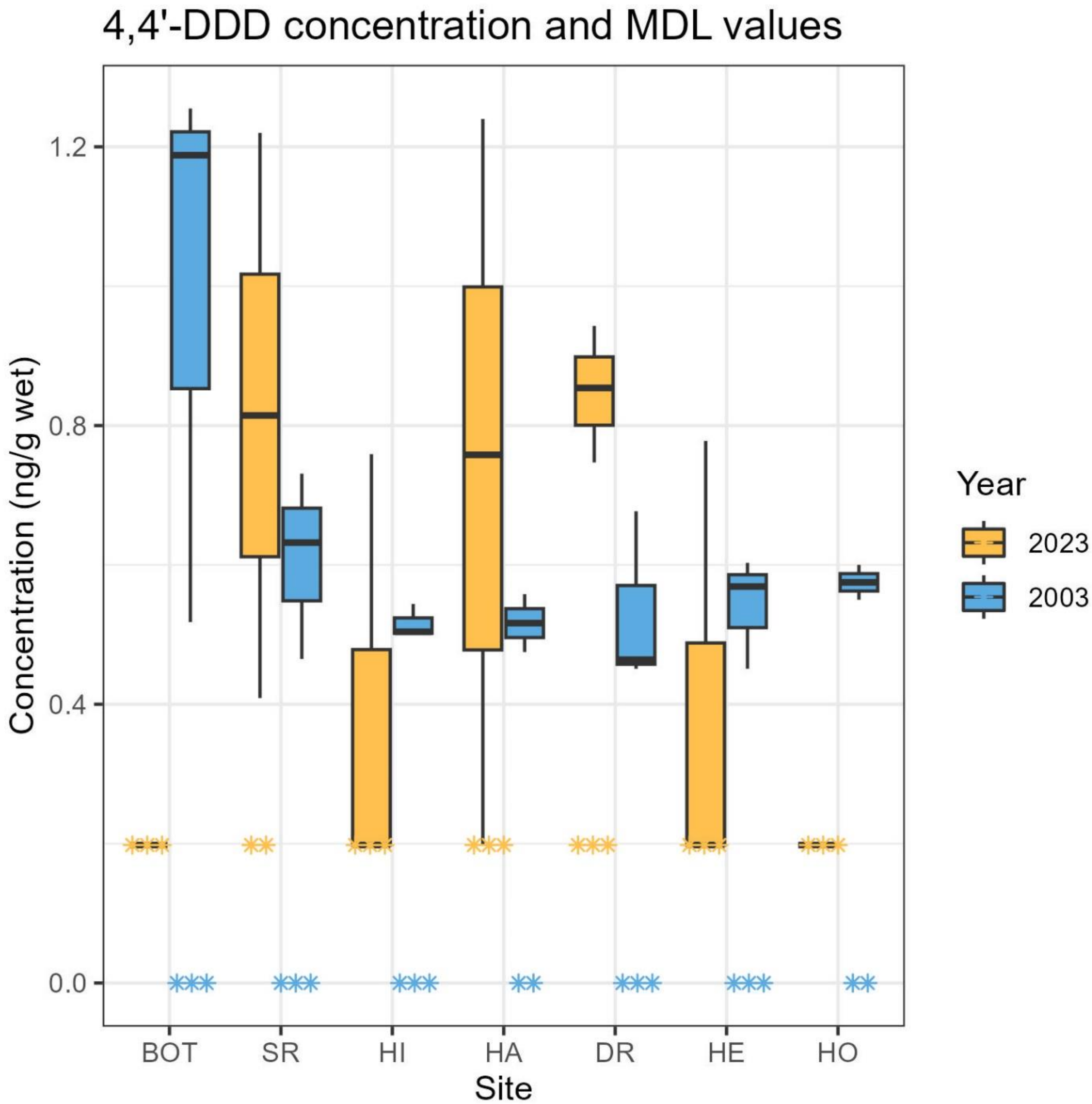

BHC-delta concentration and MDL values
Concentration (ng/g wet)
0.25
0.20
0.15
0.10
0.05
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


BHC-beta concentration and MDL values
Concentration (ng/g wet)
0.25
0.20
0.15
0.10
0.05
0.00
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

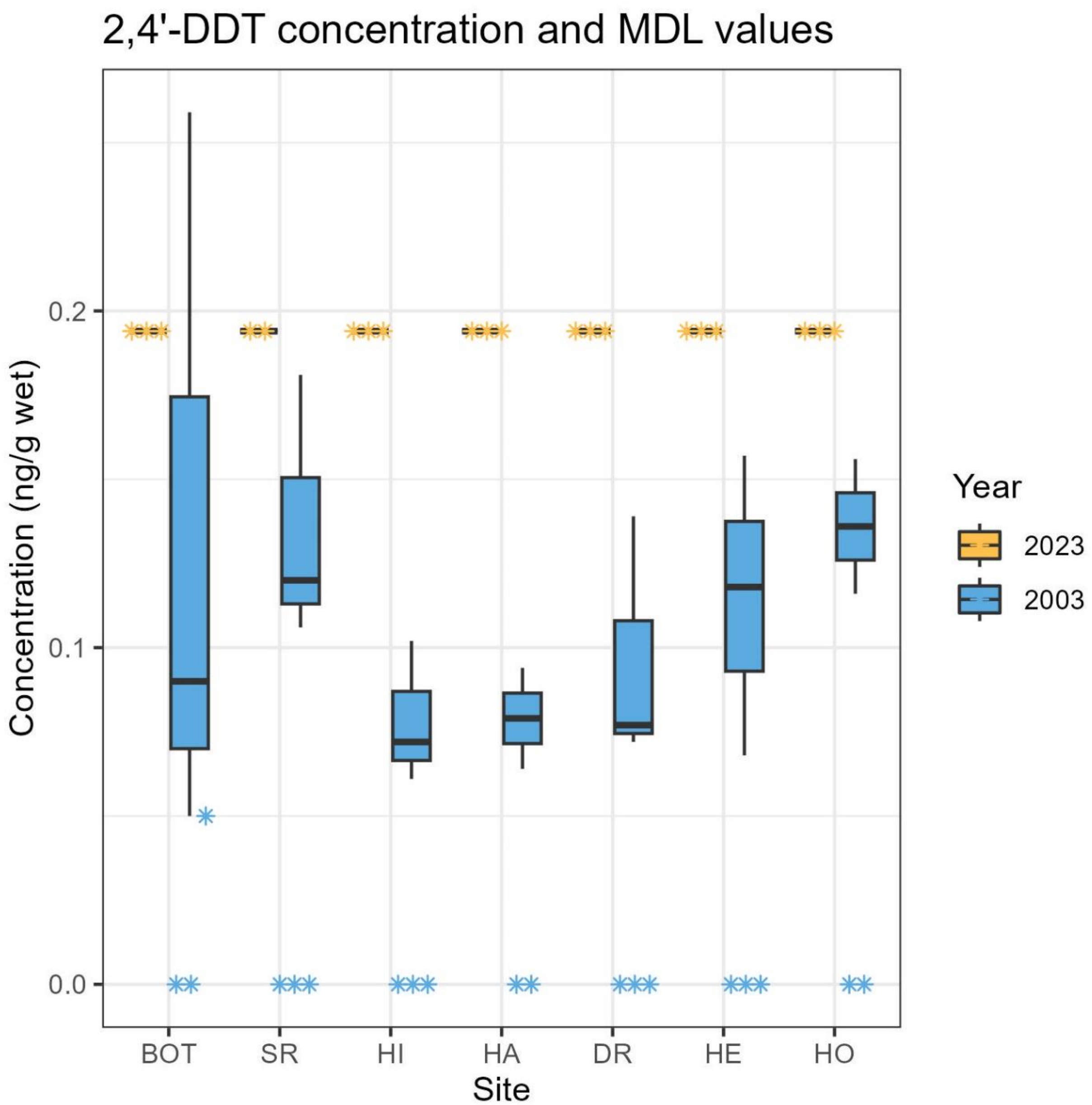

BHC-alpha concentration and MDL values
Concentration (ng/g wet)
0.9
0.6
0.3
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

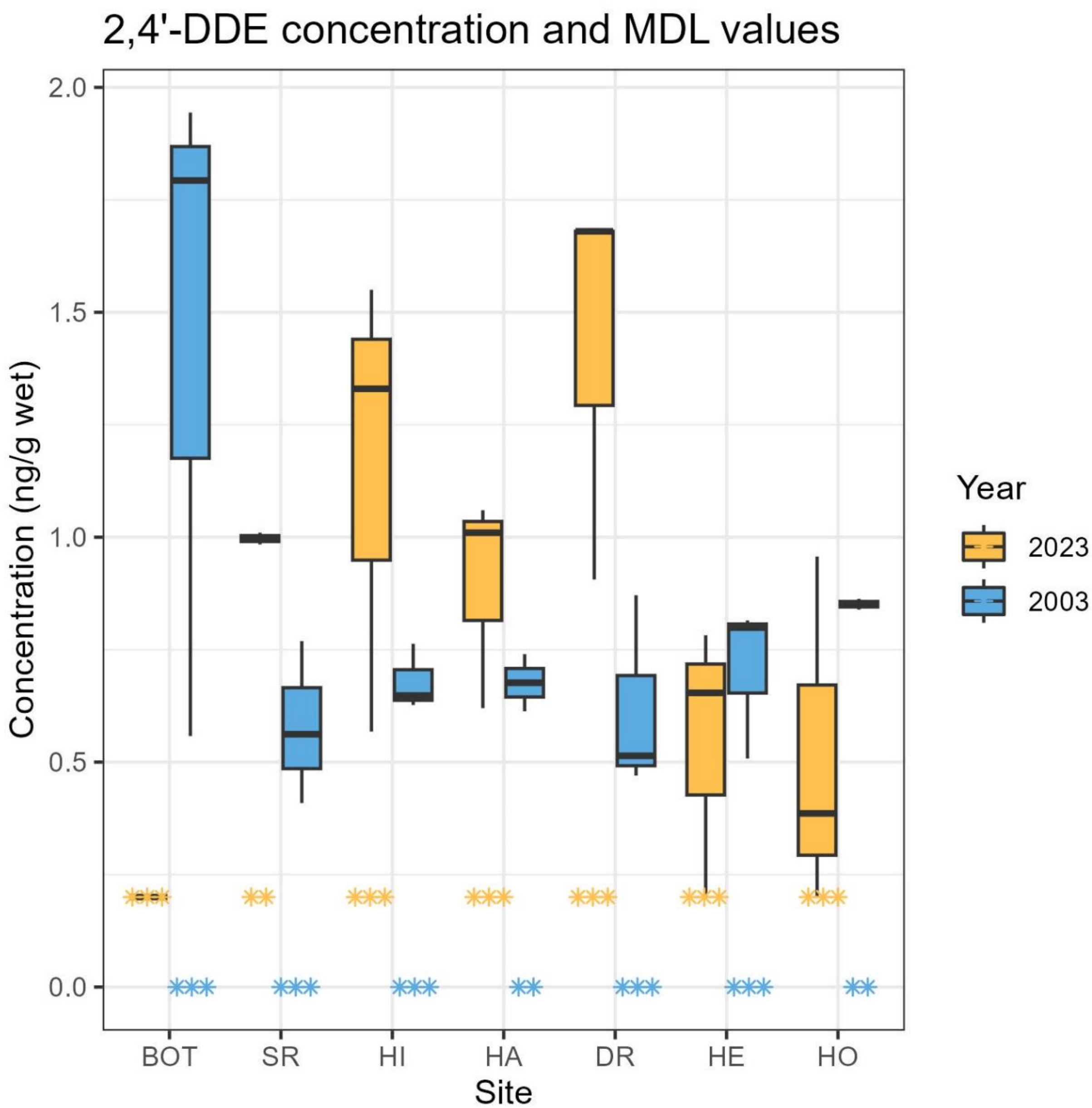

4,4'-DDT concentration and MDL values
Concentration (ng/g wet)
0.5
0.4
0.3
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


4,4'-DDE concentration and MDL values
12.5
10.0
7.5
5.0
2.5
0.0
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

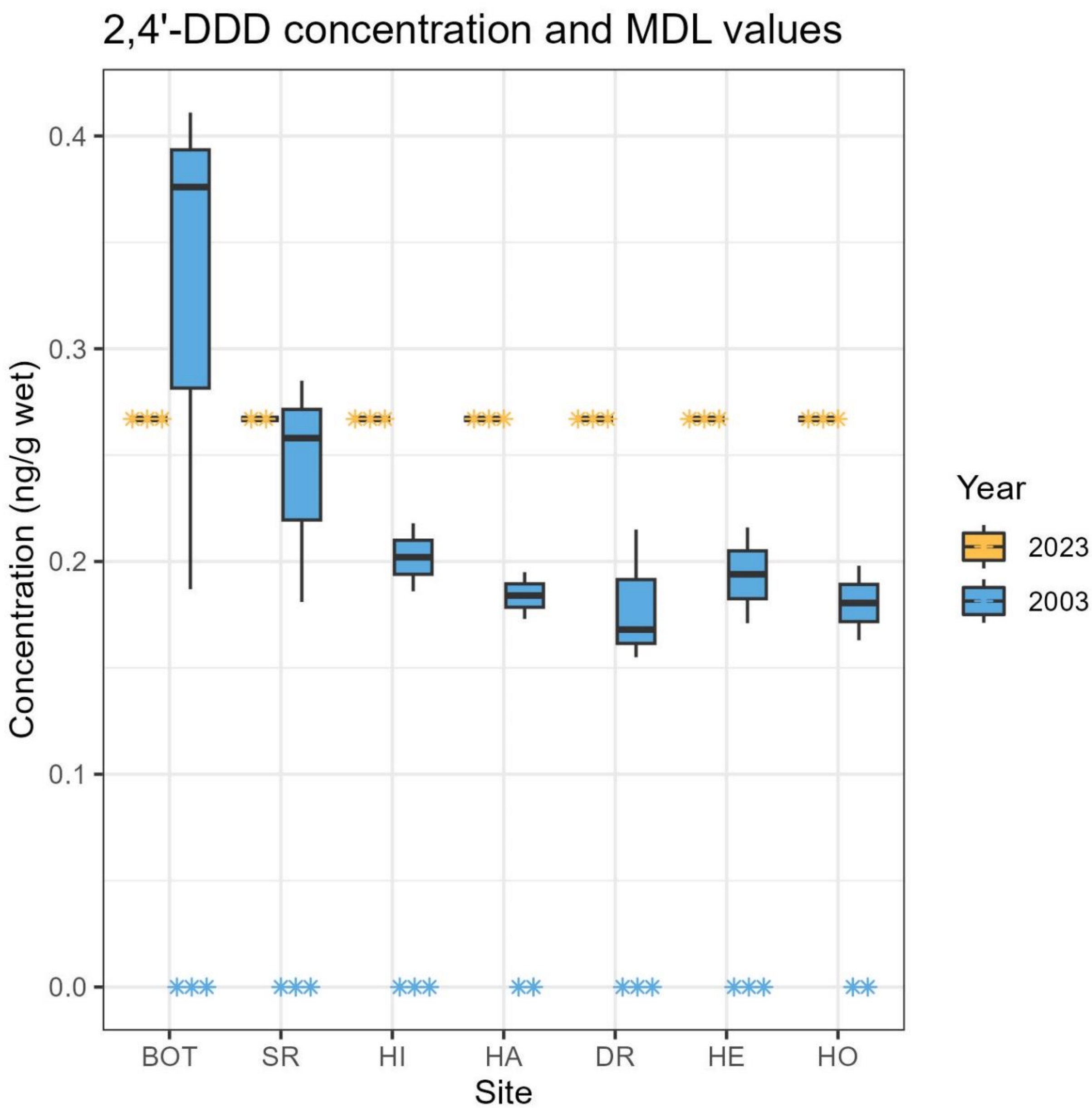


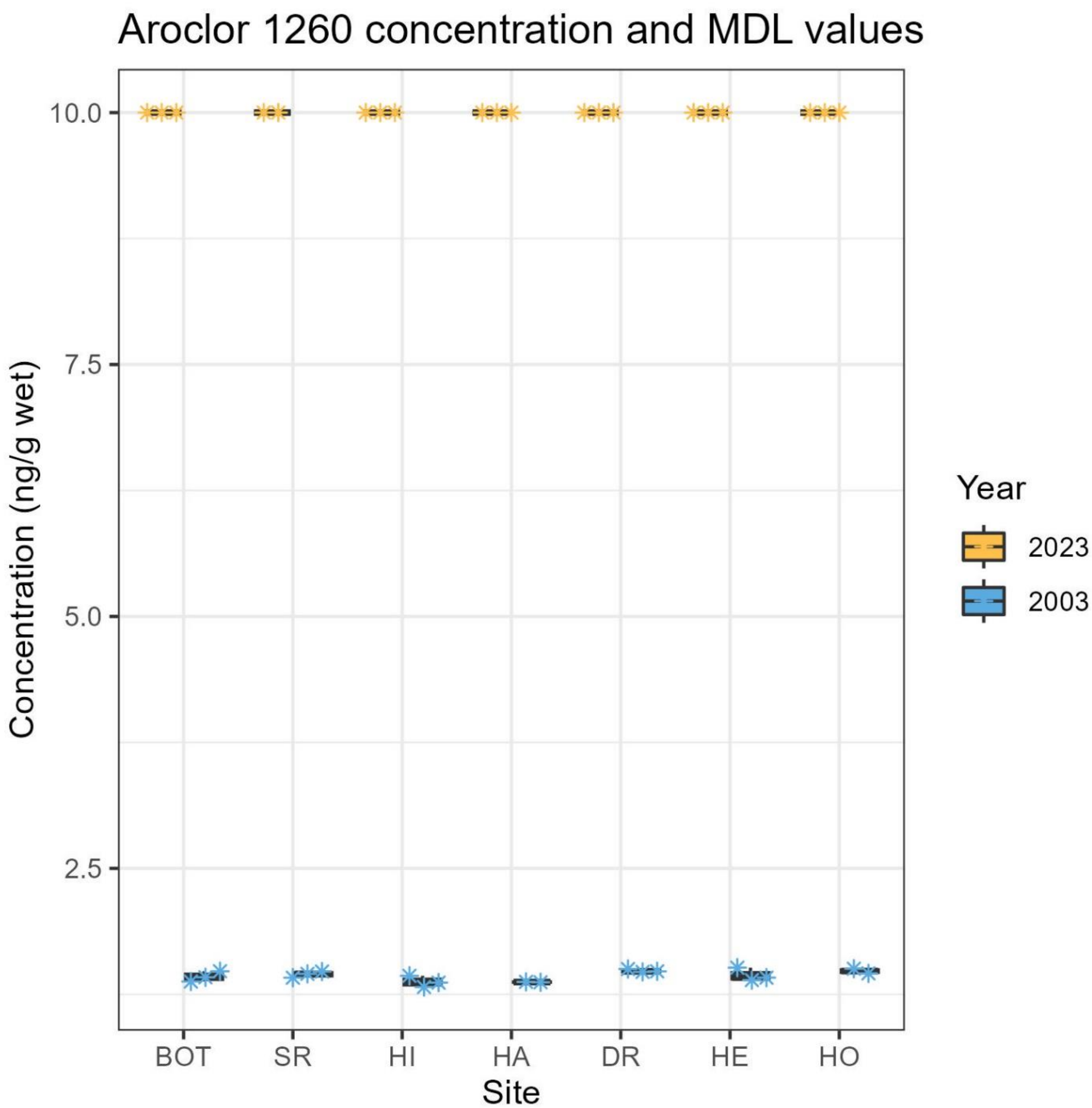
4,4'-DDD concentration and MDL values
Concentration (ng/g wet)
1.2
0.8
0.4
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

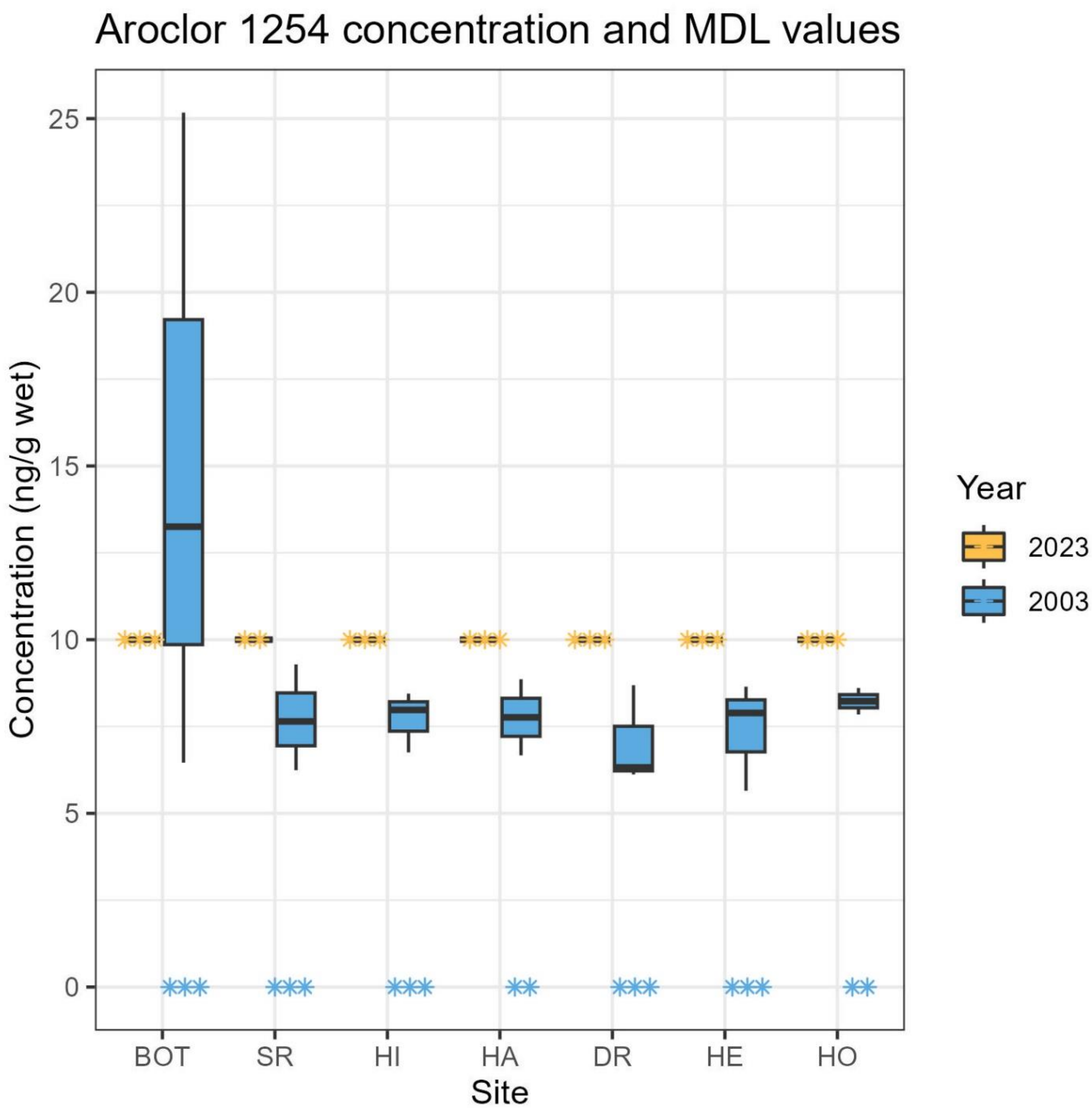

2,4'-DDT concentration and MDL values
Concentration (ng/g wet)
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003



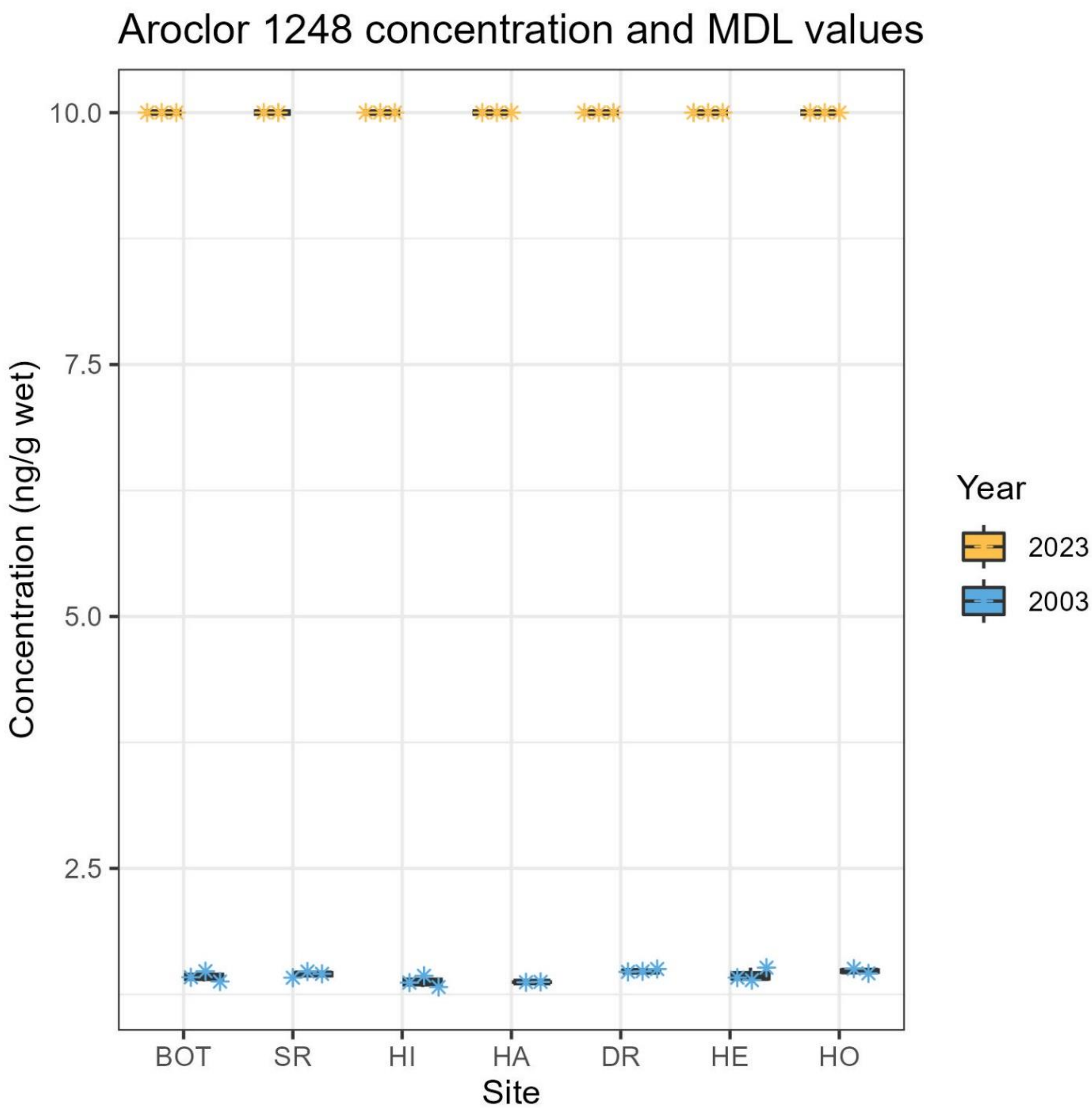
2,4'-DDE concentration and MDL values
Concentration (ng/g wet)
2.0
1.5
1.0
0.5
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

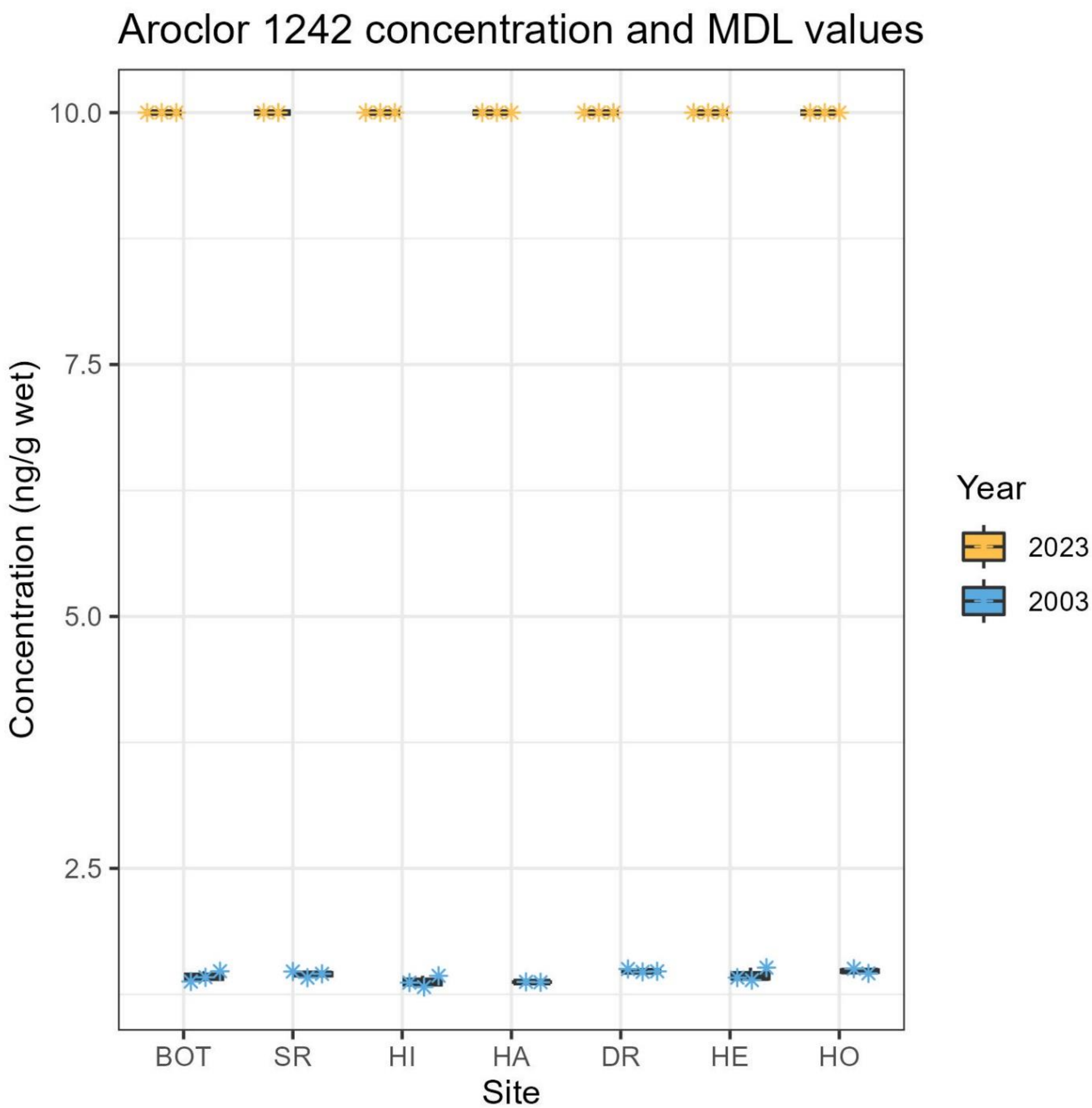

2,4'-DDD concentration and MDL values
Concentration (ng/g wet)
0.4
0.3
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

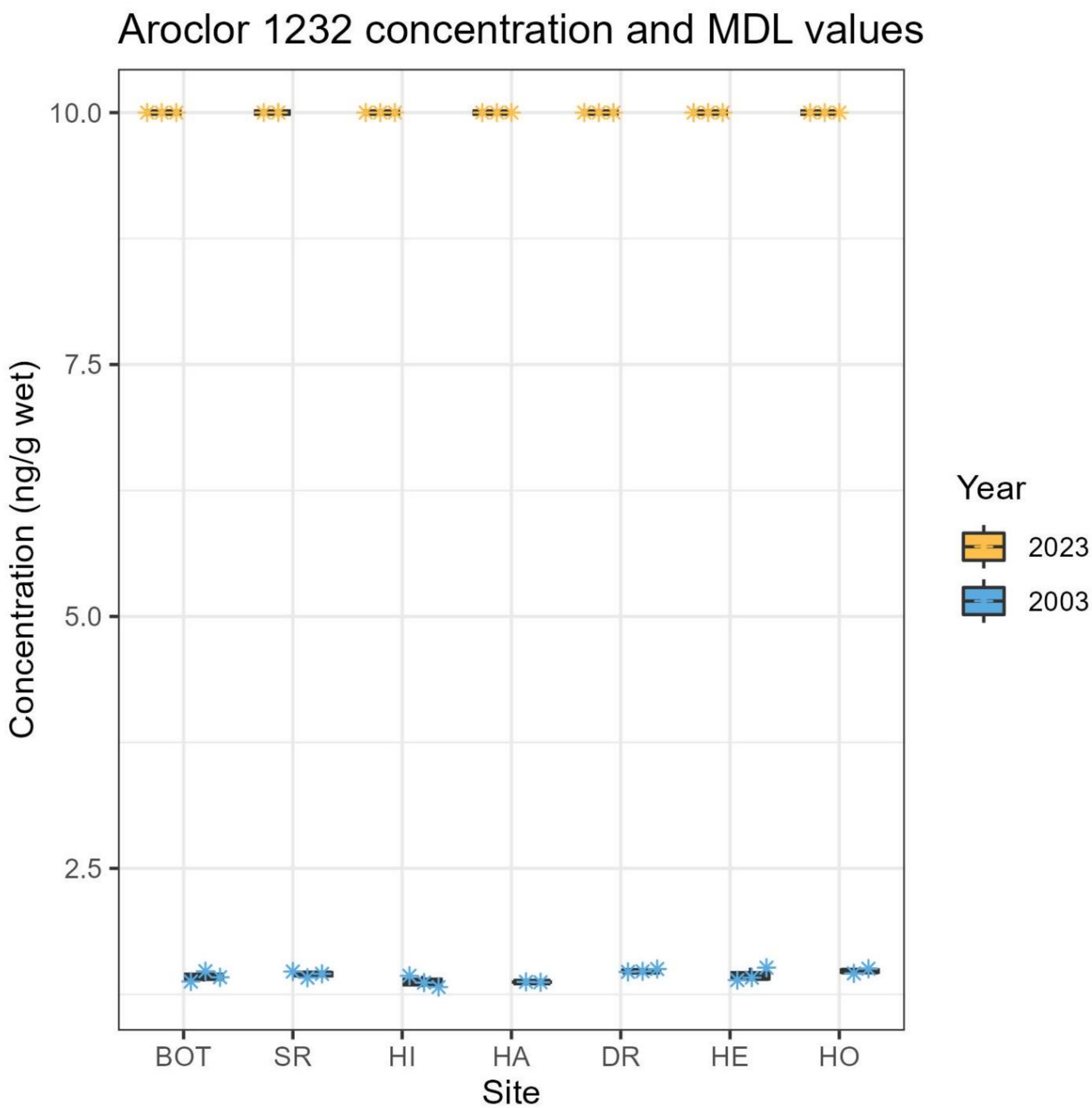

Aroclor 1260 concentration and MDL values
Concentration (ng/g wet)
10.0
7.5
5.0
2.5
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

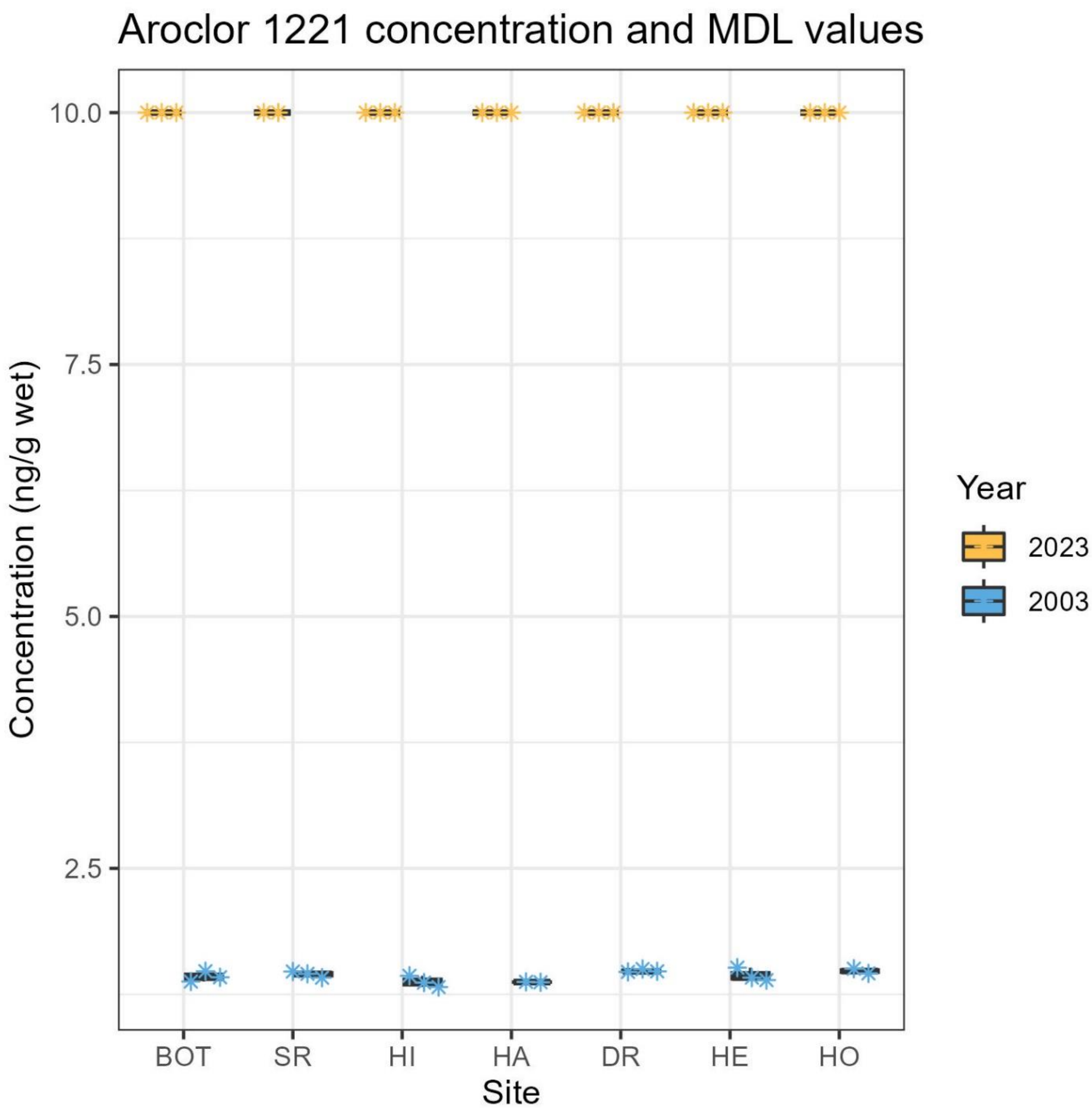


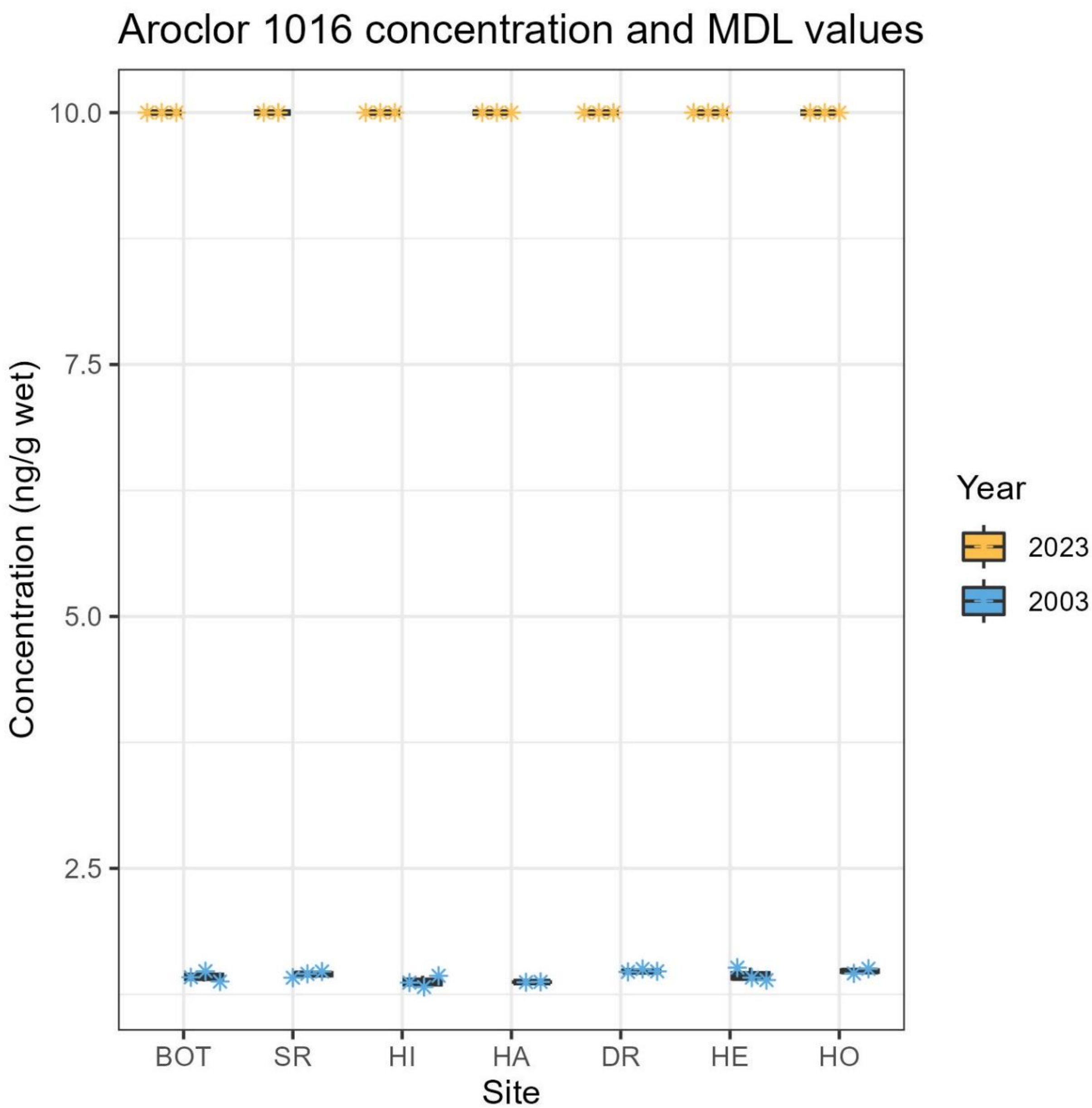
Aroclor 1254 concentration and MDL values
Concentration (ng/g wet)
25
20
15
10
5
0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

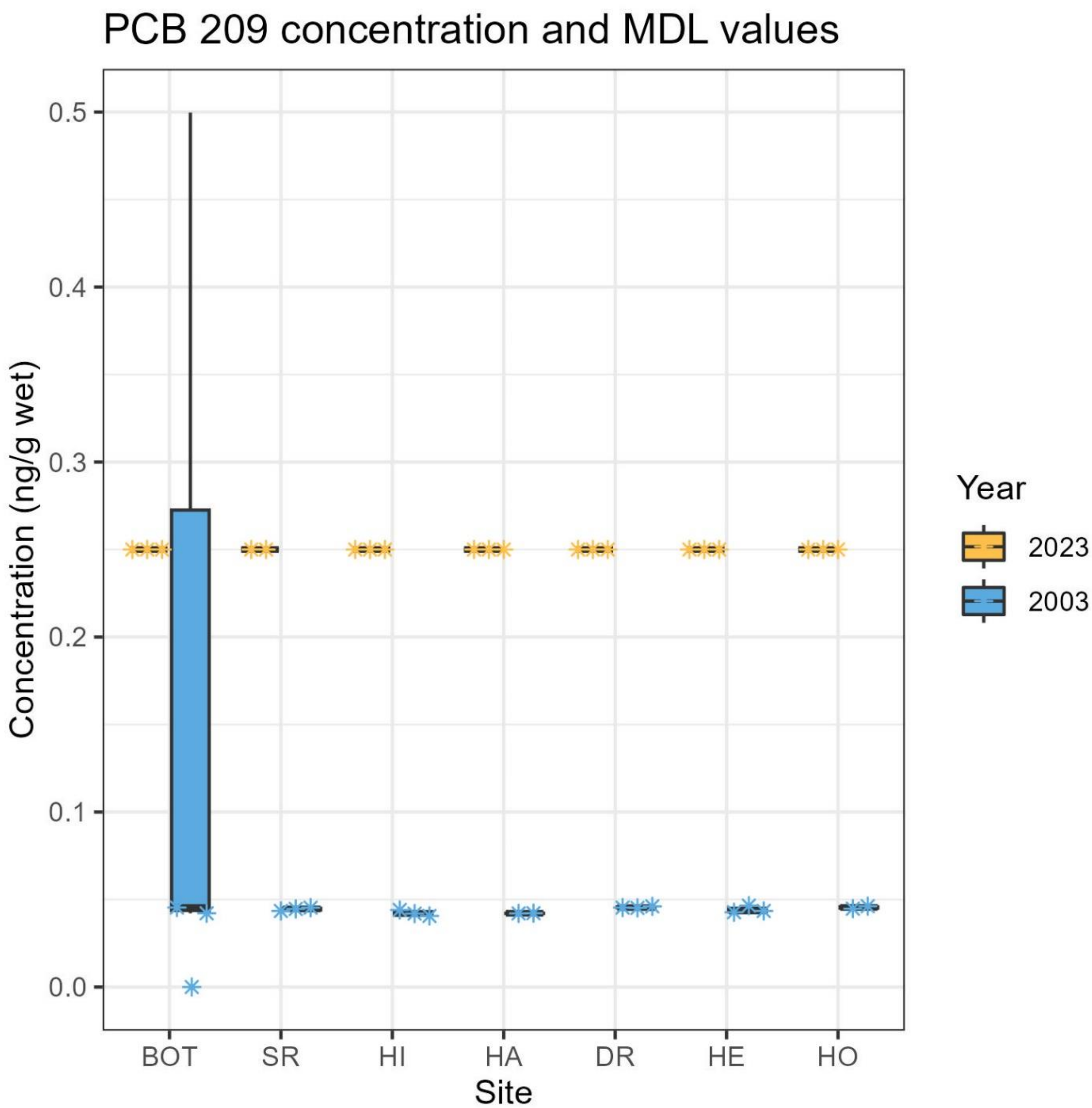

Aroclor 1248 concentration and MDL values
10.0
7.5
5.0
2.5
Concentration (ng/g wet)
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Aroclor 1242 concentration and MDL values
Concentration (ng/g wet)
10.0
7.5
5.0
2.5
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Aroclor 1232 concentration and MDL values
Concentration (ng/g wet)
10.0
7.5
5.0
2.5
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Aroclor 1221 concentration and MDL values
Concentration (ng/g wet)
10.0
7.5
5.0
2.5
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


Aroclor 1016 concentration and MDL values
Concentration (ng/g wet)
10.0
7.5
5.0
2.5
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003


PCB 209 concentration and MDL values
Concentration (ng/g wet)
0.5
0.4
0.3
0.2
0.1
0.0
BOT
SR
HI
HA
DR
HE
HO
Site
Year
2023
2003

Appendix D

BOT versus EOT statistical testing results

Parameter	Year	Levene Test	Levene Result	Sites Tested	t-test p-value	t-test result	Test	Mean Conc. (BOT)	Mean Conc. (EOT)	Units	Type
Aroclor 1254	2003	0.001	Unequal	BOT SR HI HA DR HE HO	0.311	No Diff	Welch's	14.962	7.603	ng/g wet	ArPCB
2,4'-DDD	2003	0.070	Equal	BOT SR HI HA DR HE HO	0.210	No Diff	Welch's	0.325	0.199	ng/g wet	ChlPest
2,4'-DDE	2003	0.043	Unequal	BOT SR HI HA DR HE HO	0.226	No Diff	Welch's	1.432	0.676	ng/g wet	ChlPest
4,4'-DDD	2003	0.049	Unequal	BOT SR HI HA DR HE HO	0.202	No Diff	Welch's	0.987	0.548	ng/g wet	ChlPest
4,4'-DDE	2023	0.222	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	1.873	5.235	ng/g wet	ChlPest
4,4'-DDE	2003	0.147	Equal	BOT SR HI HA DR HE HO	0.105	No Diff	Welch's	9.421	4.008	ng/g wet	ChlPest
4,4'-DDT	2003	0.287	Equal	BOT SR HI HA DR HE HO	0.255	No Diff	Welch's	0.369	0.225	ng/g wet	ChlPest
BHC-alpha	2003	0.789	Equal	BOT SR HI HA DR HE HO	0.278	No Diff	Welch's	0.582	0.700	ng/g wet	ChlPest
Chlordane-alpha	2003	0.129	Equal	BOT SR HI HA DR HE HO	0.229	No Diff	Welch's	0.452	0.261	ng/g wet	ChlPest
Chlordane-gamma	2003	0.010	Unequal	BOT SR HI HA DR HE HO	0.206	No Diff	Welch's	0.346	0.116	ng/g wet	ChlPest
cis-Nonachlor	2003	0.005	Unequal	BOT SR HI HA DR HE HO	0.119	No Diff	Welch's	0.233	0.072	ng/g wet	ChlPest
Dieldrin	2003	0.020	Unequal	BOT SR HI HA DR HE HO	0.185	No Diff	Welch's	0.170	0.064	ng/g wet	ChlPest
trans-Nonachlor	2003	0.028	Unequal	BOT SR HI HA DR HE HO	0.206	No Diff	Welch's	0.395	0.154	ng/g wet	ChlPest
Percent Lipids	2023	0.076	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	1.810	1.431	%	Conv
Percent Lipids	2003	0.081	Equal	BOT SR HI HA DR HE HO	0.007	Diff	Welch's	1.228	1.443	%	Conv

Parameter	Year	Levene Test	Levene Result	Sites Tested	t-test p-value	t-test result	Test	Mean Conc. (BOT)	Mean Conc. (EOT)	Units	Type
Percent Solids	2023	0.508	Equal	BOT SR HI HA DR HE HO	0.743	No Diff	Welch's	16.500	16.241	%	Conv
Percent Solids	2003	0.306	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	20.784	18.196	%	Conv
Aluminum	2023	0.260	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	13.177	59.500	µg/g wet	Metal
Aluminum	2003	0.093	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	19.567	33.344	µg/g wet	Metal
Antimony	2003	0.479	Equal	BOT SR HI HA DR HE HO	0.951	No Diff	Welch's	0.005	0.005	µg/g wet	Metal
Arsenic	2023	0.637	Equal	BOT SR HI HA DR HE HO	0.253	No Diff	Welch's	1.170	1.296	µg/g wet	Metal
Arsenic	2003	0.327	Equal	BOT SR HI HA DR HE HO	0.001	Diff	Welch's	1.633	1.970	µg/g wet	Metal
Barium	2023	0.351	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.216	0.992	µg/g wet	Metal
Barium	2003	0.069	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.158	0.388	µg/g wet	Metal
Beryllium	2003	0.324	Equal	BOT SR HI HA DR HE HO	0.863	No Diff	Welch's	0.008	0.008	µg/g wet	Metal
Cadmium	2023	0.759	Equal	BOT SR HI HA DR HE HO	0.016	Diff	Welch's	1.563	1.006	µg/g wet	Metal
Cadmium	2003	0.039	Unequal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.233	1.335	µg/g wet	Metal
Chromium	2023	0.618	Equal	BOT SR HI HA DR HE HO	0.098	No Diff	Welch's	0.079	0.522	µg/g wet	Metal
Chromium	2003	0.136	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.349	0.585	µg/g wet	Metal
Cobalt	2023	0.774	Equal	BOT SR HI HA DR HE HO	0.023	Diff	Welch's	0.131	0.091	µg/g wet	Metal

Parameter	Year	Levene Test	Levene Result	Sites Tested	t-test p-value	t-test result	Test	Mean Conc. (BOT)	Mean Conc. (EOT)	Units	Type
Cobalt	2003	0.274	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.071	0.118	μg/g wet	Metal
Copper	2023	0.442	Equal	BOT SR HI HA DR HE HO	0.001	Diff	Welch's	1.607	1.090	μg/g wet	Metal
Copper	2003	0.319	Equal	BOT SR HI HA DR HE HO	0.125	No Diff	Welch's	1.012	1.080	μg/g wet	Metal
Iron	2023	0.082	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	26.333	90.306	μg/g wet	Metal
Iron	2003	0.068	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	26.700	39.975	μg/g wet	Metal
Lead	2023	0.333	Equal	BOT SR HI HA DR HE HO	0.242	No Diff	Welch's	0.047	0.052	μg/g wet	Metal
Lead	2003	0.063	Equal	BOT SR HI HA DR HE HO	0.106	No Diff	Welch's	0.205	0.110	μg/g wet	Metal
Mercury	2023	0.255	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.003	0.006	μg/g wet	Metal
Mercury	2003	0.167	Equal	BOT SR HI HA DR HE HO	0.367	No Diff	Welch's	0.011	0.011	μg/g wet	Metal
Molybdenum	2023	0.486	Equal	BOT SR HI HA DR HE HO	0.001	Diff	Welch's	0.243	0.395	μg/g wet	Metal
Molybdenum	2003	0.300	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.223	1.006	μg/g wet	Metal
Nickel	2023	0.617	Equal	BOT SR HI HA DR HE HO	0.101	No Diff	Welch's	0.206	0.382	μg/g wet	Metal
Nickel	2003	0.143	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.193	0.305	μg/g wet	Metal
Selenium	2023	0.285	Equal	BOT SR HI HA DR HE HO	0.079	No Diff	Welch's	0.523	0.584	μg/g wet	Metal
Selenium	2003	0.369	Equal	BOT SR HI HA DR HE HO	0.005	Diff	Welch's	1.153	1.440	μg/g wet	Metal

Parameter	Year	Levene Test	Levene Result	Sites Tested	t-test p-value	t-test result	Test	Mean Conc. (BOT)	Mean Conc. (EOT)	Units	Type
Vanadium	2023	0.080	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.118	0.325	µg/g wet	Metal
Vanadium	2003	0.222	Equal	BOT SR HI HA DR HE HO	0.001	Diff	Welch's	0.102	0.226	µg/g wet	Metal
Zinc	2023	0.621	Equal	BOT SR HI HA DR HE HO	0.542	No Diff	Welch's	13.400	14.147	µg/g wet	Metal
Zinc	2003	0.006	Unequal	BOT SR HI HA DR HE HO	0.119	No Diff	Welch's	24.933	24.219	µg/g wet	Metal
1-Methylnaphthalene	2023	0.231	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	1.857	0.515	ng/g wet	PAH
1-Methylnaphthalene	2003	0.202	Equal	BOT SR HI HA DR HE HO	0.186	No Diff	Welch's	0.226	0.168	ng/g wet	PAH
1-Methylphenanthrene	2003	0.116	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	0.269	0.137	ng/g wet	PAH
2-Methylnaphthalene	2023	0.337	Equal	BOT SR HI HA DR HE HO	0.001	Diff	Welch's	2.877	1.281	ng/g wet	PAH
2-Methylnaphthalene	2003	0.090	Equal	BOT SR HI HA DR HE HO	0.173	No Diff	Welch's	0.414	0.281	ng/g wet	PAH
Benz[a]anthracene	2003	0.725	Equal	BOT SR HI HA DR HE HO	0.010	Diff	Welch's	0.306	0.037	ng/g wet	PAH
Biphenyl	2003	0.396	Equal	BOT SR HI HA DR HE HO	0.077	No Diff	Welch's	0.169	0.237	ng/g wet	PAH
Chrysene	2003	0.314	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	1.585	0.282	ng/g wet	PAH

Parameter	Year	Levene Test	Levene Result	Sites Tested	t-test p-value	t-test result	Test	Mean Conc. (BOT)	Mean Conc. (EOT)	Units	Type
Dibenzothiophene	2003	0.476	Equal	BOT SR HI HA DR HE HO	0.001	Diff	Welch's	0.184	0.104	ng/g wet	PAH
Fluoranthene	2003	0.930	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	2.302	0.215	ng/g wet	PAH
Fluorene	2003	0.686	Equal	BOT SR HI HA DR HE HO	0.761	No Diff	Welch's	0.593	0.568	ng/g wet	PAH
Naphthalene	2023	0.418	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	3.043	0.908	ng/g wet	PAH
Naphthalene	2003	0.084	Equal	BOT SR HI HA DR HE HO	0.668	No Diff	Welch's	0.962	0.827	ng/g wet	PAH
Phenanthrene	2003	0.469	Equal	BOT SR HI HA DR HE HO	0.000	Diff	Welch's	1.007	0.363	ng/g wet	PAH
PCB 066	2003	0.001	Unequal	BOT SR HI HA DR HE HO	0.188	No Diff	Welch's	0.333	0.058	ng/g wet	PCB
PCB 101	2003	0.009	Unequal	BOT SR HI HA DR HE HO	0.312	No Diff	Welch's	0.788	0.455	ng/g wet	PCB
PCB 105	2003	0.031	Unequal	BOT SR HI HA DR HE HO	0.223	No Diff	Welch's	0.242	0.116	ng/g wet	PCB
PCB 110	2003	0.006	Unequal	BOT SR HI HA DR HE HO	0.218	No Diff	Welch's	0.457	0.153	ng/g wet	PCB
PCB 118	2003	0.005	Unequal	BOT SR HI HA DR HE HO	0.219	No Diff	Welch's	0.772	0.280	ng/g wet	PCB
PCB 138	2003	0.021	Unequal	BOT SR HI HA DR HE HO	0.229	No Diff	Welch's	1.087	0.456	ng/g wet	PCB
PCB 153	2003	0.002	Unequal	BOT SR HI HA DR HE HO	0.241	No Diff	Welch's	1.482	0.638	ng/g wet	PCB
PCB 187	2003	0.237	Equal	BOT SR HI HA DR HE HO	0.197	No Diff	Welch's	0.383	0.208	ng/g wet	PCB

Appendix E

Study Year Statistical Testing Results

Parameter	Difference Between Mounds	Test	t-test p-value	Mean Conc. at Mounds in 2003	Mean Conc. at Mounds in 2023	Units
1-Methylnaphthalene	No Diff	Welch's	0.2939	1.0000	1.0375	NA
2-Methylnaphthalene	Diff	Welch's	0.0134	1.0000	1.2575	ng/g wet
2,4'-DDE	No Diff	Welch's	0.6742	0.7215	0.7764	NA
4,4'-DDD	No Diff	Welch's	0.3217	0.5354	0.4266	NA
4,4'-DDE	No Diff	Welch's	0.0941	4.0283	5.0317	NA
4,4'-DDT	Diff	Welch's	0.0003	0.2457	0.1280	ng/g wet
Aluminum	Diff	Welch's	0.0003	30.3800	54.5917	µg/g wet
Arsenic	Diff	Welch's	0.0000	1.9270	1.3225	µg/g wet
Barium	Diff	Welch's	0.0024	0.3724	1.0802	µg/g wet
BHC-alpha	Diff	Welch's	0.0000	0.7440	0.2500	ng/g wet
Biphenyl	No Diff	Welch's	0.1911	1.0000	1.0175	NA
Cadmium	Diff	Welch's	0.0000	1.3800	0.9536	µg/g wet
Chlordane-alpha	Diff	Welch's	0.0002	0.2699	0.1870	ng/g wet
Chromium	Diff	Welch's	0.0005	0.5879	0.2833	µg/g wet
cis-Nonachlor	No Diff	Welch's	0.3388	0.1920	0.2034	NA
Cobalt	Diff	Welch's	0.0001	0.1169	0.0937	µg/g wet
Copper	No Diff	Welch's	0.7867	1.0869	1.0676	NA
Fluoranthene	No Diff	Welch's	0.3388	1.0000	1.0133	NA
Iron	Diff	Welch's	0.0000	36.3900	86.4667	µg/g wet
Lead	Diff	Welch's	0.0000	0.1035	0.0498	µg/g wet
Mercury	Diff	Welch's	0.0000	0.0105	0.0059	µg/g wet
Molybdenum	Diff	Welch's	0.0000	0.7444	0.3616	µg/g wet
Naphthalene	Diff	Welch's	0.0438	1.0096	1.7858	ng/g wet
Nickel	No Diff	Welch's	0.8408	0.2936	0.2896	NA
PCB 049	No Diff	Welch's	0.7831	0.1227	0.1494	NA
PCB 052	No Diff	Welch's	0.3388	0.0462	0.0972	NA

Parameter	Difference Between Mounds	Test	t-test p-value	Mean Conc. at Mounds in 2003	Mean Conc. at Mounds in 2023	Units
PCB 066	Diff	Welch's	0.0001	0.0585	0.0270	ng/g wet
PCB 087	No Diff	Welch's	0.1732	0.0871	0.0810	NA
PCB 101	Diff	Welch's	0.0136	0.4856	0.2033	ng/g wet
PCB 105	Diff	Welch's	0.0000	0.1169	0.0470	ng/g wet
PCB 110	No Diff	Welch's	0.6581	0.1634	0.1422	NA
PCB 118	Diff	Welch's	0.0000	0.3055	0.0690	ng/g wet
PCB 128	No Diff	Welch's	0.1185	0.0842	0.0810	NA
PCB 138	Diff	Welch's	0.0000	0.5110	0.1180	ng/g wet
PCB 153	Diff	Welch's	0.0001	0.6597	0.2989	ng/g wet
PCB 183	Diff	Welch's	0.0286	0.0707	0.0560	ng/g wet
PCB 187	Diff	Welch's	0.0017	0.2256	0.1680	ng/g wet
PCB 195	No Diff	Welch's	0.3388	0.0930	0.1096	NA
Percent Lipids	No Diff	Welch's	0.6720	1.4807	1.4395	NA
Percent Solids	Diff	Welch's	0.0052	18.1216	16.6250	%
Pyrene	No Diff	Welch's	0.3388	1.0000	1.0233	NA
Selenium	Diff	Welch's	0.0000	1.4070	0.5913	μg/g wet
Silver	No Diff	Welch's	0.0698	0.0250	0.0285	NA
trans-Nonachlor	No Diff	Welch's	0.1211	0.1860	0.2072	NA
Vanadium	Diff	Welch's	0.0000	0.1921	0.3259	μg/g wet
Zinc	Diff	Welch's	0.0000	24.0700	13.9167	μg/g wet

Parameter	Difference Between Reference Sites	Test	t-test p-value	Mean Conc. at Reference sites in 2003	Mean Conc. at Reference sites in 2023	Units
1-Methylnaphthalene	Not Tested	Not Tested	Not Tested	NA	NA	NA
2-Methylnaphthalene	Diff	Welch's	0.0021	1.0000	1.3380	ng/g wet
2,4'-DDE	Not Tested	Not Tested	Not Tested	NA	NA	NA

Parameter	Difference Between Reference Sites	Test	t-test p-value	Mean Conc. at Reference sites in 2003	Mean Conc. at Reference sites in 2023	Units
4,4'-DDD	Not Tested	Not Tested	Not Tested	NA	NA	NA
4,4'-DDE	Not Tested	Not Tested	Not Tested	NA	NA	NA
4,4'-DDT	No Diff	Welch's	0.0967	0.2062	0.1280	ng/g wet
Aluminum	No Diff	Welch's	0.1154	38.2833	71.2800	µg/g wet
Arsenic	Diff	Welch's	0.0000	2.0417	1.2340	µg/g wet
Barium	Diff	Welch's	0.0214	0.4148	0.7800	µg/g wet
BHC-alpha	Diff	Welch's	0.0012	0.6255	0.2500	ng/g wet
Biphenyl	Not Tested	Not Tested	Not Tested	NA	NA	NA
Cadmium	No Diff	Welch's	0.0988	1.2600	1.1318	µg/g wet
Chlordane-alpha	No Diff	Welch's	0.6959	0.2518	0.3008	ng/g wet
Chromium	No Diff	Welch's	0.5778	0.5803	1.0962	µg/g wet
cis-Nonachlor	Not Tested	Not Tested	Not Tested	NA	NA	NA
Cobalt	Diff	Welch's	0.0014	0.1197	0.0842	µg/g wet
Copper	Not Tested	Not Tested	Not Tested	NA	NA	NA
Fluoranthene	Not Tested	Not Tested	Not Tested	NA	NA	NA
Iron	Diff	Welch's	0.0079	45.9500	99.5200	µg/g wet
Lead	Diff	Welch's	0.0000	0.1201	0.0582	µg/g wet
Mercury	Diff	Welch's	0.0000	0.0115	0.0056	µg/g wet
Molybdenum	Diff	Welch's	0.0086	1.4427	0.4768	µg/g wet
Naphthalene	No Diff	Welch's	0.1933	1.0065	1.0000	ng/g wet
Nickel	Not Tested	Not Tested	Not Tested	NA	NA	NA
PCB 049	Not Tested	Not Tested	Not Tested	NA	NA	NA
PCB 052	Not Tested	Not Tested	Not Tested	NA	NA	NA
PCB 066	Diff	Welch's	0.0013	0.0564	0.0270	ng/g wet
PCB 087	Not Tested	Not Tested	Not Tested	NA	NA	NA
PCB 101	Diff	Welch's	0.0003	0.4029	0.0270	ng/g wet
PCB 105	Diff	Welch's	0.0005	0.1135	0.0470	ng/g wet

Parameter	Difference Between Reference Sites	Test	t-test p-value	Mean Conc. at Reference sites in 2003	Mean Conc. at Reference sites in 2023	Units
PCB 110	Not Tested	Not Tested	Not Tested	NA	NA	NA
PCB 118	Diff	Welch's	0.0004	0.2386	0.0690	ng/g wet
PCB 128	Not Tested	Not Tested	Not Tested	NA	NA	NA
PCB 138	Diff	Welch's	0.0086	0.3645	0.0615	ng/g wet
PCB 153	Diff	Welch's	0.0493	0.6021	0.3662	ng/g wet
PCB 183	No Diff	Welch's	0.2417	0.0661	0.0560	ng/g wet
PCB 187	Diff	Welch's	0.0446	0.2035	0.1680	ng/g wet
PCB 195	Not Tested	Not Tested	Not Tested	NA	NA	NA
Percent Lipids	Not Tested	Not Tested	Not Tested	NA	NA	NA
Percent Solids	Diff	Welch's	0.0001	18.3198	15.3200	%
Pyrene	Not Tested	Not Tested	Not Tested	NA	NA	NA
Selenium	Diff	Welch's	0.0000	1.4950	0.5654	µg/g wet
Silver	Not Tested	Not Tested	Not Tested	NA	NA	NA
trans-Nonachlor	Not Tested	Not Tested	Not Tested	NA	NA	NA
Vanadium	No Diff	Welch's	0.4365	0.2825	0.3244	µg/g wet
Zinc	Diff	Welch's	0.0000	24.4667	14.7000	µg/g wet

Appendix F

All Sites Statistical Testing Results

Differences between sites, including mounds and reference sites, are tested using ANOVA. Post Hoc results include Tukey and SNK tests to determine groups.

Parameter	Year	Bartlett	Levene	Tested Sites	ANOVA p-value	Difference
Aroclor 1254	2003	0.8936	0.9427	SR HI DR HE	0.9149	No Diff
2,4'-DDD	2003	0.4496	0.6608	SR HI DR HE	0.2234	No Diff
2,4'-DDE	2023	0.8902	0.9674	HI HA DR HE HO	0.0749	No Diff
2,4'-DDE	2003	0.6333	0.8754	SR HI DR HE	0.7946	No Diff
2,4'-DDT	2003	0.8300	0.9114	SR HI DR HE	0.3285	No Diff
4,4'-DDD	2023	0.3329	0.6847	HI HA DR HE	0.3255	No Diff
4,4'-DDD	2003	0.2789	0.6941	SR HI DR HE	0.6934	No Diff
4,4'-DDE	2023	0.0581	0.7207	HI HA DR HE HO	0.0464	Diff
4,4'-DDE	2003	0.2817	0.5687	SR HI DR HE	0.4678	No Diff
4,4'-DDT	2003	0.3347	0.4573	SR HI DR HE	0.8578	No Diff
BHC-alpha	2003	0.2622	0.7654	SR HI DR HE	0.0726	No Diff
Chlordane-alpha	2003	0.8260	0.8369	SR HI DR HE	0.2621	No Diff
Chlordane-gamma	2003	0.9462	0.9875	SR HI DR HE	0.2660	No Diff
cis-Nonachlor	2003	0.2167	0.6098	SR HI DR HE	0.2230	No Diff
Dieldrin	2003	0.6003	0.7956	SR HI DR HE	0.5462	No Diff
trans-Nonachlor	2023	0.1185	0.4943	HA HO	0.1642	No Diff
trans-Nonachlor	2003	0.5812	0.8877	SR HI DR HE	0.4738	No Diff
Percent Lipids	2003	0.1047	0.5414	SR HI DR HE	0.0222	Diff
Percent Lipids	2023	0.2423	0.6694	HI HA DR HE HO	0.0449	Diff
Percent Solids	2023	0.2572	0.4443	HI HA DR HE HO	0.0044	Diff
Percent Solids	2003	0.2359	0.5257	SR HI DR HE	0.1251	No Diff
Aluminum	2003	0.1488	0.4860	SR HI DR HE	0.0045	Diff
Aluminum	2023	0.5408	0.8911	HI HA DR HE HO	0.9953	No Diff
Antimony	2003	0.0558	0.6241	SR HI DR HE	0.2839	No Diff
Arsenic	2003	0.4094	0.4471	SR HI DR HE	0.1202	No Diff
Arsenic	2023	0.8519	0.8931	HI HA DR HE HO	0.0137	Diff
Barium	2023	0.3828	0.7341	HI HA DR HE HO	0.0002	Diff
Barium	2003	0.2497	0.3287	SR HI DR HE	0.0163	Diff
Beryllium	2003	0.9156	0.9434	SR HI DR HE	0.6416	No Diff
Cadmium	2003	0.9997	0.9994	SR HI DR HE	0.0515	No Diff
Cadmium	2023	0.1185	0.5362	HI HA DR HE HO	0.0001	Diff
Chromium	2023	0.0010	0.3598	HI HA DR HE HO	0.3665	No Diff
Chromium	2003	0.7927	0.9442	SR HI DR HE	0.1263	No Diff
Cobalt	2023	0.5522	0.7277	HI HA DR HE HO	0.0003	Diff
Cobalt	2003	0.9314	0.9819	SR HI DR HE	0.1239	No Diff
Copper	2023	0.1093	0.7535	HI HA DR HE HO	0.0049	Diff
Copper	2003	0.5137	0.6476	SR HI DR HE	0.1148	No Diff
Iron	2003	0.1915	0.3583	SR HI DR HE	0.0016	Diff

Parameter	Year	Bartlett	Levene	Tested Sites	ANOVA p-value	Difference
Iron	2023	0.7086	0.9098	HI HA DR HE HO	0.9518	No Diff
Lead	2023	0.6754	0.9057	HI HA DR HE HO	0.5597	No Diff
Lead	2003	0.2347	0.7199	SR HI DR HE	0.0005	Diff
Mercury	2003	0.8946	0.9496	SR HI DR HE	0.0005	Diff
Mercury	2023	0.2337	0.4468	HI HA DR HE HO	0.1069	No Diff
Molybdenum	2023	0.1384	0.4204	HI HA DR HE HO	0.4073	No Diff
Molybdenum	2003	0.3734	0.4984	SR HI DR HE	0.0000	Diff
Nickel	2023	0.1550	0.3718	HI HA DR HE HO	0.2332	No Diff
Nickel	2003	0.4434	0.7402	SR HI DR HE	0.2848	No Diff
Selenium	2003	0.8097	0.8253	SR HI DR HE	0.0896	No Diff
Selenium	2023	0.8721	0.9162	HI HA DR HE HO	0.0091	Diff
Silver	2023	0.1038	0.6973	HI DR HE HO	0.2321	No Diff
Thallium	2003	0.4772	0.5147	SR HI DR HE	0.0145	Diff
Vanadium	2003	0.3242	0.7773	SR HI DR HE	0.1125	No Diff
Vanadium	2023	0.8035	0.9408	HI HA DR HE HO	0.7125	No Diff
Zinc	2023	0.8963	0.8690	HI HA DR HE HO	0.1732	No Diff
Zinc	2003	0.2295	0.4061	SR HI DR HE	0.0278	Diff
1-Methylnaphthalene	2023	0.0218	0.4199	HI HA	0.4199	No Diff
1-Methylnaphthalene	2003	0.7316	0.8653	SR HI DR HE	0.6863	No Diff
1-Methylphenanthrene	2003	0.1045	0.5221	SR HI DR HE	0.0571	No Diff
2-Methylnaphthalene	2003	0.0241	0.2572	SR HI DR HE	0.3796	No Diff
2-Methylnaphthalene	2023	0.1747	0.6358	HI HA DR HE HO	0.3237	No Diff
2,3,5-Trimethylnaphthalene	2003	0.7327	0.8701	SR HI DR HE	0.4130	No Diff
2,6-Dimethylnaphthalene	2003	0.0033	0.5237	SR DR HE	0.4419	No Diff
Acenaphthene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Acenaphthylene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Anthracene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Benz[a]anthracene	2003	0.0783	0.5437	SR DR HE	0.4877	No Diff
Benzo[a]pyrene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Benzo[b]fluoranthene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Benzo[e]pyrene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Benzo[g,h,i]perylene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Benzo[k]fluoranthene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Biphenyl	2023	0.3981	0.6779	HE HO	0.6779	No Diff
Biphenyl	2003	0.6402	0.7915	SR HI DR HE	0.3348	No Diff
Chrysene	2003	0.1897	0.7170	SR HI DR HE	0.4986	No Diff
Dibenz[a,h]anthracene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Dibenzothiophene	2003	0.0471	0.4101	SR HI DR HE	0.3669	No Diff
Fluoranthene	2003	0.2147	0.7182	SR HI DR HE	0.0291	Diff

Parameter	Year	Bartlett	Levene	Tested Sites	ANOVA p-value	Difference
Fluoranthene	2023	0.5785	0.7768	HA DR	0.7768	No Diff
Fluorene	2003	0.1776	0.5669	SR HI DR HE	0.1802	No Diff
Indeno[1,2,3-cd]pyrene	2003	0.3280	0.6206	SR HE	0.8539	No Diff
Naphthalene	2003	0.7644	0.9435	SR HI DR HE	0.7692	No Diff
Naphthalene	2023	0.7204	0.7960	HI HA	0.7227	No Diff
Perylene	2003	0.0000	0.4033	SR DR HE	0.0759	No Diff
Phenanthrene	2003	0.0079	0.4976	SR HI DR HE	0.6080	No Diff
Pyrene	2003	0.0232	0.4469	SR HI DR HE	0.0111	Diff
PCB 049	2023	0.4739	0.7199	HA HE	0.7199	No Diff
PCB 066	2003	0.6007	0.8192	SR HI DR HE	0.3107	No Diff
PCB 087	2003	0.9469	0.9968	HI DR	0.6138	No Diff
PCB 101	2023	0.7631	0.9269	HI HA HO	0.9269	No Diff
PCB 101	2003	0.9302	0.9641	SR HI DR HE	0.2695	No Diff
PCB 105	2003	0.5144	0.8710	SR HI DR HE	0.7497	No Diff
PCB 110	2003	0.4248	0.7593	SR HI DR HE	0.2651	No Diff
PCB 110	2023	0.6118	0.8842	DR HE HO	0.8842	No Diff
PCB 118	2003	0.6352	0.7595	SR HI DR HE	0.3609	No Diff
PCB 128	2003	0.5809	0.7908	SR HI DR HE	0.0981	No Diff
PCB 138	2003	0.9041	0.9508	SR HI DR HE	0.1705	No Diff
PCB 153	2023	0.1000	0.8754	HI HA DR HE HO	0.3284	No Diff
PCB 153	2003	0.6709	0.8857	SR HI DR HE	0.8846	No Diff
PCB 183	2003	0.2676	0.7064	SR HI DR HE	0.0368	Diff
PCB 187	2003	0.3553	0.5708	SR HI DR HE	0.6995	No Diff

Parameter	Year	Site	Tukey Group	SNK Group
4,4'-DDE	2023	DR	a	a
		HA	a	a
		HE	a	a
		HI	a	a
		HO	a	a
Arsenic	2023	DR	b	b
		HA	a	a
		HE	b	b
		HI	ab	b
		HO	b	b
Barium	2023	DR	b	b
		HA	a	a
		HE	b	b

Parameter	Year	Site	Tukey Group	SNK Group
		HI	b	b
		HO	b	b
Cadmium	2023	DR	a	a
		HA	c	c
		HE	ab	a
		HI	c	c
		HO	bc	b
Cobalt	2023	DR	c	b
		HA	a	a
		HE	ab	a
		HI	a	a
		HO	bc	b
Copper	2023	DR	b	b
		HA	b	b
		HE	a	a
		HI	ab	b
		HO	b	b
Percent Lipids	2023	DR	a	a
		HA	a	a
		HE	a	a
		HI	a	a
		HO	a	a
Percent Solids	2023	DR	bc	b
		HA	a	a
		HE	abc	b
		HI	ab	a
		HO	c	b
Selenium	2023	DR	ab	abc
		HA	a	a
		HE	ab	bc
		HI	a	ab
		HO	b	c
Aluminum	2003	DR	a	a
		HE	ab	a
		HI	b	b
		SR	a	a
Barium	2003	DR	ab	a
		HE	ab	a
		HI	b	b

Parameter	Year	Site	Tukey Group	SNK Group
		SR	a	a
Fluoranthene	2003	DR	b	b
		HE	Ab	ab
		HI	a	a
		SR	ab	a
Iron	2003	DR	a	a
		HE	bc	bc
		HI	c	c
		SR	ab	ab
Lead	2003	DR	a	a
		HE	bc	b
		HI	c	c
		SR	ab	ab
Mercury	2003	DR	a	a
		HE	b	b
		HI	b	b
		SR	b	b
Molybdenum	2003	DR	b	b
		HE	b	b
		HI	b	b
		SR	a	a
PCB 183	2003	DR	a	a
		HE	a	a
		HI	a	a
		SR	a	a
Percent Lipids	2003	DR	b	b
		HE	b	b
		HI	a	a
		SR	ab	ab
Pyrene	2003	DR	b	b
		HE	ab	ab
		HI	a	a
		SR	a	a
Thallium	2003	DR	b	b
		HE	b	b
		HI	a	a
		SR	ab	ab
Zinc	2003	DR	a	a
		HE	ab	ab

Parameter	Year	Site	Tukey Group	SNK Group
		HI	ab	b
		SR	b	b

Appendix C3

2022 ROV Survey Technical Report (Chevron 4H Shell Mounds Environmental Assessment)

Chevron 4H Shell Mounds Environmental Assessment

Final Technical Report of Survey Results to: DUDEK

Contract Job No. 14384

Report Prepared by: Heidi Lovig

Reviewed by: Dirk Rosen & Andrew Lauermann

August, 2022

Marine Applied Research and Exploration
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INTRODUCTION

Marine Applied Research and Exploration (MARE) completed video surveys on July 8th and 9th of 2022 under contract to Dudek to describe habitats and associated species at the locations of four shell mounds, formerly underneath 4H oil rigs that have since been removed. This survey was a part of California's State Lands Commission's environmental assessment evaluating Chevron's proposal to leave the shell mounds in place. The shell mounds, Hazel, Heidi, Hilda and Hope are located between Oxnard and Santa Barbara, California. Video and still photos were captured at all four sites, and then reviewed to characterize finfish, macroinvertebrates and their associated habitats on and around each shell mound. Video was also reviewed for the location of oil rig and other man-made debris on and around each shell mound.

DATA COLLECTION METHODS

EQUIPMENT

The hydrodynamic towed sled used in this survey is called the BATFish and it was designed and built by MARE. The BATFish has actuated main wings for movement up and down and actuated tail wings to control the vehicles pitch and roll. Pilot control was accomplished via a joystick and throttle package. The joystick allowed the pilot to control the vehicle's altitude, and the throttle levers provided pitch and roll control and main wing setpoint angle.

The vehicle was equipped with one forward facing high definition video camera, one GoPro camera to capture timed stills, two lights, a ranging sonar, and paired lasers for scaling. Real time video was displayed on a monitor with a superimposed display that provided the pilot with real time sensor data (depth, altitude, water temperature, heading, and pitch/roll angle). All video was recorded with vMix® recording software (30fps, 1920 x 1080) and stored on an external hard drive. Positional information was calculated and recorded using HYPACK® hydrographic survey and navigation software.

OPERATIONS AND SAMPLING DESIGN

BATFish operations were conducted off the boat, 'The Way Out' operated by the Keith Wollart. The Way Out is a 35-foot fiberglass hull power-cruiser built to conduct oceanographic research in and around Southern California.

The BATFish was manually deployed off the stern side of the vessel by hand. Once in the water, one crewmember paid out the desired length of umbilical and clipped it into the tow harness of the boat. The boat towed the BATFish at approximately 1.1 meters per second making multiple passes in varying directions on and around each shell mound study site in a figure-8 pattern.

Transects covered a study area of approximately 31 square kilometers for all four shell mounds. Each transect was an average of approximately 270 meters-long and 4.5-feet wide and took an average of 4.2 minutes to complete. Transects were larger than the shell mound diameter in order to compare each mound with surrounding benthic finfish and macroinvertebrate communities and habitats, and to identify debris that is located away from the mounds.

POST-PROCESSING METHODS

POSITIONAL AND SENSOR DATA

Positional information, in the form of XY metric coordinates, was recorded for the BATFish using a layback calculation built into HYPACK® based on the amount of umbilical paid out and the depth of the equipment in relation to the survey boat. This positional data was post-processed to provide a one-second file that contains the merged position and the real time sensor data.

MAPPING

Maps were generated of survey lines detailing the precise locations of habitat, fish, macroinvertebrates and oil rig debris. These were overlaid in ArcMap onto multibeam echosounder images taken from Fugro USA Marine's Carpinteria Shell Mounds Field Operations Report (Fugro 2021), in order to reference their locations in relation to each shell mound.

A portion of each survey transect line was classified as 'off transect', meaning the bottom was not visible during that portion of the video. Segments of transects that were classified as off transect were not reviewed for habitat, finfish, macroinvertebrates, still photos or oil rig debris, and were therefore not included when mapping each of these elements.

HABITAT CHARACTERIZATION

Video was reviewed for three different habitat types: rock, mud and shell debris (AKA 'shell'). Rock was defined as any igneous, metamorphic or sedimentary substrate; mud as fine silt-like material, and shell as fragments or whole pieces of shell (Green et al. 1999).

FINFISH ENUMERATION AND DENSITY

Transects were post-processed for fish using the forward camera's horizontal field of view at the mid-screen. A screen overlay representing a diminishing perspective was used during fish review to approximate the transect width above the mid-screen of the viewing monitor. The overlay served as a guide for determining if a fish was in or out of the transect. Fish that entered the viewing area were only counted if more than half the fish crossed the overlay guidelines.

Fish density was calculated using the distance traveled (from Hypack) and the width of the transect, which was estimated for each second using the forward ranging sonar and the known properties of the camera's field of view (Karpov et al. 2006). Using this approach, an area covered per second was calculated and then summarized by habitat type for each transect.

INVERTEBRATE ENUMERATION AND DENSITY

Invertebrates were post-processed using the forward camera's field of view at the bottom of the viewing monitor. A screen overlay was used during invertebrate review to approximate the transect width at the bottom of the screen. The diminishing perspective overlay lines served as a guide for determining if an invertebrate was in or out of the transect. The overlay used for invertebrate enumeration was the same as the overlay used in habitat classification, allowing for direct correlation of habitat to each invertebrate observation.

Invertebrate density was also calculated using the distance traveled (from Hypack) and the width of the transect, which was estimated for each second using the forward ranging sonar and the known properties of the camera's field of view (Karpov et al. 2006). Using this approach, an area covered per second was calculated and then summarized by habitat type for each transect.

STILL IMAGE POST-PROCESSING

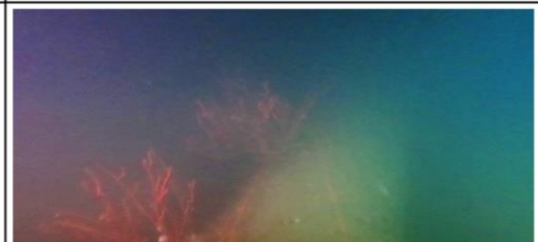
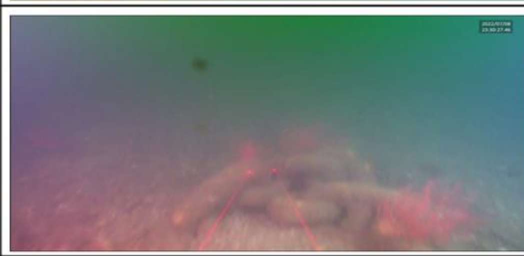
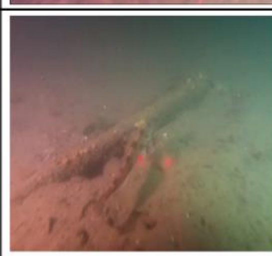
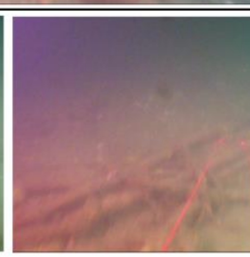
GoPro still images were processed to identify evidence of bioturbation including holes, tracks and feeding disturbances. As it is difficult to infer what species caused the hole, track or disturbance, they were not identified to the species level. Holes may have been caused by withdrawn clam siphons, mollusk burrows, worm tubes, or another burrowing invertebrate. Feeding disturbances may include bat ray wallows, sand star indentations etc. Photos were also reviewed for evidence of intact half or full mussel shells, not shell fragments.

All photos that did not show both parallel lasers were not processed because the lasers are necessary for an accurate area estimate. In addition, only the lower half of the photos was reviewed, as the upper half of the majority of the photos was unusable. The area of each photo was calculated using the paired 10-cm spaced lasers and the known properties of the forward HD camera.

DEBRIS

The location of oil rig debris and other man-made debris seen along each survey transect was annotated during video review. Debris included: crab and lobster pots, large structures, pipes, large chains, UI debris and other oil rig debris (Table 1). The location of debris was mapped by overlaying it onto contour maps of each shell mound. The approximate location of debris off of each shell mound was measured from the outside perimeter of each mound based on multibeam echosounder images to determine their approximate distance from the shell mound being surveyed.

Table 1. Examples and descriptions of debris (with the exception of crab/lobster pots) identified from video review.

Large structure	Large solid structure extending above the seafloor	
Pipe	Large pipe(s) that appear intact and extend beyond the vehicle's field of view	
UI debris	Visible debris, but unidentifiable due to poor visibility	
Large chain	Sections of anchor or buoy chain, often in piles	
Oil rig debris	Pieces of metal, cable, rigging or smaller sections of rope and/or pipes	 

RESULTS

SURVEY TOTALS

From July 8th through 9th, the BATFish surveyed a total of 24.6 linear kilometers during 5.17 hours of towed-survey time around four former oil rig sites: Hilda, Hope, Heidi and Hazel (Figure 1). During deployment, the BATFish flew wide loops to circle back around for each new transect. These loops were not post-processed along with unusable segments of transects which included: areas of low visibility due to bottom sedimentation stirring, obstacle avoidance(debris) or loss of bottom due to changes in topography (backside of shell mounds).

Usable data, totaling 7.2 linear kilometers on 27 transects were post-processed. This generated a total of 1.68 hours of usable video with depths ranging from 12.3 meters to 43.2 meters (Table 2). Figures 2-5 show the useable BATFish transect lines flown at each shell mound location.

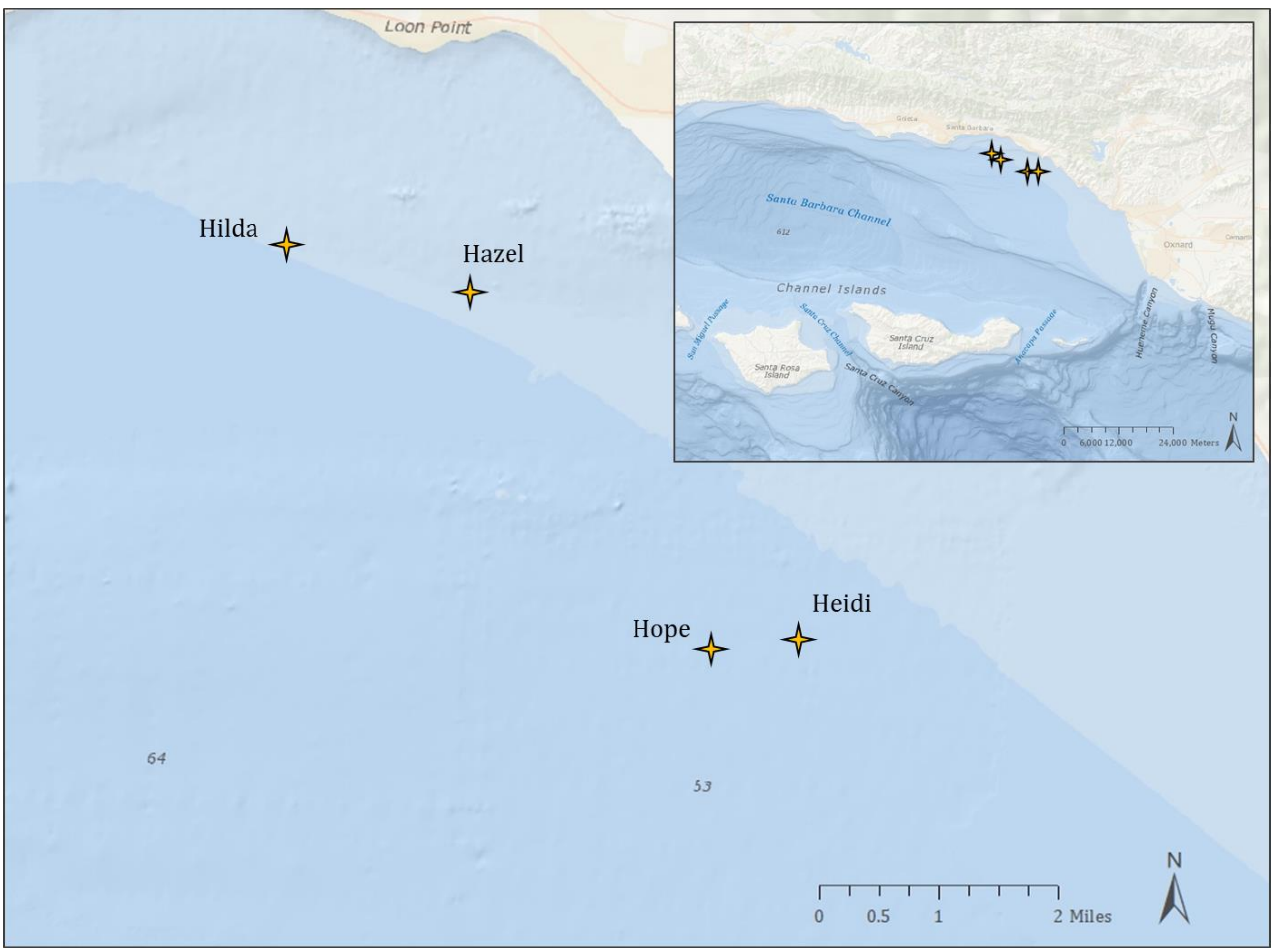


Figure 1. Locations of four survey sites: Hilda, Hazel, Hope and Heidi.

Table 2. Survey totals for usable portions of each transect at Hilda, Hope, Heidi and Hazel, including total number of transects surveyed at each site, minutes of video, total distance surveyed, transect area for fish and invertebrates, and depth (average, minimum and maximum).

Site	Total Number of passes (Transects)	Minutes of video	Survey Distance (km)	Transect Area (m^2)		Depth (m)		
				Fish	Invert	Average	Min	Max
Hilda	8	22.9	1.8	6,872.4	4,123.4	31.3	12.3	36.1
Hope	7	25.9	1.5	7,885.3	4,731.2	39.4	30.1	43.2
Heidi	6	30.8	1.8	8,346.2	5,007.7	37.8	31.8	40.2
Hazel	6	32.3	2.1	8,718.3	5,231.0	28.9	22.4	31.5

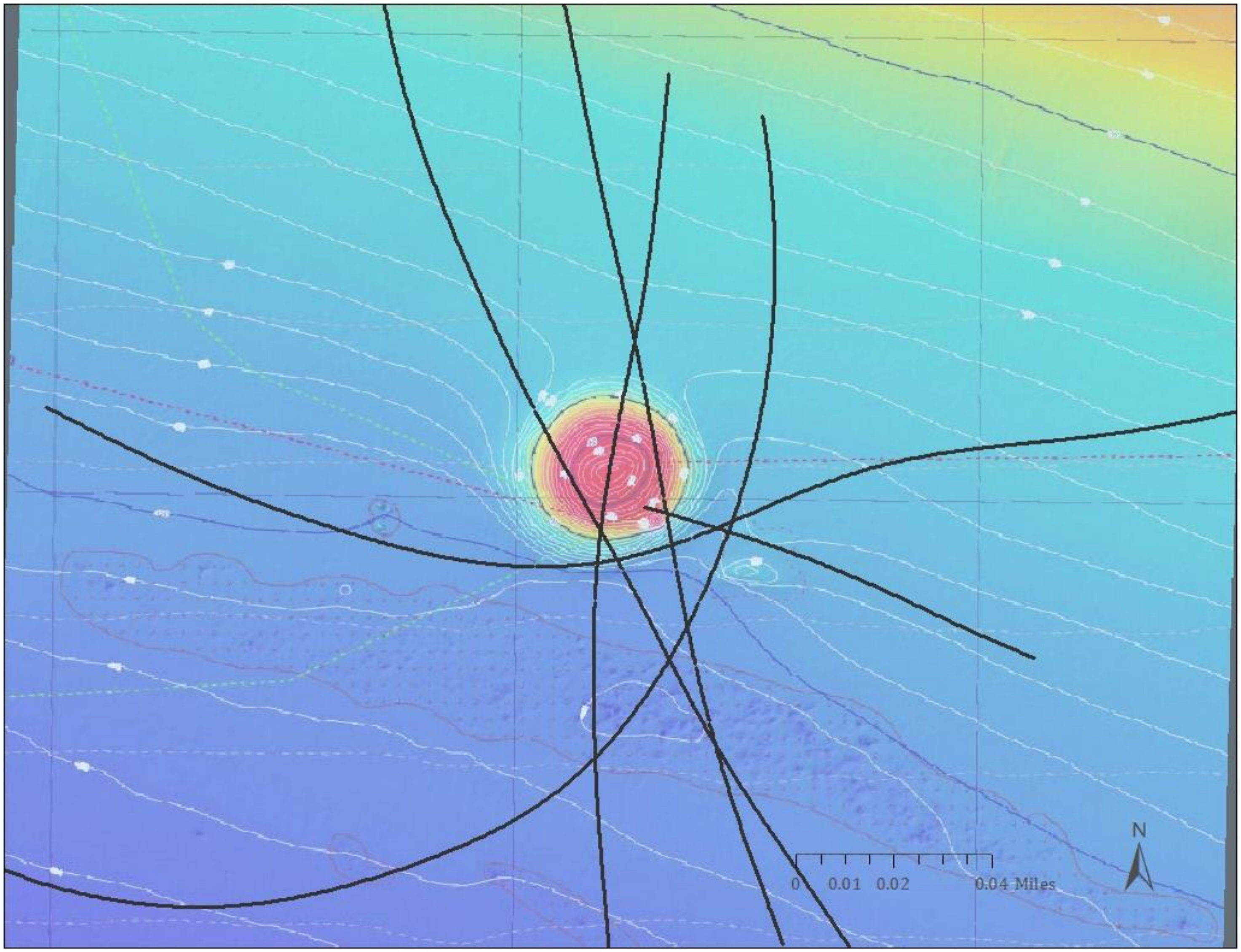


Figure 2. Map of Hazel shell mound showing BATFish survey lines around the shell mound.

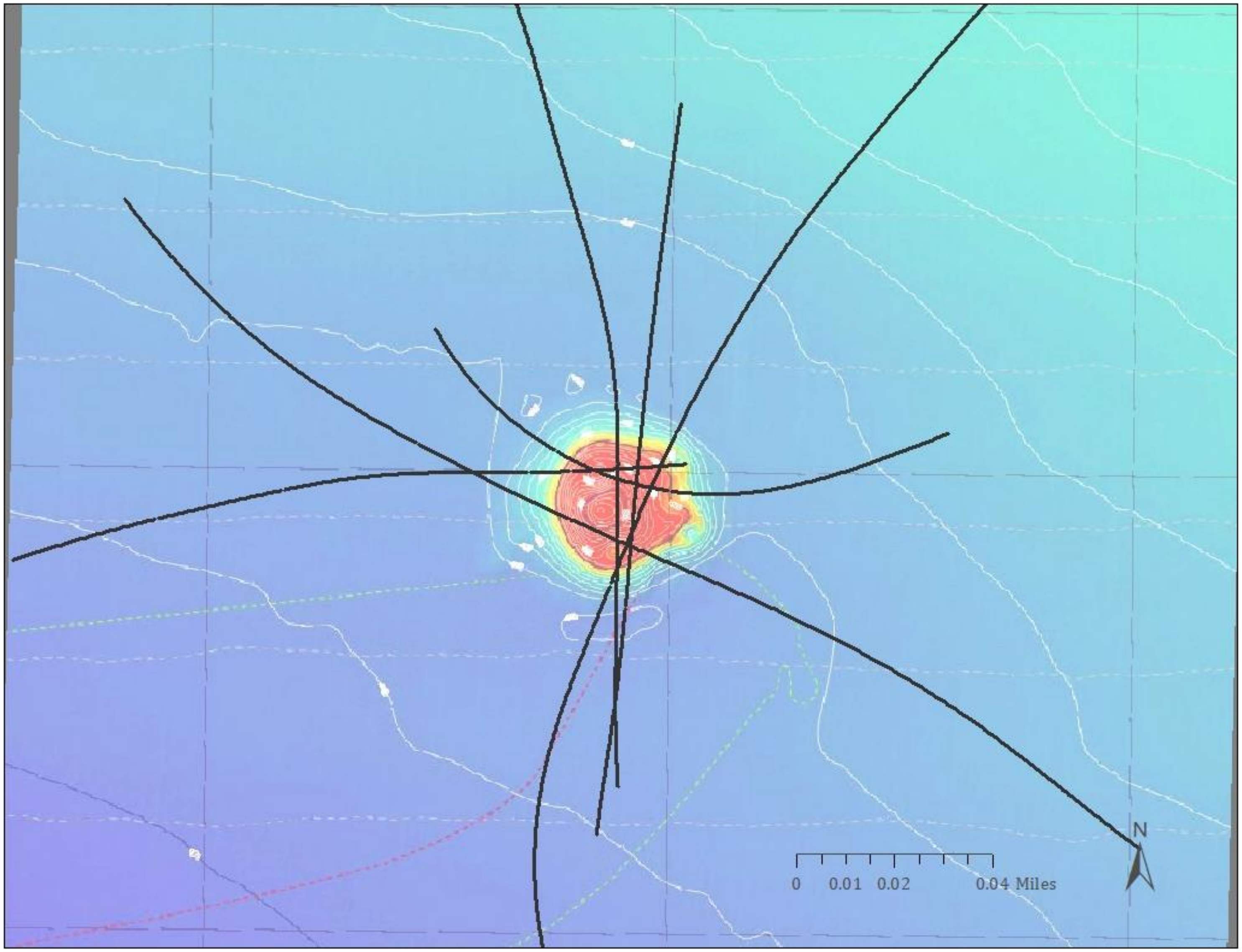


Figure 3. Map of Heidi shell mound showing BATFish survey lines around the shell mound.

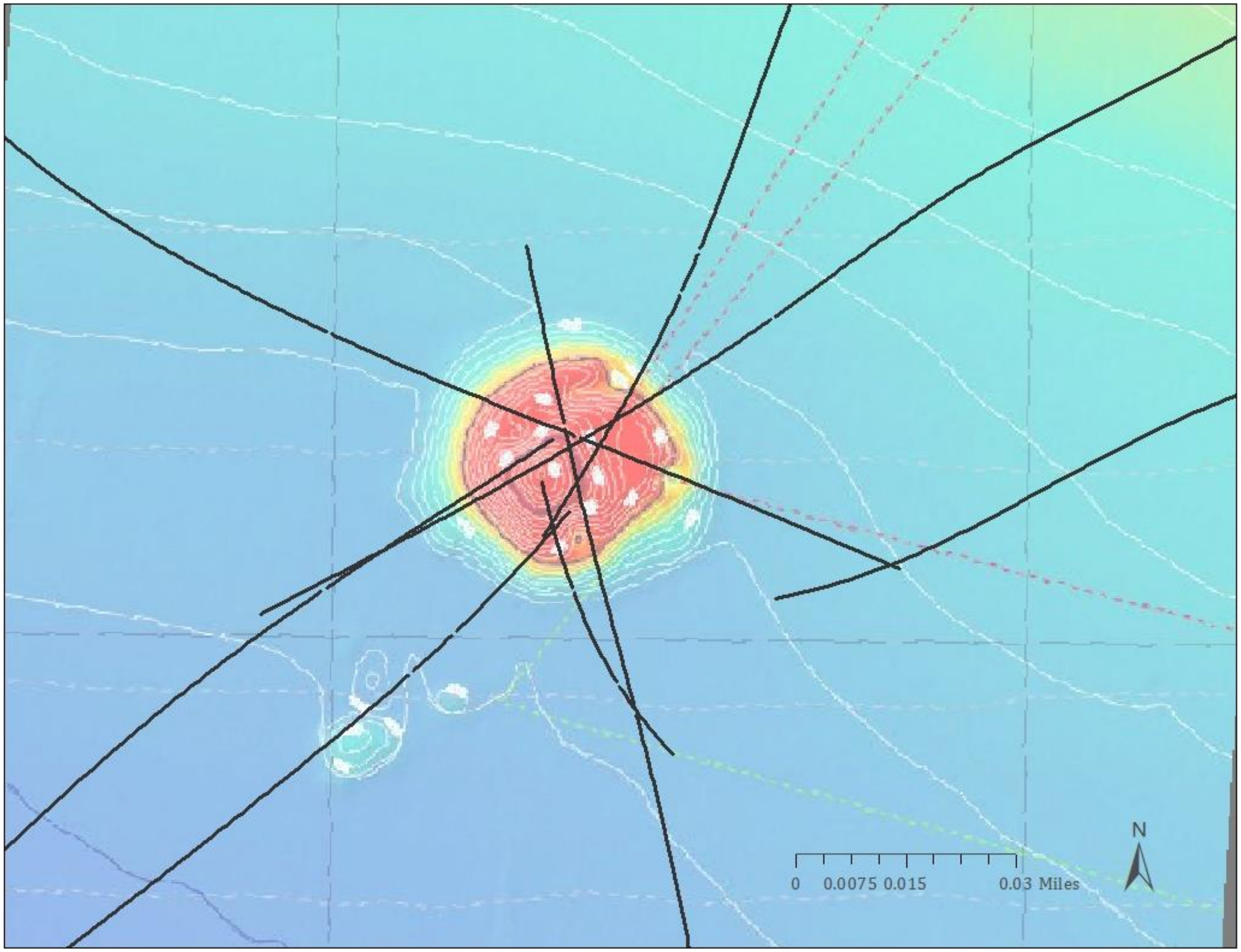


Figure 4. Map of Hilda shell mound showing BATFish survey lines around the shell mound.

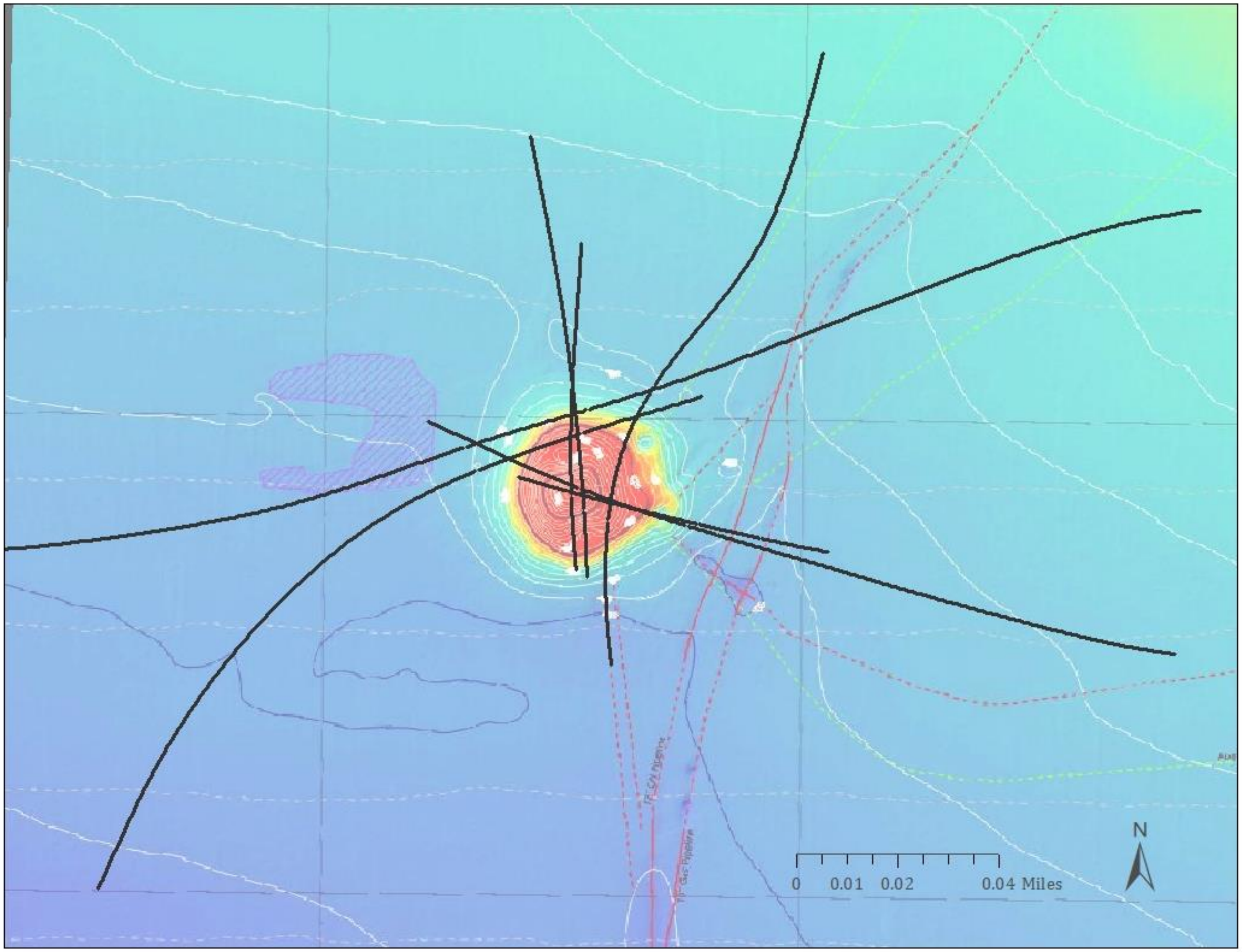


Figure 5. Map of Hope shell mound showing BATFish survey lines around the shell mound.

HABITAT

At all four sites, the BATFish surveyed a comparable amount of total transect distance and ranged between 4.1 and 5.2 kilometers (Table 3). A total of three habitat types, including mud, shell and rock were identified during video review (Figure 6). Mud accounted for the highest percentage of habitat at all four sites, accounting for approximately 78 to 87 percent of the habitats encountered (Table 3, Figures 7-10). Shell fragments were less common across all sites, and accounted for approximately 13 to 22 percent of the habitats encountered (Table 3, Figures 7-10). One very small section of rock was observed at Hazel, and was not seen at any other site (Table 3, Figure 7).

Figure 6. From left to right: examples of mud and shell.

Table 3. Total usable transect area, and the percent habitat type for those portions, including mud, shell and rock at all four survey sites.

Site	Total Area Surveyed (Km^2)	Percent Habitat		
		Mud	Shell	Rock
Hazel	5.2	86.6	13.1	0.3
Heidi	5.0	78.1	21.9	0
Hilda	4.1	86.2	13.8	0
Hope	4.7	80.5	19.5	0

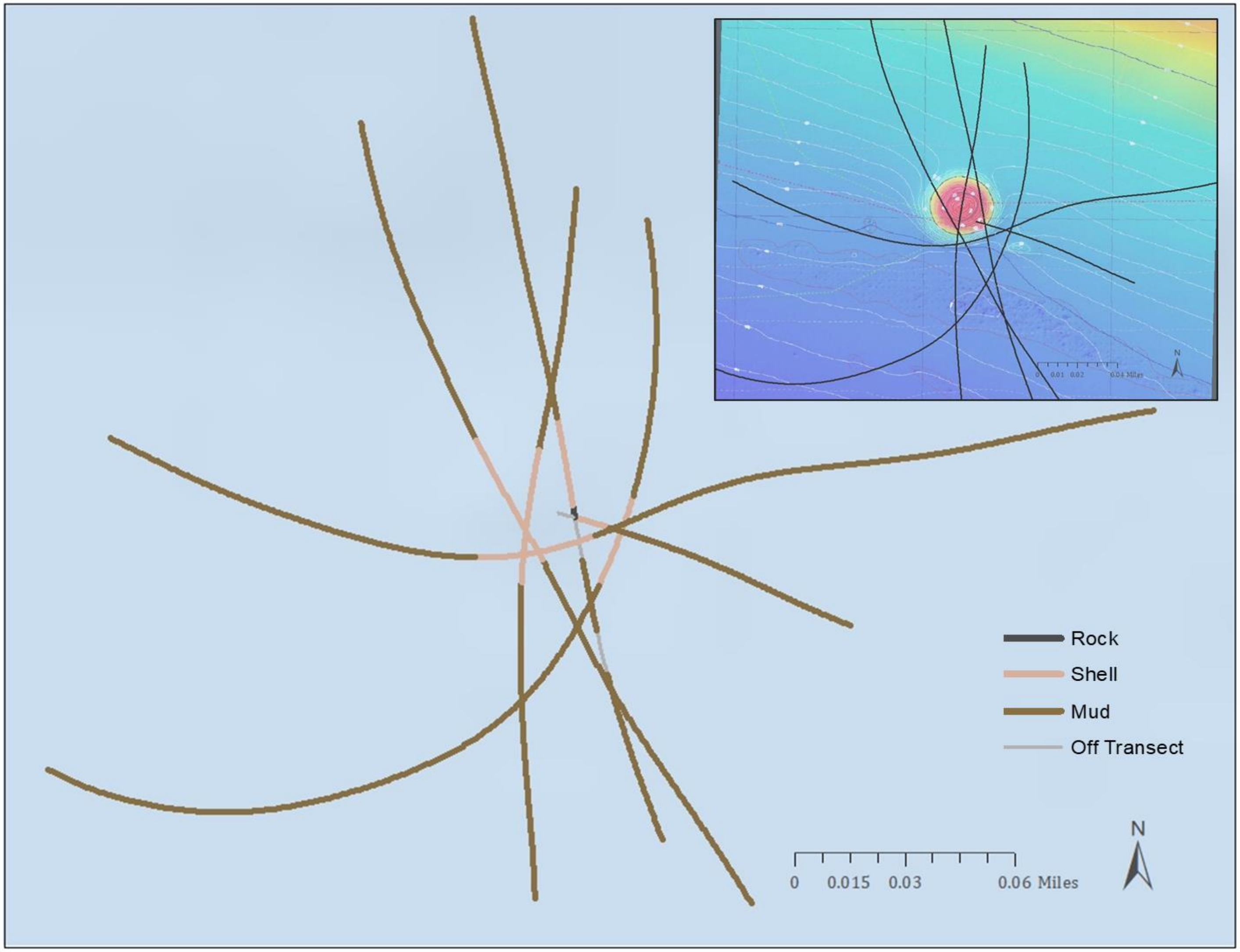


Figure 7. Map of Hazel shell mound showing three habitat types, including mud, shell and rock and off transect areas identified from video review. Inset shows the location of the shell mound in reference to transect lines.

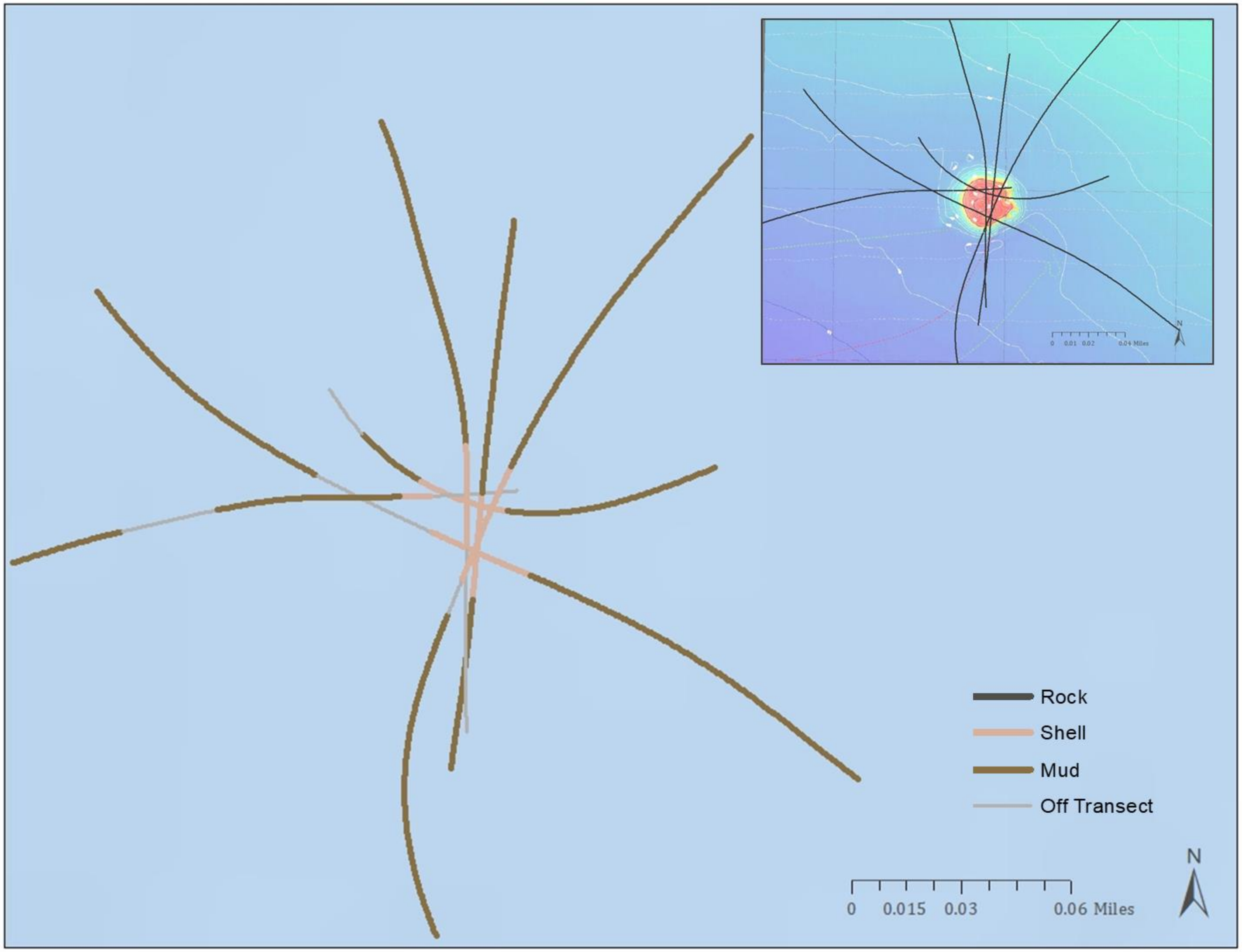


Figure 8. Map of Heidi shell mound showing three habitat types, including mud, shell and rock and off transect areas identified from video review. Inset shows the location of the shell mound in reference to transect lines.

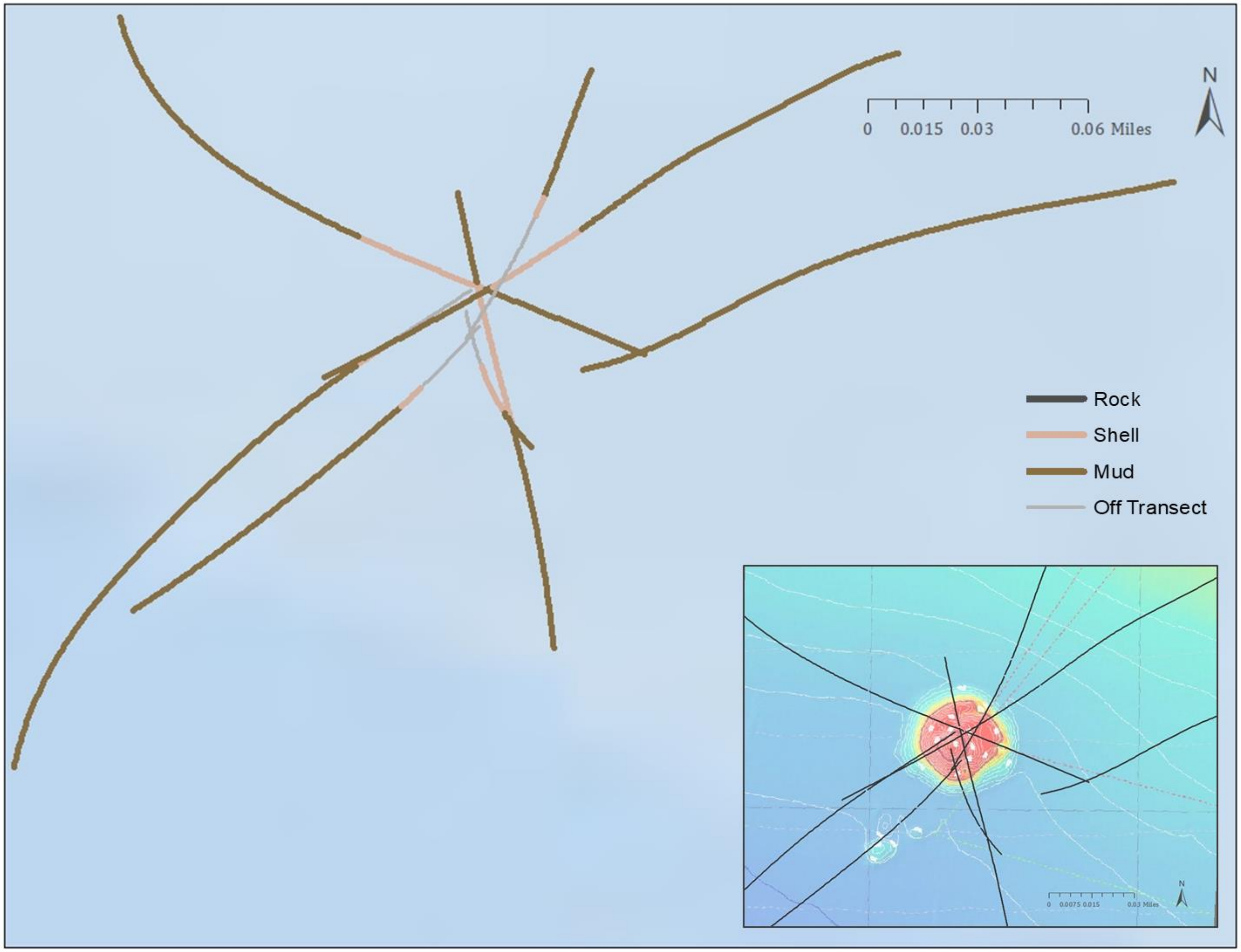


Figure 9. Map of Hilda shell mound showing three habitat types, including mud, shell and rock and off transect areas identified from video review. Inset shows the location of the shell mound in reference to transect lines.

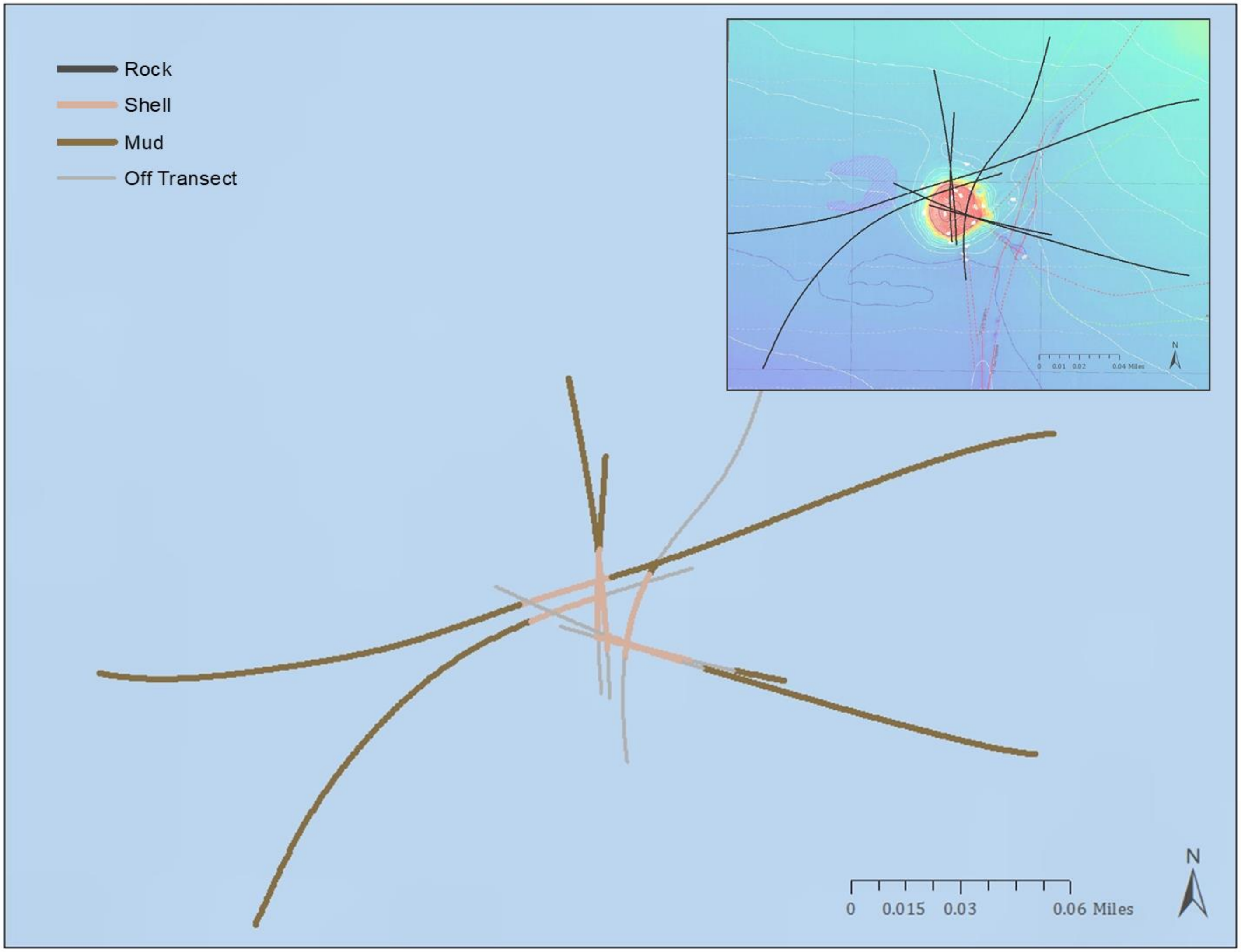


Figure 10. Map of Hope shell mound showing three habitat types, including mud, shell and rock and off transect areas identified from video review. Inset shows the location of the shell mound in reference to transect lines.

FISH

A total of 207 individual fish from fifteen species/groupings were observed during the survey across all sites combined (Table 4). Surfperch were the most commonly observed fish grouping, with UI Surfperch and Pink Surfperch accounting for over half (53.1%) of all fish observed. Other fish species/groupings that were also more commonly observed include: Barred Sand Bass, Short and Longspine Combfish and small benthic fish (Table 4). More fish (41% of all fish seen) were observed at Heidi when compared to all other survey sites (Table 5). Figures 11–14 show the locations of all fish observations on survey transects recorded during video review at each shell mound.

Table 4. The common name, scientific name and total count of all fish species or groupings of fish observed at all four survey sites.

Common Name	Species Name	Total Count
UI surfperch	Unidentified Embiotocidae	63
Pink Seaperch	Zalembius rosaceus	47
Barred Sand Bass	Paralabrax nebulifer	25
Shortspine/Longspine Combfish complex	Zaniolepis frenata or latipinnis	24
UI small benthic fish	Unidentified small benthic fish	17
UI fish	Unidentified fish	10
YOY	Young of year	6
Lingcod	Ophiodon elongatus	5
UI rockfish	Unidentified Sebastes sp.	3
UI flatfish	Unidentified Pleuronectidae	2
Brown Rockfish	Sebastes auriculatus	1
Calico Rockfish	Sebastes dallii	1
Pile Perch	Rhacochilus vacca	1
UI ray/skate	Unidentified Elasmobranchii (ray or skate)	1
UI Sebastomus rockfish	Unidentified Sebastomus sp.	1
	Total:	**207**

Table 5. The common name, count and mean density per 100m² of fish observed on each habitat type at the four survey sites, Hazel, Heidi, Hilda and Hope.

Site	Habitat	Common Name	Count	Density per 100m²
Hazel	Mud	Pink Seaperch	13	0.16
		Shortspine/Longspine Combfish complex	5	0.06
		UI surfperch	24	0.29
	Shell	Barred Sand Bass	3	0.04
		Brown Rockfish	1	0.01
		Lingcod	3	0.04
		UI fish	4	0.05
		UI rockfish	1	0.01
		UI surfperch	2	0.02
	Rock	UI fish	2	0.02
		Hazel Total	**58**	
Heidi	Mud	Pink Seaperch	11	0.22
		Shortspine/Longspine Combfish complex	15	0.30
		UI small benthic fish	13	0.26
		UI surfperch	19	0.38
	Shell	Barred Sand Bass	16	0.32
		Calico Rockfish	1	0.02
		UI rockfish	1	0.02
		UI surfperch	2	0.04
		YOY	1	0.02
		Heidi Total	**79**	
Hilda	Mud	Pink Seaperch	15	0.23
		Shortspine/Longspine Combfish complex	4	0.06
		UI surfperch	3	0.05
	Shell	Barred Sand Bass	3	0.05
		UI ray/skate	1	0.02
		Hilda Total	**26**	
Hope	Mud	Lingcod	1	0.02
		Pile Perch	1	0.02
		Pink Seaperch	7	0.15
		UI fish	2	0.04
		UI flatfish	2	0.04
		UI small benthic fish	2	0.04
		UI surfperch	9	0.19
	Shell	Barred Sand Bass	3	0.06
		Lingcod	1	0.02
		UI fish	1	0.02
		UI rockfish	1	0.02
		UI Sebastomus rockfish	1	0.02
		UI surfperch	1	0.02
		YOY	5	0.11
		Hope Total	**37**	

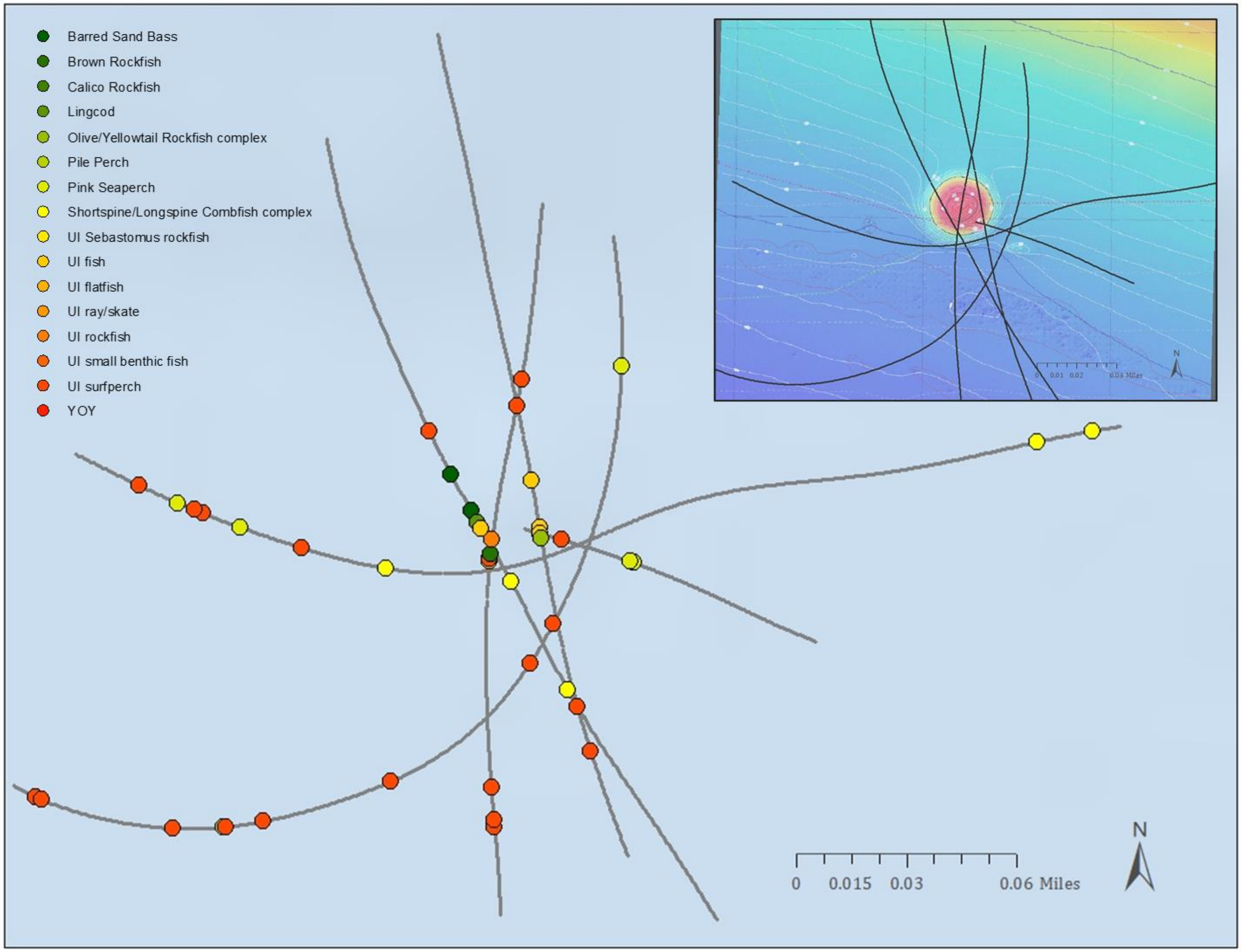


Figure 11. Map of Hazel shell mound showing all fish observations on survey transects recorded during video review. Inset shows the location of the shell mound in reference to transect lines.

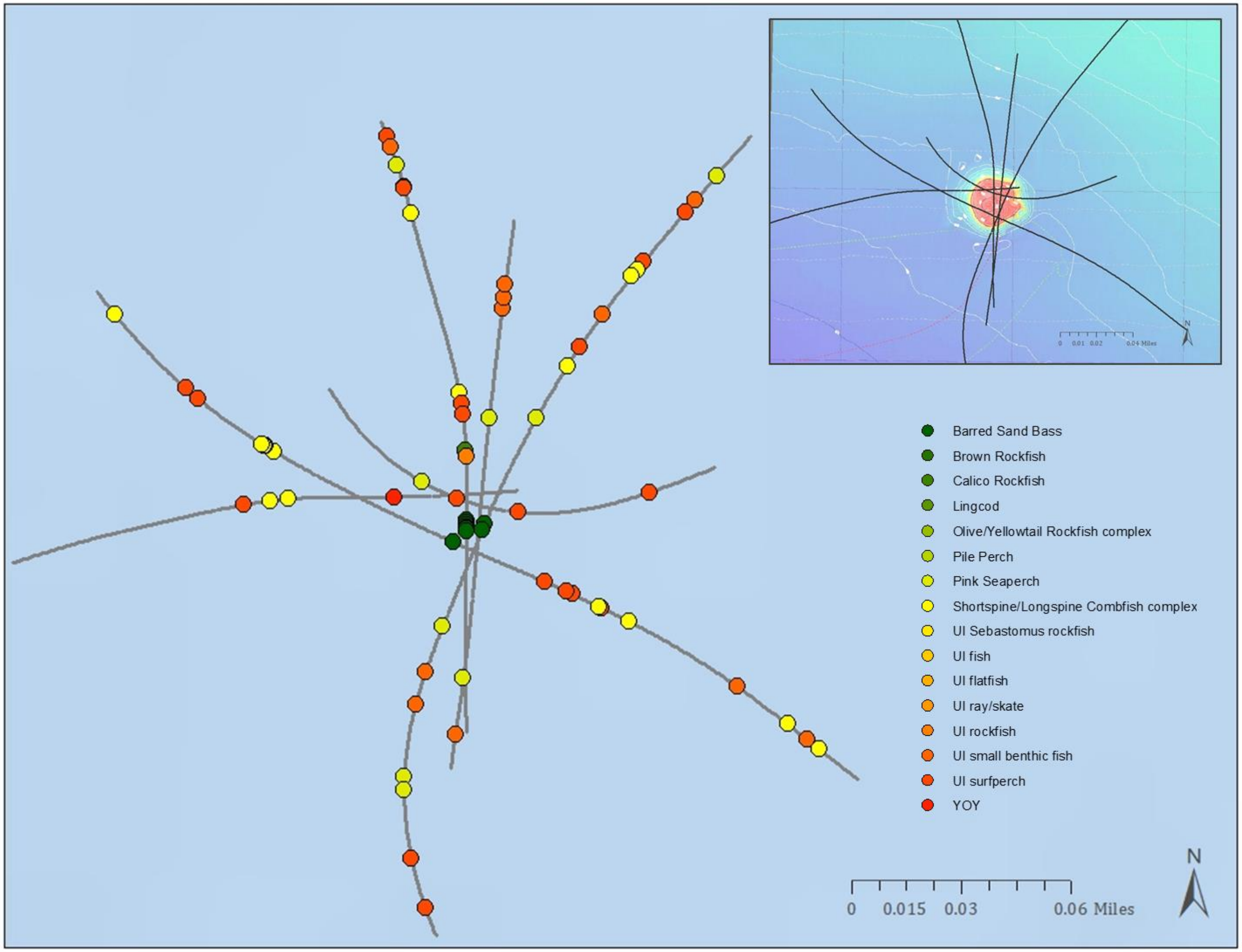


Figure 12. Map of Heidi shell mound showing all fish observations on survey transects recorded during video review. Inset shows the location of the shell mound in reference to transect lines.

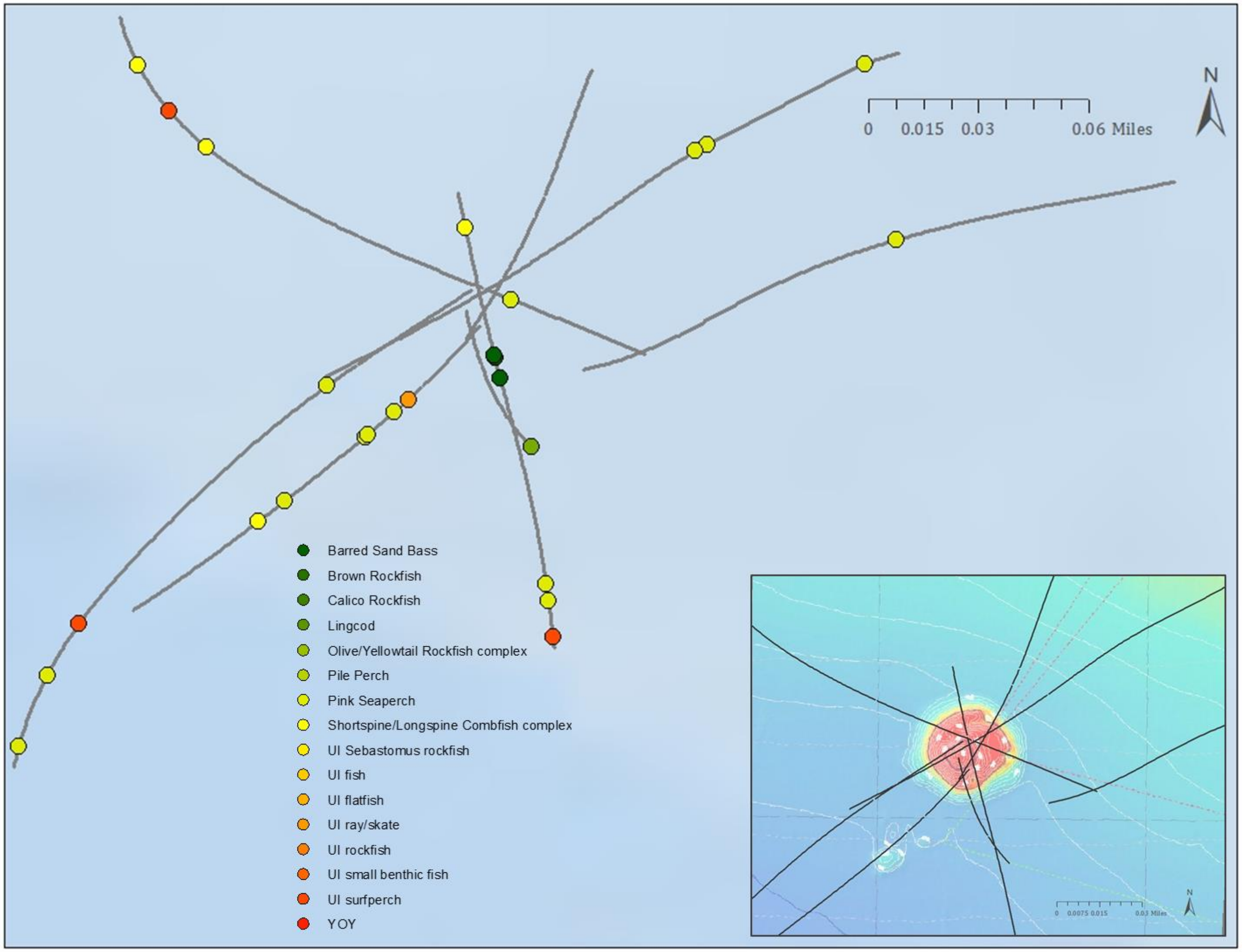


Figure 13. Map of Hilda shell mound showing all fish observations on survey transects recorded during video review. Inset shows the location of the shell mound in reference to transect lines.

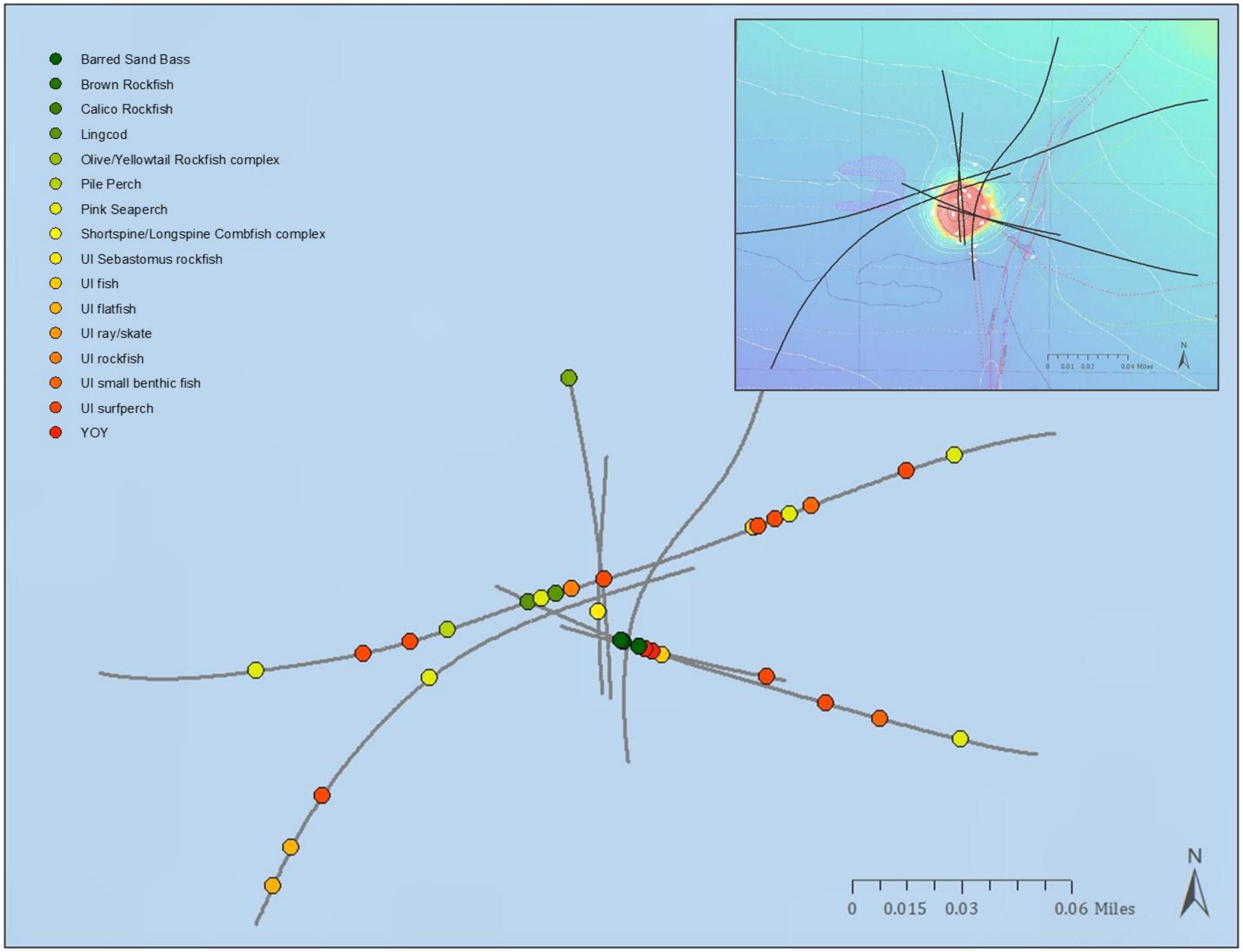


Figure 14. Map of Hope shell mound showing all fish observations on survey transects recorded during video review. Inset shows the location of the shell mound in reference to transect lines.

MACROINVERTEBRATES

A total of 20,932 individual macroinvertebrates or groupings of invertebrates were observed during the survey across all sites (Table 6). White sea pens were the most commonly seen invertebrate, accounting for 98.7% of all invertebrates observed during this survey. Soft corals, including red, purple and orange gorgonians were also relatively common, with the majority of individuals (over 70%) being enumerated at Hazel (Table 7). Additionally, more invertebrates were observed at Hazel than at any other site combined (Table 7). Figures 15 – 18 show all invertebrate observations on survey transects recorded during video review at each shell mound.

Table 6. The common name, scientific name and total count of all invertebrate species or groupings of invertebrates observed at all four survey sites.

Common Name	Species Name	Total Count
White sea pen	Stylatula elongata	20,655
Red gorgonian	Leptogorgia chilensis	90
Purple gorgonian	Eugorgia rubens	84
Bat star	Patiria miniata	50
Orange gorgonian	Adelogorgia phyllosclera	22
Sea whip	Halipteris californica	15
California market squid	Loligo opalescens	6
Giant rock-scallop	Crassadoma gigantea	6
UI tube dwelling anemone	Unidentified Actiniaria (tube dwelling)	3
California sea cucumber	Apostichopus californicus /syn./ Parastichopus californicus	1
	Total:	**20,932**

Table 7. The common name, count and mean density per 100m² of macroinvertebrates observed on each habitat type at the four survey sites, Hazel, Heidi, Hilda and Hope.

Site	Habitat	Common Name	Count	Density per 100m²
Hazel	Mud	California market squid	6	0.12
		Sea whip	1	0.02
		UI tube dwelling anemone	1	0.02
		White sea pen	14,021	280.69
	Shell	Bat star	1	0.02
		Giant rock-scallop	6	0.12
		Orange gorgonian	4	0.08
		Purple gorgonian	42	0.83
		Red gorgonian	21	0.43
	Rock	Orange gorgonian	18	0.36
		Purple gorgonian	26	0.53
		Red gorgonian	27	0.53
		Hazel Total	**14,174**	
Heidi	Mud	Purple gorgonian	1	0.03
		Red gorgonian	2	0.07
		Sea whip	1	0.03
		White sea pen	1,343	44.90
	Shell	Purple gorgonian	1	0.03
		Red gorgonian	9	0.30
		White sea pen	3	0.10
		Heidi Total	**1,360**	
Hilda	Mud	White sea pen	4,925	125.09
	Shell	Bat star	1	0.03
		Purple gorgonian	12	0.30
		Red gorgonian	18	0.46
		Sea whip	1	0.03
		Hilda Total	**4,957**	
Hope	Mud	Bat star	2	0.07
		Purple gorgonian	1	0.04
		Red gorgonian	5	0.18
		Sea whip	12	0.42
		UI tube dwelling anemone	1	0.04
		White sea pen	353	12.47
	Shell	Bat star	46	1.63
		California sea cucumber	1	0.04
		Purple gorgonian	1	0.04
		Red gorgonian	8	0.28
		UI tube dwelling anemone	1	0.04
		Hope Total	**431**	

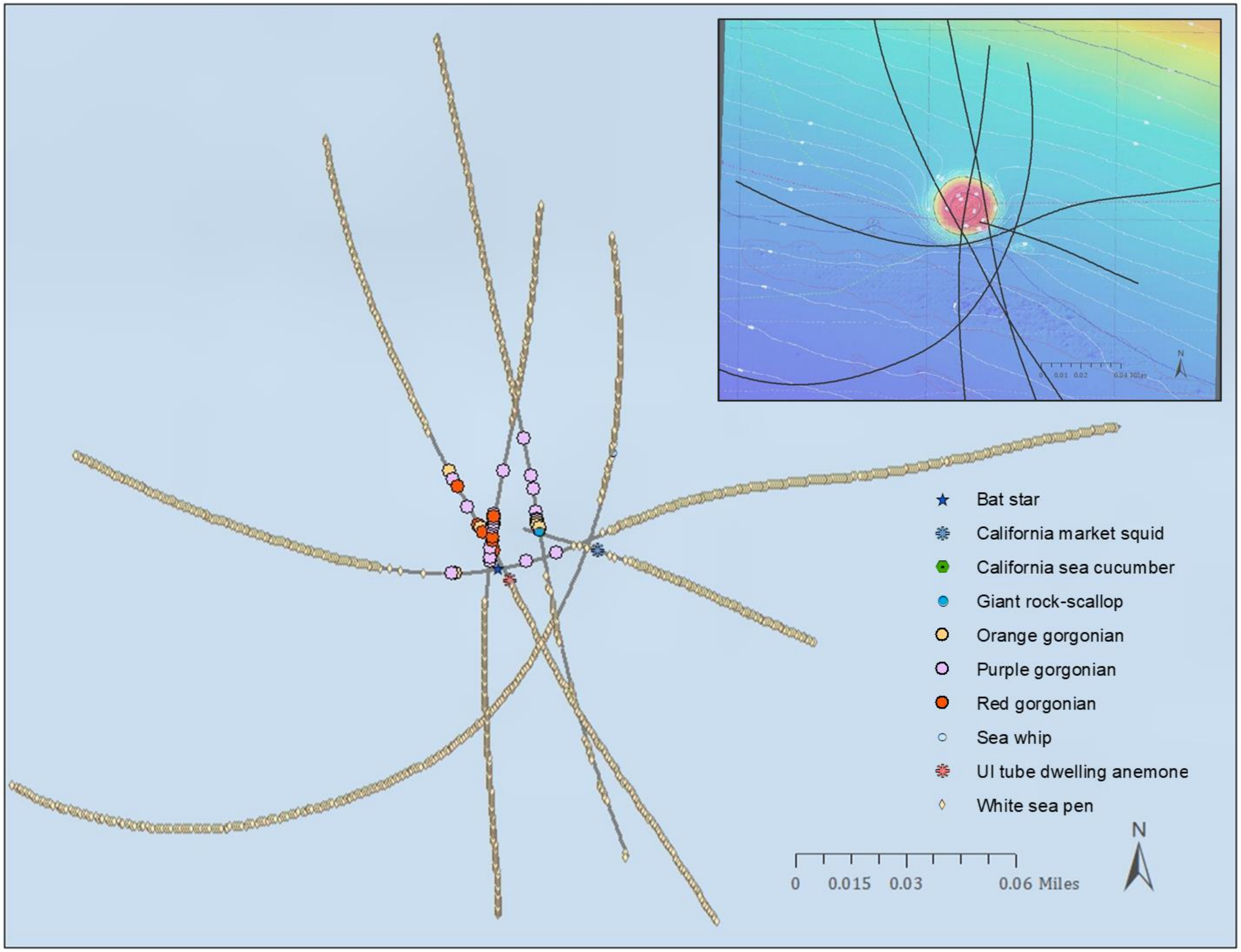


Figure 15. Map of Hazel shell mound showing all Invertebrate observations on survey transects recorded during video review. Inset shows the location of the shell mound in reference to transect lines.

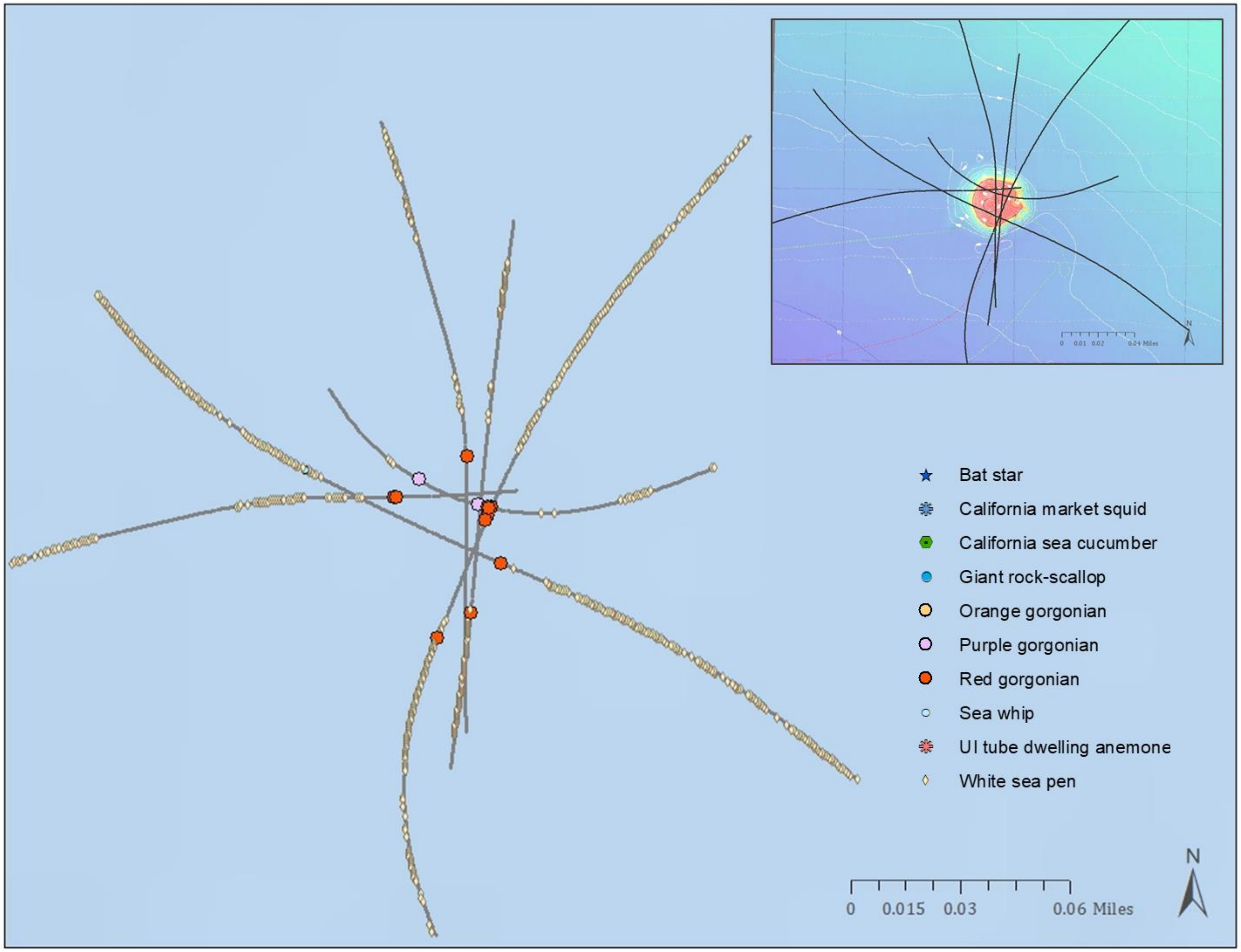


Figure 16. Map of Heidi shell mound showing all Invertebrate observations on survey transects recorded during video review. Inset shows the location of the shell mound in reference to transect lines.

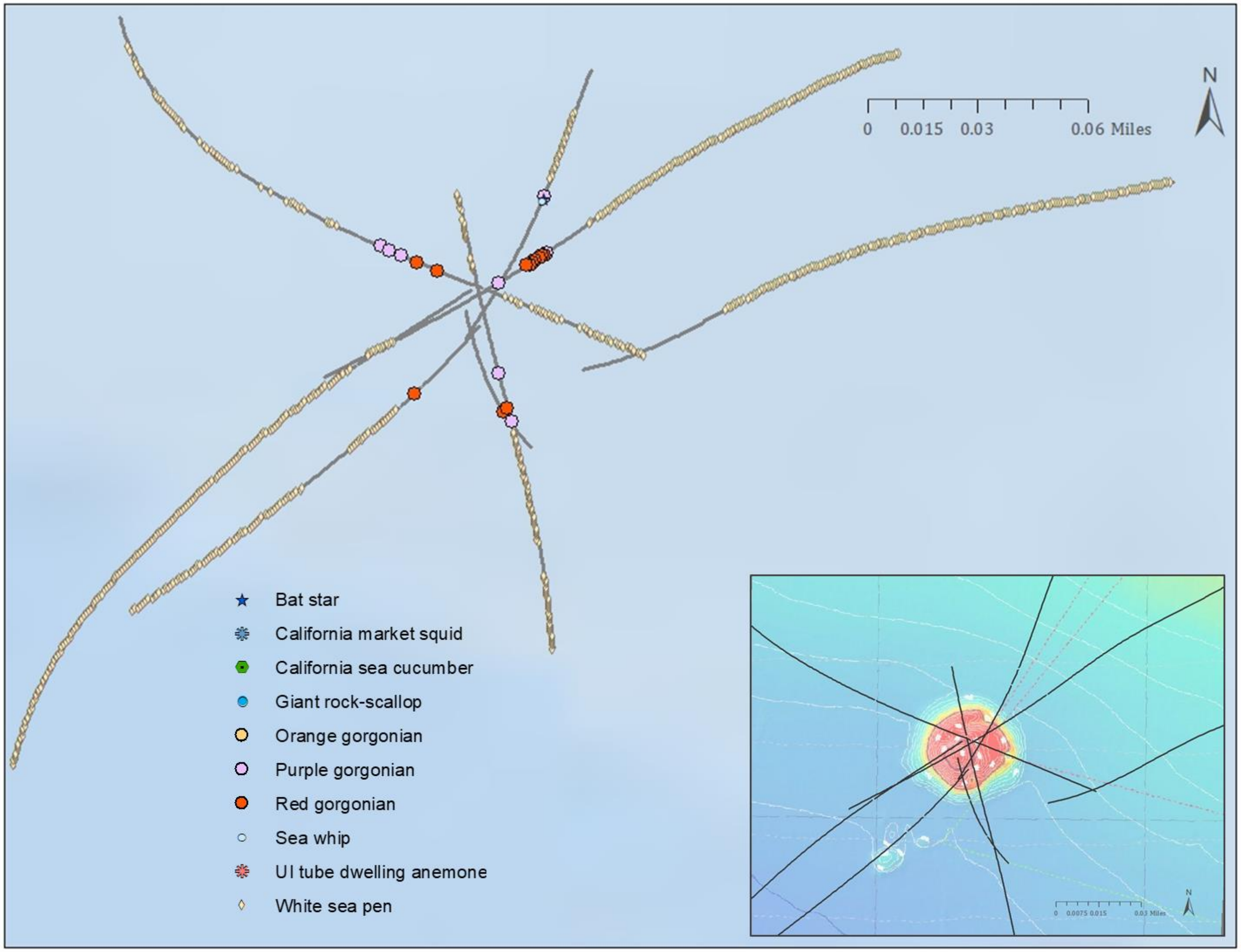


Figure 17. Map of Hilda shell mound showing all Invertebrate observations on survey transects recorded during video review. Inset shows the location of the shell mound in reference to transect lines.

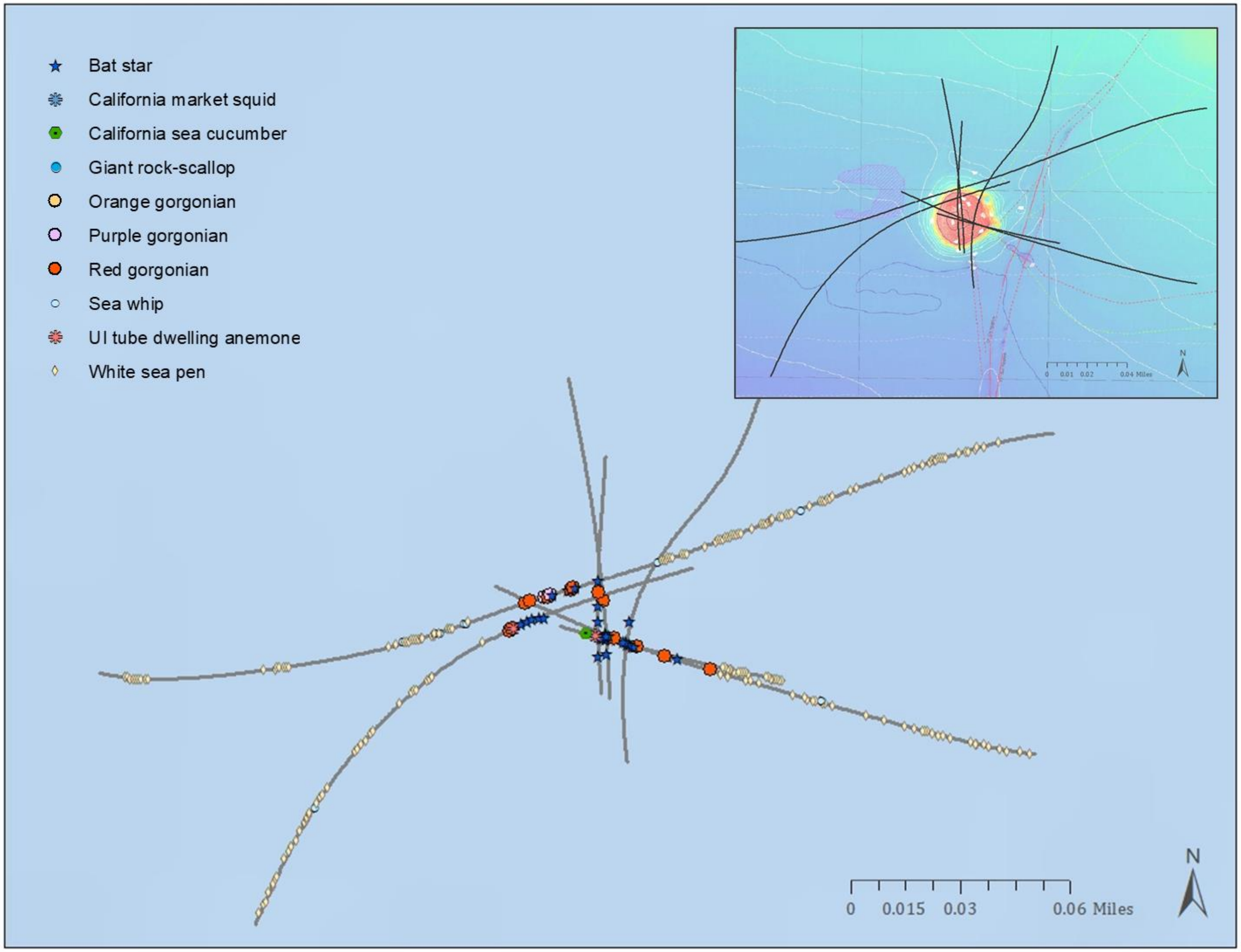


Figure 18. Map of Hope shell mound showing all Invertebrate observations on survey transects recorded during video review. Inset shows the location of the shell mound in reference to transect lines.

STILL PHOTOS

A total of 2,249 photos were captured during the survey via a GoPro camera center-mounted above the main HD video camera. Of those, 63 'usable' photos, (both parallel lasers visible in the frame and the photo clearly showing bottom habitat) were processed for holes, tracks, feeding disturbances and number of intact half or full shells. Due to high turbidity/sedimentation during the survey, the substrate was indistinguishable in the majority of the photos and they were therefore not usable for analysis.

Of the photos that were processed, holes were the most common type of disturbance at all four survey sites, with a total of 2,199 holes enumerated in all photos (Table 8). All other types of disturbances were very infrequent (Table 8). Of the 63 photos processed, 59 were on mud habitat, and only 4 were on shell habitat. This is likely why few shells were encountered during still photo review.

Table 8. The total count of photos reviewed at each site, and the mean density and standard error (SE) of holes, tracks, and feeding disturbances and shells observed at all four study sites/shell mound locations: Hazel, Heidi, Hilda and Hope.

Study Site	Total Count	Mean Density (100 m^2) ± 1SE											
		Holes			Tracks			Feeding Disturbances			Shells		
Hazel	27	5,091.88	±	3.56	25.18	±	0.11	-	±	-	25.18	±	0.04
Heidi	4	17,009.62	±	14.67	-	±	-	-	±	-	-	±	-
Hilda	20	7,464.46	±	4.71	-	±	-	9.17	±	0.05	-	±	-
Hope	12	3,126.92	±	8.05	-	±	-	-	±	-	-	±	-

DEBRIS

The location of potential oil rig and other man-made debris was annotated during video review (Table 9). Figures 19-22 show the mapped locations of debris on survey transects on and off each shell mound survey site. Debris included: crab and lobster pots, large structures, pipes, large chains, UI debris and other oil rig debris (Table 1). A total of 43 unique occurrences of debris were annotated across all four sites (Table 9), 15 of which were found off the shell mounds (Table 9).

Although some debris was not located on the mounds themselves, the average range of debris off each mound was only 3.6 to 72.9 meters from the edge of the mound across all sites (Table 9). Only at Heidi did we see one observation of oil rig debris relatively far off the mound, at approximately 150 meters from the edge of the mound (Figure 20).

Table 9. The location, type and total count of debris on and off each shell mound at each of the four survey sites: Hazel, Heidi, Hilda and Hope. Average, minimum and maximum distance from each mound's perimeter is included for off-mound debris.

Site	Location	Debris type	Count	Distance from shell mound (m)		
				Avg	Min	Max
Hazel	On Mound	Large structure	2			
		Oil rig debris	6			
	Off	Oil rig debris	4	15.5	7.0	34.4
Heidi	On Mound	Large chain	2			
		Oil rig debris	8			
	Off	Oil rig debris	2	72.9	5.8	140.1
		Crab/lobster pot	1	7.6	N/A	N/A
		UI debris	1	63.6	N/A	N/A
Hilda	On Mound	Large chain	2			
		Oil rig debris	2			
	Off	Oil rig debris	4	29.2	19.3	43.2
Hope	On Mound	Large chain	3			
		Oil rig debris	3			
	Off	Oil rig debris	1	8.7	N/A	N/A
		Pipe	2	22.9	10.4	35.3
		Total	43			

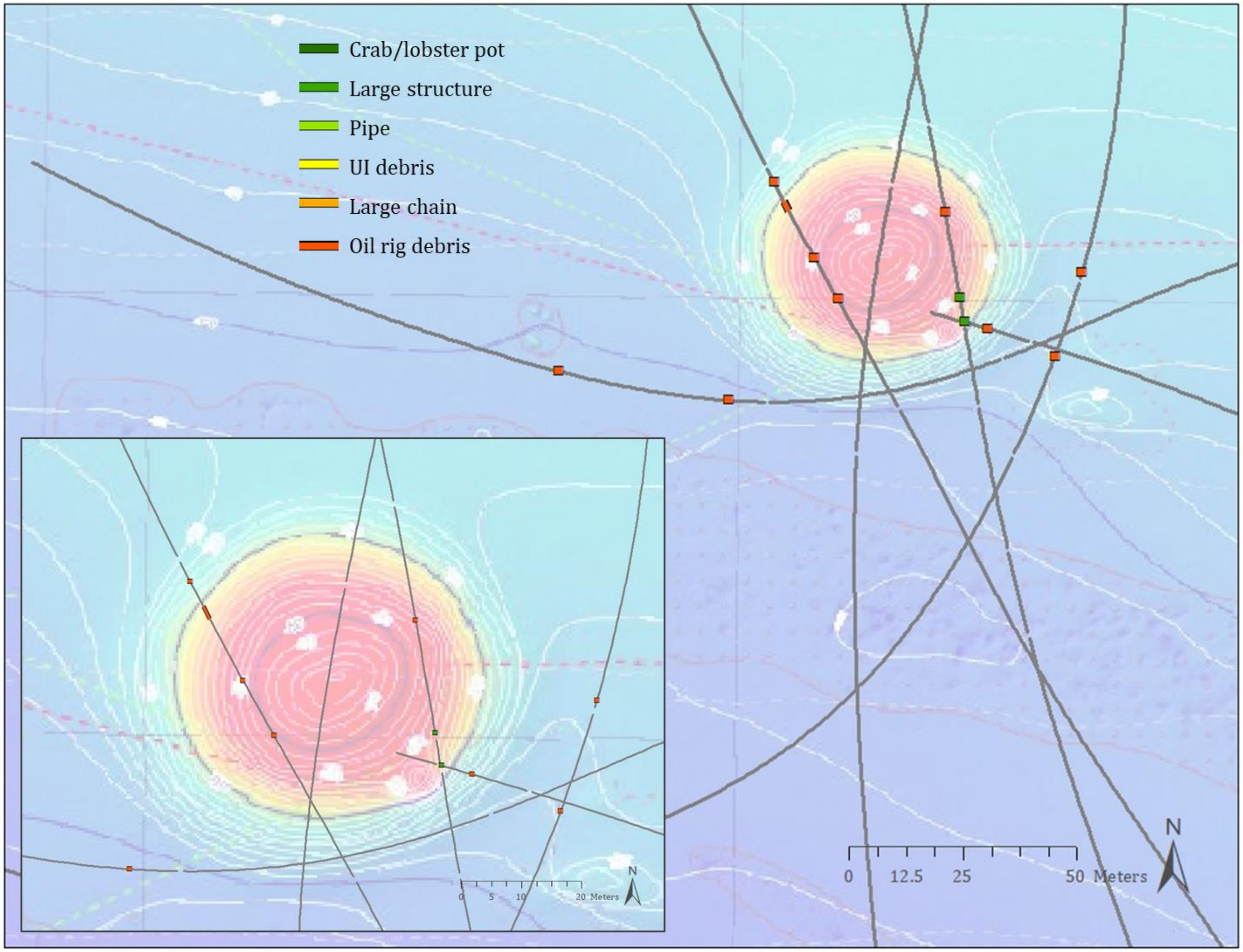


Figure 19. Map of Hazel shell mound showing oil rig and other man-made debris observed on survey transects recorded during video review. Inset shows a zoomed-in view of debris located on the mound.

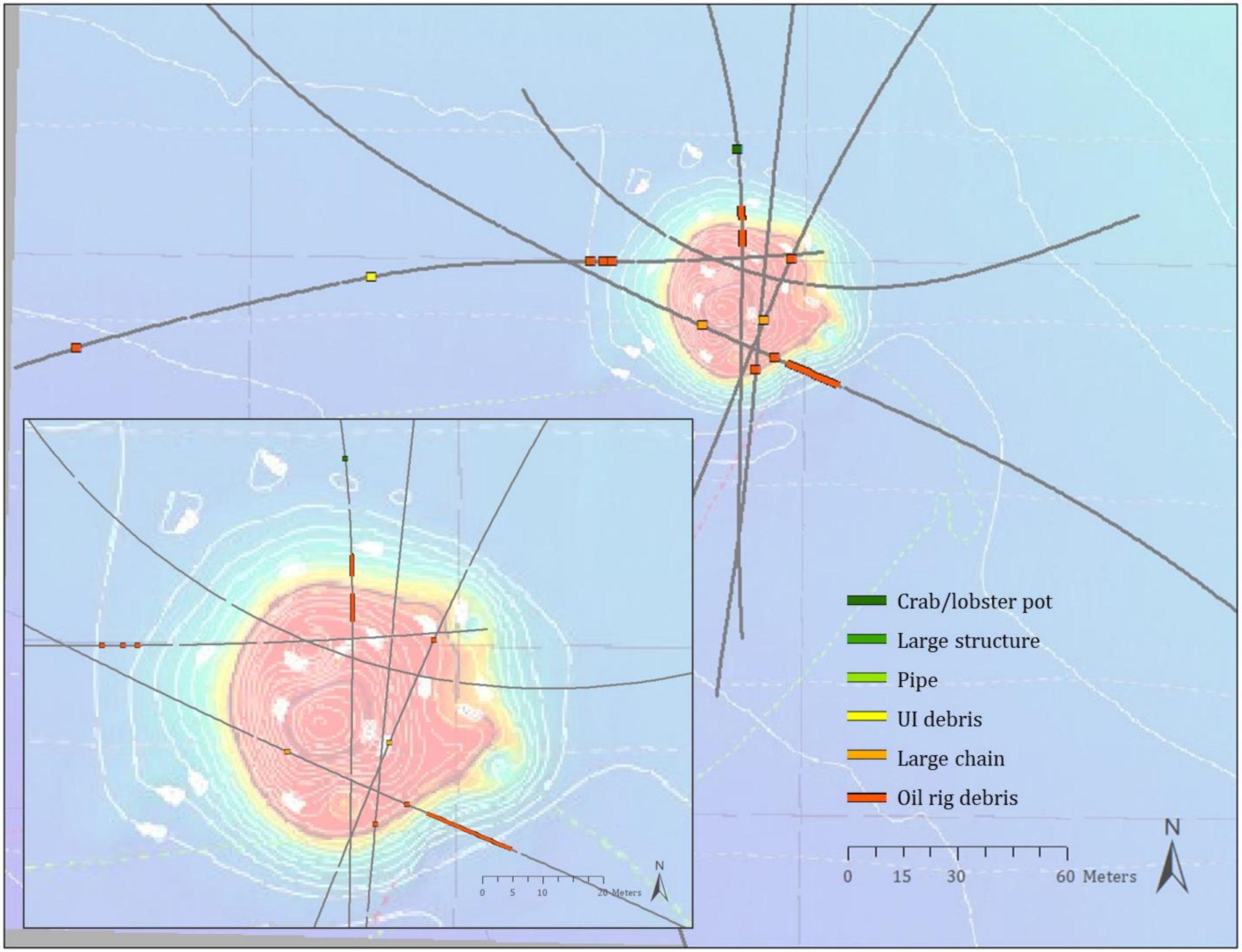


Figure 20. Map of Heidi shell mound showing oil rig and other man-made debris observed on survey transects recorded during video review. Inset shows a zoomed-in view of debris located on the mound.

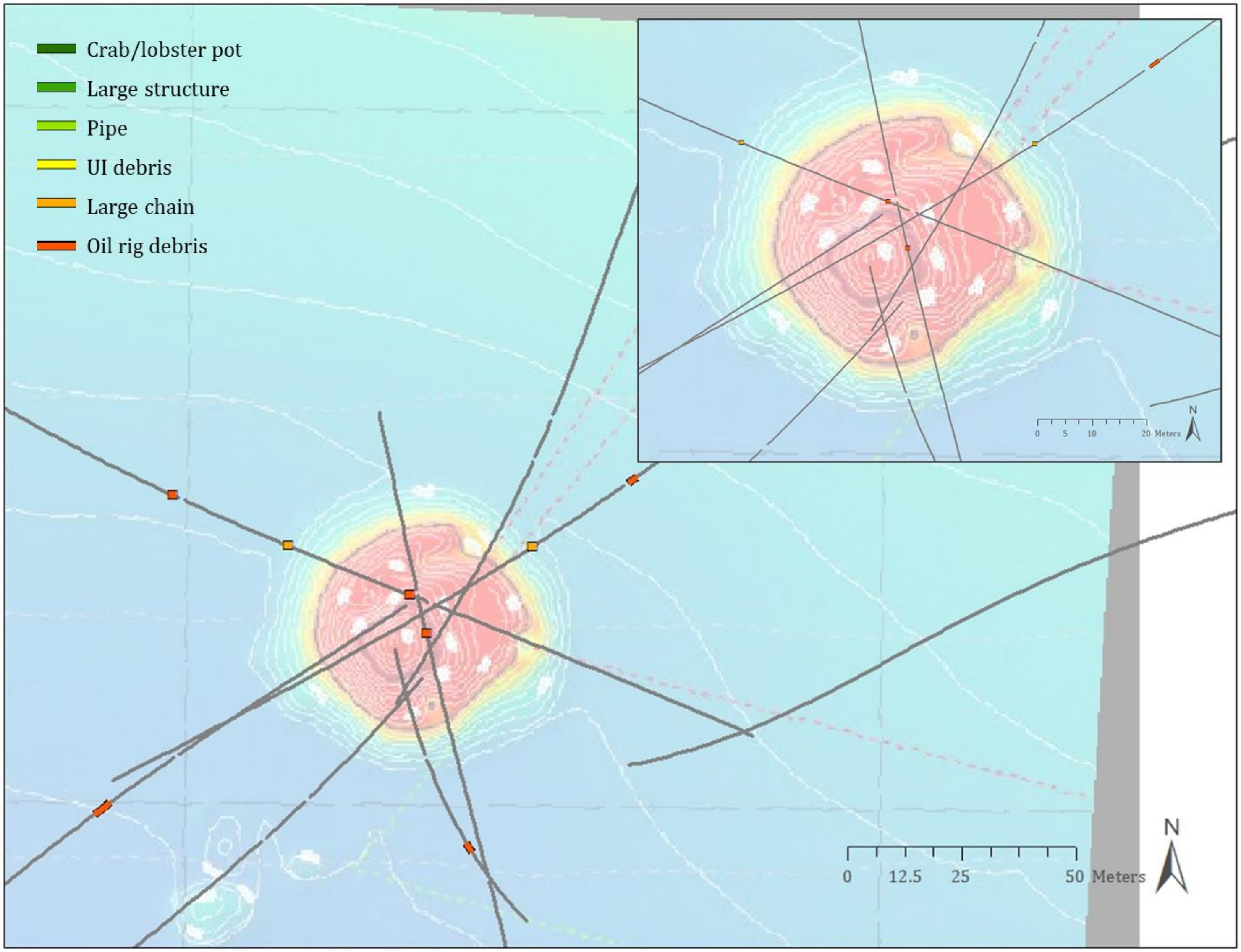


Figure 21. Map of Hilda shell mound showing oil rig and other man-made debris observed on survey transects recorded during video review. Inset shows a zoomed-in view of debris located on the mound.

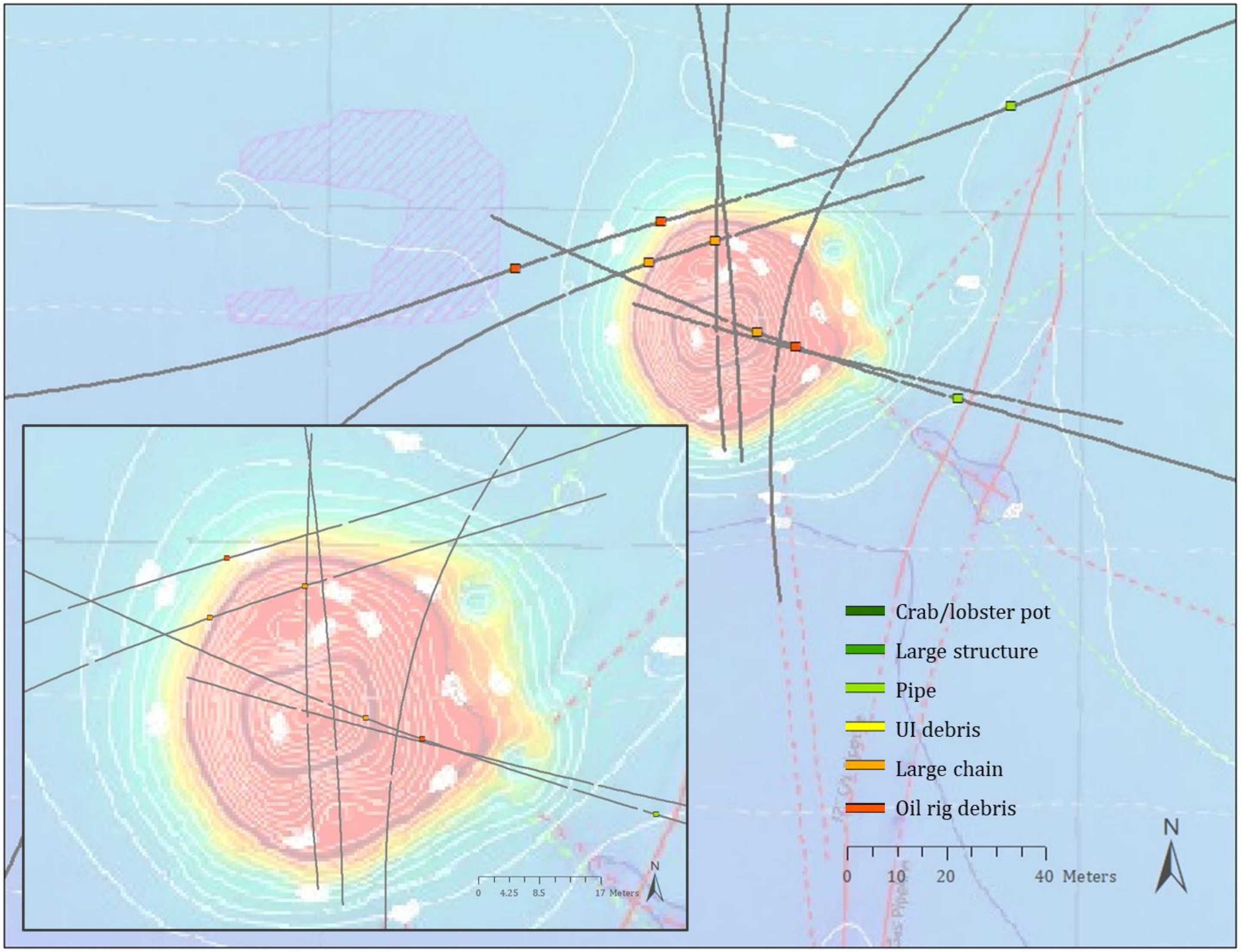


Figure 22. Map of Hope shell mound showing oil rig and other man-made debris observed on survey transects recorded during video review. Inset shows a zoomed-in view of debris located on the mound.

PROJECT DELIVERABLES

MARE will provide DUDEK with copies of the primary video and GoPro still photos for the entire survey, and those used for still photo processing on a portable hard drive. All video and photos contain timecode that can be used to link video derived observations. A copy of the GIS project layers and the master Microsoft Access database which contains all the post-processed data will also be provided to DUDEK.

In addition, one or more still photos of each occurrence of debris will provided digitally to DUDEK on the aforementioned external hard drive for further use.

REFERENCES

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Appendix C4

Ocean Science Trust Scientific and Technical Peer Review

MEMORANDUM

To: Nicole Dobroski, Chief of the Environmental Planning & Management Division, California State Lands Commission

From: Monica LeFlore, Science Officer, California Ocean Science Trust

CC: Eric Gillies, Assistant Chief of the Marine Environmental Protection Division, California State Lands Commission
Liz Whiteman, Executive Director, California Ocean Science Trust
Anthony Rogers, Director of Programs, California Ocean Science Trust
Kiya Bibby, Senior Science Officer, California Ocean Science Trust

Date: January 10, 2023

Re: California Ocean Science Trust scientific and technical review of the information and conclusions presented in the "Review of Lease Obligations and Assessment of Impacts to Public Trust Resources and Values: State Oil and Gas Leases PRC 1824 and PRC 3150 Terminations and 4H Shell Mounds Disposition" on behalf of the California State Lands Commission

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REVIEW REQUEST AND SCOPE

In order to ensure state decisions are grounded in sound scientific conclusions, California State Lands Commission (CSLC) has requested California Ocean Science Trust (OST), a non-profit organization dedicated to convening science expertise to accelerate process toward a resilient coast and ocean, coordinate a peer review to evaluate the scientific and technical merits of the white paper "Review of Lease Obligations and Assessment of Impacts to Public Trust Resources and Values: State Oil and Gas Lease PRC 1824 and PRC 3150 Terminations and 4H Shell Mounds Disposition", which includes an assessment of effects to public trust resources and values associated with the presence of the 4H shell mounds on the seafloor.

The review panel conducted an assessment of whether:

1) the scientific information presented within the report is sound and reasonable,
2) the relevant science included in the report is comprehensive and representative of existing knowledge in this field of research; and,
3) interpretations and conclusions drawn in the report are appropriate given the available scientific information.

REVIEW PROCESS OVERVIEW

OST facilitated the review process between October and December 2022. Steps included:

1. ***Scoping the review.*** OST worked closely with CSLC to develop and formalize the review scope and process, identify reviewer expertise needs, and develop review instructions and guiding questions for reviewers. The co-produced scope and process document can be found on the OST website[1].

2. ***Reviewer selection.*** OST recruited four external scientific experts to complete reviews, accepting recommendations from the California State University Council on Ocean Affairs, Science and Technology (CSU COAST), and OST's own professional network. Reviewers were selected based on relevant expertise and were required to sign a form to declare any conflicts of interest prior to the review. Reviewers were informed of the client and authorship of the report. Reviewer names were kept anonymous to CSLC and the public during the review, and their comments were submitted anonymously without attribution to any single reviewer. With the release of this document, the reviewers are made public:
    - Dr. Eunha Hoh, Professor of Environmental Health, School of Public Health at San Diego State University
    - Dr. Milton Love, Research Biologist, Marine Science Institute at University of California Santa Barbara
    - Dr. Samuel Y Johnson, Emeritus Research Geologist & Independent Consultant, United States Geological Survey
    - Dr. Tom Connolly, Physical Oceanographer, Moss Landing Marine Laboratories at San Jose State University

3. ***Facilitating the review process.*** OST provided the reviewers with a set of instructions and review questions to guide their evaluation of the document's scientific merits. Reviewers were asked to respond in writing to the questions in the instructions and were able to provide anonymous annotated comments directly to the report.

4. ***Providing deliverables.*** This memo was produced as a public summary of the review and will remain available on the OST website[1]. OST also provided CSLC with comprehensive anonymized reviewer feedback, which included individual responses to the review questions and in-text comments. The comprehensive review documents are for internal use only.

OST valued this opportunity to collaborate with CSLC to provide scientific support to the State of California. CSLC's commitment to ensuring decisions are founded in sound scientific reasoning and conclusions is commendable. We appreciated their constructive engagement and dedication to upholding scientific values throughout the review process. OST would also like to thank the four reviewers who dedicated their time to provide thoughtful comments and expertise.

[1] Project page url: https://www.oceansciencetrust.org/projects/seafloormounds/

REVIEW BACKGROUND

CSLC administers leases related to oil and gas operations located in and adjacent to the state's waterways, beaches, and coastline. Although CSLC issued a moratorium on new oil and gas leases in 1969, the Commission still oversees the management, revenue, and regulation of leases issued prior to that time. Four relic leases associated with oil and gas production from Platforms Hilda, Hazel, Hope and Heidi (collectively the '4H' Platforms), were installed in State waters offshore Santa Barbara County between 1958 and 1965. The lease holders for the 4H Platforms include Chevron Corporation, ExxonMobil and BP p.l.c.

After approval by CSLC in 1994, Chevron removed the 4H Platforms in 1996, leaving behind four subsea shell mounds that had accumulated at the base of each platform. The shell mounds are composed of empty mussel shells, sediment, and debris covering an inner layer of drill muds and cuttings. The 4H Platform Removal Project that CSLC approved did not specify removal of the shell mounds. Chevron maintains that it has met the lease obligations and has submitted a petition to quitclaim its leases, which includes a proposal to keep the 4H shell mounds in place in their current configuration, unless otherwise specified by CSLC.

The white paper entitled "Review of Lease Obligations and Assessment of Impacts to Public Trust Resources and Values: State Oil and Gas Leases PRC 1824 and PRC 3150 Terminations and 4H Shell Mounds Disposition", presents an assessment of the effects to public trust resources and values associated with the presence of the 4H shell mounds on the seafloor. The document includes information on a) Chevron's renewed proposal to quitclaim its leases related to the 4H Platforms; b) Commission staff's evaluation of historic records related to the leases; and c) an assessment of effects to public trust resources and values associated with the continued presence of the 4H shell mounds on the seafloor, if they are not removed.

REVIEW SUMMARY

Scientific Rigor

- One reviewer recommended a comprehensive assessment of sediment samples from the shell mounds to provide additional information on contaminant levels. The reviewer recommended that sediment contaminant levels be compared temporally, spatially and per individual in-depth core sample. They also recommended an assessment of contaminant bioaccumulation in surrounding biota.
- One reviewer suggested that potential dispersal of contaminants should be further investigated. They expressed the need for estimates of spatial and time scales for contaminant dispersal because such estimates are important for assessing impacts on commercial fisheries, recreation at nearby beaches, and on public safety in the event of seismic activity or shell mound removal.
- One reviewer recommended that a series of biological surveys be conducted at each shell mound, at least quarterly, for at least two years. The reviewer pointed out that the biological

surveys that were conducted were either short term or one of a kind, which does not account for potential seasonal or interannual changes to fish assemblages. The reviewer also recommended that future surveys investigate assemblages of smaller organisms in addition to the fishes and large invertebrates included in completed surveys.

Comprehensiveness of Cited Literature

Reviewers were overall satisfied with the literature review conducted and reflected in the report. Several specific additional works cited were recommended, but reviewers also acknowledged that there is limited existing knowledge that specifically addresses impacts from shell mounds produced by offshore drilling operations. Reviewers therefore expressed that the report authors included a majority of the limited relevant studies.

- One reviewer recommended conducting additional literature reviews for what other chemical contaminants are associated with oil drilling activities and ensuing samples to determine presence and level of those contaminants within the shell mounds' sediments.
- One reviewer pointed out that a 2019 publication assessing ecological resources on shell mounds surrounding platform decommissioning sites in the Santa Barbara Channel found that shell mounds support higher fish and invertebrate diversity than surrounding soft-bottom reference areas, indicating that removal of the mounds may be detrimental to biodiversity.

Science-Based Conclusions to Support Decision-Making

Reviewers did not raise major concerns about a lack of drawing on existing available scientific information. However, reviewers across the board did recommend further assessment of the various ways in which leaving the shell mounds intact or removing them could threaten public trust resources. The reviewers' feedback was primarily focused on recommendations for additional studies, such as collecting and analyzing time-series data about biodiversity supported by the shell mounds, rather than on recommendations for inclusion of additional readily-available scientific information.

Reviewers recommended additional analyses of the following:

- Sediment contaminant levels
- Habitat value of the shell mounds
- Earthquake hazards
- Effects of decreasing ocean pH conditions on the shell mounds
- Quantification of ocean currents in the vicinity of the mounds

Regarding triggers for post-earthquake monitoring response, one reviewer suggested a more conservative approach to setting the trigger for post-earthquake surveys. The reviewer agreed with the report's proposed response protocol that within one week of a qualifying trigger event, Chevron should be required to complete high-resolution bathymetric surveys of the shell mounds to assess the extent of damage. The more conservative earthquake events that the reviewer recommended trigger this response include:

- An event of magnitude 6-6.5 within 20 km of the 4H shell mounds;

- An event of magnitude 6.6 to 7.0 within 50 km of the shell mounds; or
- An event of magnitude greater than 7.0 within 80 km of the shell mounds.

Additional Comments

- One reviewer highlighted the need for identification of data gaps since there are significant additional analyses that could be conducted to more thoroughly assess the potential public trust impacts of leaving the shell mounds intact.
- One reviewer recommended that the predicted carbon footprint of, and pollution created by, shell mound removal should be investigated and made public, so as to account for the ramifications of the various potential scenarios dealing with the shell mounds.
- One reviewer suggested that the report more directly discuss ways in which earthquake strong ground motions could lead to exposure of potentially toxic drilling muds to the open sea. The two scenarios that the reviewer considered possible are:
    - Slope failure on the steep margins of the shell mounds, with drilling muds exposed in slide scars; or,
    - Cracks, fissures or liquefaction-associated sediment boils on the upper surface and slopes of the shell mounds, causing exposure of drilling muds on the flanks and rims of the mounds.

Appendix D

2022 Update of Geotechnical Evaluations and Findings in Fugro (2004)

FUGRO
5855 Rickenbacker Road
Commerce, California 90040
1 323 591-6210

Padre Associates
Attention: Mr. Simon Poulter
1861 Knoll Drive
Ventura, California 93003

June 29, 2022

Subject: Update of Geotechnical Evaluations and Findings in Fugro (2004)
Stability and Seismic Displacement of Shell Mound Materials
Platforms Hazel, Heidi, Hilda, and Hope, Santa Barbara County, California
Fugro Project No. 04.00213509

Dear Mr. Poulter,

Fugro is pleased to provide geotechnical engineering consulting services to update slope stability and seismic displacement analyses of the composite shell mound materials that are present at abandoned platforms Hazel, Heidi, Hilda, and Hope located offshore of the Summerland and Carpinteria area in Santa Barbara County, California. This report summarizes our understanding of the project, our scope of work, and the results of our updated analyses.

Project Background

Former production Platforms Hazel, Heidi, Hilda, and Hope were located in State Lands to the south of Summerland and Carpinteria. Those platforms, which were operated by Chevron, were abandoned in the mid-1990s. When the platforms were removed, the mounds of drilling waste, drilling muds, drill cuttings, and shell (referred to as the “shell mounds”) that had accumulated beneath the platforms were left in place.

Fugro conducted bathymetric surveys of the shell mounds in 1996, 1999, 2004, 2009, and 2021 and a comparison of those survey data indicates that the shell mound geometries have not significantly changed since the platforms were abandoned.

The shell mounds at the four former platform locations rise about 20 to 25 feet above the surrounding nearly horizontal seafloor. The mounds are generally circular in geometry with a base diameter of between about 200 and 250 feet. The diameter of the flat area at the top of the mounds is about 20 to 40 feet, and the average side slope inclinations of the mounds range from about as shallow as 5 horizontal to 1 vertical (5H:1V) to as steep as about 3 horizontal to 1 vertical (3H:1V).

Fugro performed a material characterization study of the shell mounds at the platforms in 2000 that involved collecting vibracore samples at sixteen locations at the four platform sites (Fugro, 2000). The sampling indicated that the shell mounds were found to be composed of a 1- to 2-1/2-foot-thick (typically) surface layer of *shell hash* underlain by *drilling waste* consisting of a mixture of drilling mud, drill cuttings, and rock chips. The shell mounds are underlain by *native clay sediments* at all four former platform locations. The material characterization consisted of performing geotechnical index testing (such as unit weight, water content, grain size distribution, Atterberg limit tests, etc.). No shear strength testing of the materials was performed.

In 2004, at the request of Padre Associates, Fugro performed a seismic stability evaluation of the shell mounds to estimate the horizontal displacement of the mounds. The horizontal displacement analyses used empirical relationships between displacement, yield acceleration, and peak ground acceleration for two assumed hypothetical earthquake magnitudes and peak ground accelerations. The analyses were performed for two simplified geometries consisting of:

- A 20-foot-high mound with a uniform 4 horizontal to 1 vertical slope.
- A 24-foot-high mound with a uniform 3 horizontal to 1 vertical slope.

Shear strength parameters used in the analyses were interpreted using empirical correlations that compare soil classification properties reported in Fugro (2000).

The findings were provided in Fugro (2004) and suggested the static factor of safety for the shell mounds to be 1.65 and 1.35 for the flatter/lower and steeper/taller mounds, respectively. The seismic stability evaluation and displacement analyses were performed for two earthquake scenarios consisting of a magnitude 6.0 event with a peak ground acceleration of (PGA) of 0.23g and a 6.5 event with a PGA of 0.56. Those two events were thought to be associated with 50 and 10 percent probabilities of exceedance, respectively, during a 50-year exposure period. Lateral seismic slope displacements for those two earthquake scenarios were computed using the empirical relationships of Bray and Rathje (1998) and consisted of displacements of less than an inch to several inches for the two mounds for the moderate 6.0 event and about 3/4-foot to 2 feet for the larger 6.5 event.

The 2004 study suggested that the shell mounds could move on the order of inches in response to a moderate earthquake and several feet in response to a larger earthquake. The study anticipated that the computed movement would include bulging near the toe of the mound in conjunction with overall settlement of the mounds. Given the non-uniform composition of the mounds, the study also concluded there is a potential for localized flow type failures. However, the evaluation performed for that study did not consider issues relative to possible fault rupture or liquefaction.

We understand the findings of the 2004 study set a preliminary seismic action-level criteria corresponding to a 6.5 earthquake event occurring within 2 miles (about 3.2 km) of the site, which would require geophysical surveys or other activities be performed to evaluate possible displacements of the mounds.

Purpose of the Current Slope Stability Evaluation

Based on recent discussions with Padre Associates, we understand that this updated evaluation of the Fugro 2004 analyses has been requested in an effort to refine the action level event criteria related to the earthquake magnitude and distance from the platform sites and potential surface displacements of the mounds.

Scope of Services

As noted, static and seismic slope stability analyses were performed by Fugro in 2004 to evaluate the vulnerability the shell mounds at the sites of former offshore platforms (Hazel, Heidi, Hilda, and Hope). In the years since those analyses were performed, the methods used to perform slope stability and seismic displacement analyses have changed and evolved. We have updated the previous analyses utilizing current methodology and analytical procedures. Our update utilized the same simplified geometries and general material properties and parameters that were used in the 2004 analyses. The following describes the general analytical process that we used to perform the update.

Seismic Setting

We reviewed the 2008 National Seismic Hazards Maps, Fault Parameters data to determine the range of maximum earthquake magnitudes that may be anticipated from faults in the Santa Barbara Channel area. The following table lists known active faults in the vicinity of the former platform sites and their estimated maximum earthquake magnitudes.

Table 1: Nearby Faults

Fault Name	Fault Type	Estimated Maximum Magnitude
Red Mountain	Reverse	7.4
Mission Ridge-Arroyo Parida-Santa Ana	Reverse	6.9
North Channel	Thrust	6.8
Ventura-Pitas Point	Reverse	7.3
Santa Ynez	Strike Slip	7.4
Oak Ridge	Reverse/Thrust	7.4
San Cayetano	Thrust	7.2
Santa Cruz Island	Strike Slip	7.2
Channel Islands Thrust	Thrust	7.3
Santa Rosa Island	Strike Slip	6.9

On the basis of those fault data, a maximum magnitude of 7.5 was selected for use in the seismic displacement calculations. Seismic displacements were also calculated for lower earthquake magnitudes of 7.0, 6.5, and 6.0.

Shear Wave Velocity

An average shear wave velocity (Vs) for the upper 100 feet (30 meters) of the seafloor materials beneath the mounds is needed for the estimation of earthquake response spectra and for the computation of seismic displacement. A Vs of 185 m/sec was estimated using the Hamilton (1976) equation for silt-clay, which was derived by regression on seafloor Vs data obtained from a depth range of 0 to 36 meters. That same equation was used to estimate a Vs of 125 m/sec for the shell mounds, for use in the seismic displacement calculations.

Earthquake Response Spectra

To perform seismic displacement calculations using current methods of analyses, earthquake response spectra were developed for each combination of earthquake magnitude and distance. We utilized the NGA-West2 earthquake-ground-motion attenuation relations to develop 5% damped response spectra for selected earthquake magnitude and distance combinations. Consistent with current probabilistic seismic hazard analysis procedures, we selected 4 attenuation relations (Abrahamson et al., 2014; Boore et al., 2014; Campbell & Bozorgnia, 2014; and Chiou & Youngs, 2014) and weighted each of them equally using geometric averaging.

Median response spectra were developed for RotD50 (median spectral acceleration when rotated over all horizontal directions) horizontal ground motions at 10 spectral ordinates assuming a reverse fault-type, that the site is located on the hanging-wall side of the fault, and a 60-degree fault dip.

Static Slope Stability Analyses

Updated static slope stability analyses were performed using the same shell mound geometries that were analyzed in 2004. Conical-shaped mounds 20- and 24-feet tall were modeled, with uniform 4H:1V and 3H:1V side-slopes, respectively.

The soil properties used to perform the stability analyses are the same as those used in 2004:

- Shell Hash:
  - Submerged Unit Weight: 55 pounds per cubic foot (pcf)
  - Angle of Internal Friction: 40 degrees
- Drill Waste:
  - Submerged Unit Weight: 40 pcf
  - Undrained Shear Strength profile that increases from at a rate of 8 pounds per square foot (psf) per foot of depth from a value of 65 psf below the shell hash layer (due to a typographical error in 2004, the starting shear strength was erroneously stated as 200 psf in the 2004 report).
- Native Clay:
  - Submerged Unit Weight: 55 pcf
  - Undrained Shear Strength: 750 psf

The updated stability analyses were performed using Rocscience's SLIDE2D computer program. Spencer's Method, which satisfies both force and moment equilibrium was selected to perform the stability analyses. The updated static factor of safety for the 3H:1V geometry was computed as 1.34 (compared to 1.35 in 2004). The updated static factor of safety for the 4H:1V geometry was computed as 1.76 (compared to 1.65 in 2004). The slight differences between the updated static factors of safety and those from 2004 are attributed to differences in searching techniques, analysis methods, and strength-profile model distributions.

Yield Acceleration Analyses

Updated yield accelerations (defined as the pseudostatic horizontal force that produces a factor of safety of one) were also computed using SLIDE2D. SLIDE2D has an automated searching algorithm that efficiently determines the yield acceleration for a slope stability model. SLIDE2D also outputs details about the geometry of the critical slip surface that can be used to compute the period of the sliding mass for use in the current displacement analysis procedures.

The updated yield acceleration for the 3H:1V geometry was computed as 0.108 (compared to 0.10 in 2004). The updated yield acceleration for the 4H:1V geometry was computed as 0.180 (compared to 0.17 in 2004). As with the static factor of safety computations, the slight differences between the updated yield accelerations and those from 2004 are attributed to differences in searching techniques, analysis methods, and strength-profile model distributions.

Seismic Displacement Analyses

Updated seismic-displacement analysis were performed using the recently developed method of Bray and Macedo (2019) to compute estimated shear-induced displacement for selected combinations of earthquake magnitude and distance. The Bray and Macedo (2019) procedure utilizes 6,711 two-component horizontal ground motion recordings from the updated NGA-West2 database along with a fully coupled, nonlinear seismic slope displacement model to estimate seismic shear-displacements due to shallow crustal earthquakes along active plate margins. By comparison, the Bray and Rathje (1998) procedure, which was used in the 2004 study, was developed from a limited evaluation based on few tens of ground-motion records. An important feature of the Bray and Macedo (2019) procedure is the ability to estimate displacement for earthquake records that exhibit near-field pulse motions in addition to displacements for records that exhibit ordinary ground motions. Bray and Macedo (2019) estimates maximum seismic displacement (D100) for slopes oriented within 45 degrees of the fault-normal direction for pulse motions in the near-field region (D100 is used in the pulse analyses we performed for this study) or median seismic displacement (D50) for other slope orientations in the near-field.

Not all near-field earthquake records exhibit pulse ground motions. A recent study by Hayden et al. (2014) evaluated the proportion of earthquake records in a database of shallow crustal earthquakes with moment magnitudes greater than 6.0 and source-to-site distances of less than 30 km. To represent the probability of pulse motions, they developed a relationship that can be used to estimate the proportion of pulse-type motions in a suite of records using source-to-site distance.

To compute shear-induced seismic displacement estimates for the shell mounds, we used the most critical yield acceleration (0.108) and slip-surface geometry, which were obtained from the 3H:1V mound yield acceleration analysis. Using 35 selected combinations of earthquake magnitude and distance, we developed individual response spectra and performed individual seismic displacement calculations for both ordinary ground motions and pulse ground motions. Those individual ordinary- and pulse-displacements at each magnitude-distance combination were then combined probabilistically using the proportional weighting equation of Hayden et al. (2014) (Epsilon=0) to produce the estimated seismic displacements depicted as displacement contours (in centimeters) on Figure 1 – Estimated seismic Displacement Contours.

To utilize the figure, the contour line for a target displacement is followed to where it intersects a desired magnitude on the Y-axis and the corresponding distance is read on the X-axis. For example, an estimated 15 cm seismic displacement could be produced by any of the following magnitude distance combinations:

Magnitude	Approximate Distance (km)
6.0	1
6.5	3
7.0	5
7.5	7

Historical Seismicity

Searches of historical seismicity were performed using the U.S. Geological Survey's online earthquake search tool (https://earthquake.usgs.gov/earthquakes/search/). A search was performed for each of the four former platform locations. There is no record of a magnitude 6.0 or larger earthquake within 20 km of the sites in the USGS data set, which goes back to the late 1860s.

Commentary

An analysis of the amount of seismic displacement needed to compromise the integrity of the mounds was not a part of the current study. However, in our opinion, the findings shown in Figure 1 can be used by others to refine the seismic action level event criteria that would require geophysical surveys or other activities be performed.

As indicated in Figure 1, the seismic displacement evaluation performed for this update study similarly indicates that the shell mounds could experience shear displacements on the order of inches in response to moderate earthquake shaking and several feet in response to a larger earthquake. As suggested in 2004, the movement could include bulging near the base of the mounds in conjunction with overall settlement of the mounds. There is a potential for localized flow-type failures, but neither the previous nor the current study evaluated the potential for liquefaction of the mounds or the underlying seafloor.

Limitations

Fugro characterized the general subsurface conditions at the site and developed the conclusions and professional opinions presented in this report in accordance with generally accepted geotechnical engineering principles and practices at the time and location this report was prepared. This statement is in lieu of all warranties, express or implied.

We prepared this report for Padre Associates, Inc., and their authorized agents only. It may not contain sufficient information for the purposes of other parties or other uses. If any changes are made in the project or site conditions as described in this report, the conclusions and recommendations contained in this report should not be considered valid unless Fugro reviews the changes and modifies and approves, in writing, the conclusions and recommendations of this report. The report and drawings contained in this report are not intended to act as construction drawings or specifications.

Soil and rock deposits will vary in type, strength, and other geotechnical properties between points of observation and exploration. Additionally, groundwater and soil moisture conditions can also vary seasonally or for other reasons. Therefore, we do not and cannot have complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based upon the findings at the points of exploration, and interpolation and extrapolation of information between and beyond the points of observation and are subject to confirmation based on the conditions revealed during construction.

The scope of services did not include any environmental assessments for the presence or absence of hazardous/toxic materials in the soil, surface water, groundwater, or atmosphere. Any statements or absence of statements in this report or data presented herein regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous/toxic assessment.

Thank you for contacting us to provide geotechnical services on this project. Please contact the undersigned, if you have any questions about this report.

Sincerely,

Gregory S. Denlinger, GE
Principal Engineer

Thomas F. Blake, GE, CEG
Principal Engineer/Engineering Geologist

Attachments:
Figure 1 – Estimated Seismic Displacement Contours

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Document Control

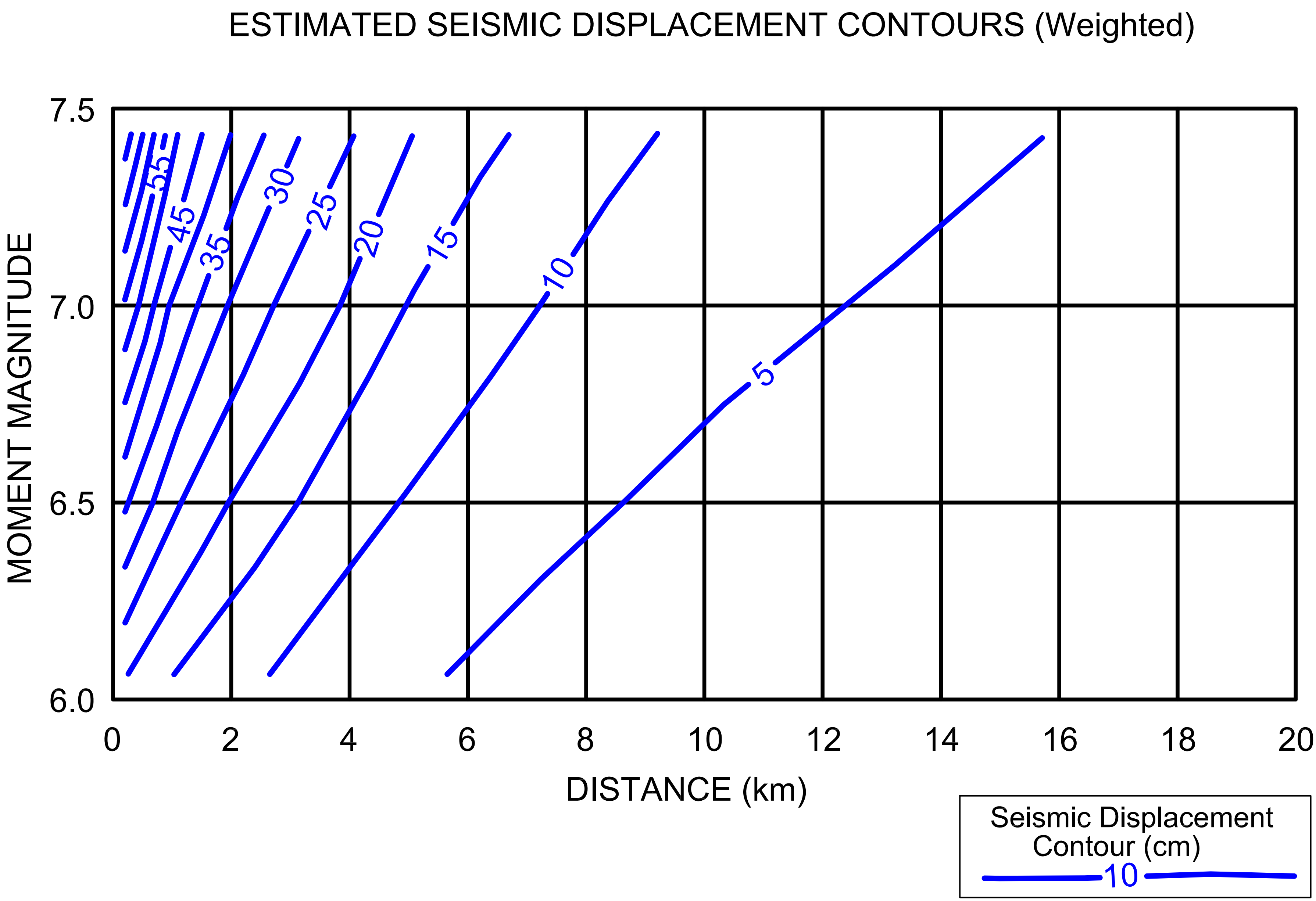
Document Information

Proposal Title	Proposal to Update Geotechnical Evaluations and Findings in Fugro (2004) Stability and Seismic Displacement of Shell Mound Materials Platforms Hazel, Heidi, Hilda and Hope, Santa Barbara County, California
Document Title	Update Geotechnical Evaluations and Findings in Fugro (2004)
Fugro Proposal No.	04.00213509
Fugro Document No.	04.00213509-L-001
Issue Number	03
Issue Status	Final

Revision History

Issue	Date	Status	Comments on Content	Prepared By	Checked By	Approved By
01	May 17, 2022	Draft	Initial submittal	GSD/TFB		GSD/TFB
02	June 21, 2022	Final		GSD/TFB	TFB	GSD/TFB
02	June 29, 2022	Final		GSD/TFB	TFB	GSD/TFB

List of Figures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6.5
6.0
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2
4
6
8
10
12
14
16
18
20
DISTANCE (km)
55
45
35
30
25
20
15
10
5
Seismic Displacement
Contour (cm)
10