Surface Spill and Inadvertent Drilling Fluid Return Contingency Plan

prepared for

Pacific Gas and Electric

for the

R-1402, L-130 Replacement HDD Crossing of the Sacramento River

Prepared by

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Introduction

This Surface Spill and Inadvertent Drilling Fluid Return (IR) Contingency Plan (Plan) was prepared by Bennett Trenchless Engineers for Pacific Gas and Electric's (PG&E) R-1402, L-130 Replacement HDD Crossing of the Sacramento River (Project). The Plan is applicable to horizontal directional drilling (HDD) construction methods and addresses the potential sources of risks of surface spills and IRs during trenchless construction. The Contractor shall adopt and be responsible for implementing the Plan. The Contractor may propose its own plan or changes to this Plan. The Contractor's plan or any proposed changes to this Plan shall be submitted in writing for the review and approval of PG&E and the Engineer.

Scope

This Plan identifies potential sources or causes of surface spills and fluid losses during trenchless construction, commonly referred to as "inadvertent fluid returns" or "IRs", "hydrofracture", or "frac-outs". The design approach and good practices specified to reduce or eliminate the risks of spills and IRs are discussed, including monitoring measures for early detection of surface spills and IRs. Contingency measures are detailed for containment and cleanup, should a spill or IR occur. Finally, this plan establishes the roles and responsibilities of the parties for monitoring, prevention, containment, cleanup, notification, and documentation.

Objectives

The specific objectives of this plan are:

- Minimize the potential for IRs and spills associated with trenchless activities.
- Provide for the timely detection of IRs and surface spills that could impact sensitive cultural, environmental, or biological resources, surface facilities or features.
- Ensure an organized, timely, and effective, minimum-impact clean-up response in the event an IR or spill occurs, in spite of good drilling practices and implementation of this plan.
- Ensure that all appropriate notifications are timely made to the permitting and regulatory agencies, and that incidents are documented.

Description of Horizontal Directional Drilling (HDD)

HDD is a surface-launched process for installing pipelines beneath natural or man-made obstacles. Since the bore begins and ends at the ground surface, shafts are not needed. Excavation at the surface is limited to small recirculation pits that are dug at each end to contain drilling fluids. The conventional HDD process consists of drilling a pilot bore from the entry to the exit location and enlarging the pilot hole through one or more successive reaming passes to a final size that is large enough to accept the product pipe(s).

Drilling fluids are used in directional drilling to cool the cutting tools, stabilize the bore, and transport the soil cuttings from the bore to a slurry separation plant. The slurry separation plant separates the solids from the fluids after which the drilling fluid is recycled and pumped to the bit once again. The drilling fluids typically consist of water and bentonite (a naturally occurring clay)

and may contain polymers or other additives to aid in the required functions of the fluid. HDD typically requires a large volume of drilling fluid that is pumped under pressure, as required based on borehole length, alignment, ground conditions, and construction methods. Therefore, IRs are a potential risk associated with HDD construction.

The slurry separation plant used with directional drilling to separate the solids from the slurry, as well as the drill rig and pumps, should be properly sized, maintained, and monitored to avoid surface spills. Surface spills could lead to fluids coming into contact with biological, cultural, or environmental resources that must be protected. An HDD rig and separation plant with silt fence and straw wattles for containment of surface spills is shown in Figure 1.

Figure 1. Drill rig placed on timber mats and plastic ground covering with silt fences in the background (left). Separation plant surrounded by straw wattles (right).

Potential Sources or Causes of Surface Spills and IRs

The potential sources of spills and IRs on trenchless construction projects are:

- Slurry losses from the bore to the surface
- Surface spills from the slurry separation plant, recirculation pits, drilling fluid mixing tanks, drill rig, pumps, and auxiliary equipment.

The potential causes of spills and IRs are:

- Slurry losses from the bore to the surface may occur if pumping pressures exceed the critical pressure required to cause IRs. In HDD projects, this can occur when the rate of progress for the pilot bore or reaming exceeds the rate at which drilling fluid can efficiently remove cuttings from the bore or when the slurry becomes viscous and thick due to the drilling fluid not being cleaned or maintained appropriately. Fluid losses to the surface may also occur if the bore intersects existing voids, desiccation cracks, tree roots, or piles, or if trenchless operations create voids through over-excavation. Over-excavation can occur in clean sands, gravels, and soils with cobbles and boulders if the slurry flow is not carefully controlled.
- Surface spills of slurry may occur if the separation plant screens become clogged or blinded by polymers, other additives, or debris; if the Contractor fails to use good

housekeeping practices; if hoses or pumps at the surface fail; or if trucks or tanks are not placed properly beneath separation plant discharge chutes. Surface spills from the separation plant, drilling fluid mixing tanks, and recirculation pits represent the most significant spill risks for HDD projects.

- Surface spills may also occur if the equipment or pumps leak fluids such as motor oil or fuel.

Design Criteria and Mitigation Measures to Reduce Risks of Spills and IRs

The risk of inadvertent returns is heavily affected by the surrounding ground conditions. A site-specific geotechnical investigation has been conducted to determine the pipe elevation based on optimal ground conditions. Certain ground conditions, such as extensive gravel deposits, and loose or soft soil, have a higher risk of inadvertent return than other soil types, such as dense cohesive sand, stiff clay, and bedrock. The design team has evaluated the risks of IRs using the reliable, industry-accepted Cavity Expansion Model to calculate the maximum allowable drilling fluid pressure, and the Bingham Plastic Model to calculate minimum required drilling fluid pressures. These approaches are widely accepted in the industry and extensively documented in the literature (Lan and Moore, 2016, Bennett and Wallin, 2008; Staheli, Bennett, O'Donnell, and Hurley, 1998; Delft Geotechnics, 1997; and Luger and Hergarden, 1988). These risk evaluations use representative geotechnical input parameter values from site specific geotechnical investigations and reasonable but conservative assumptions regarding Contractor means and methods.

After the risks of IRs was evaluated, mitigation measures were incorporated into the design to reduce the risk of hydrofracture. Mitigation measures that have been implemented to mitigate the risk of inadvertent returns include:

- Locating the trenchless alignment within optimal ground layers, and with adequate clearance, to reduce the risk of inadvertent returns impacting sensitive features.
- Providing a buffer zone between work areas and cultural or biological resources to allow contingency measures to be implemented before any spill impacts the resource.
- Requiring the HDD intersect method to reduce the minimum required drilling fluid pressures and thereby reduce IR risks.
- Using conductor casings on both sides of the HDD crossing due to the presence of very soft surficial soils that represent a high risk of inadvertent return.
- Requiring downhole drilling fluid pressure monitoring during the HDD pilot bore.
- Requiring silt fencing in the specifications between the separation plant, the lubrication plant, other equipment, and any sensitive features.
- Requiring that all slurry and spoils will be contained, transported, and disposed of at an approved offsite location. No stockpiling or dumping of spoils or slurry will be allowed onsite.

Construction activities have been designed to minimize potential for adverse impacts to sensitive features. Best practices for prevention of surface spills and IRs will be implemented before trenchless construction begins through qualification requirements in the specifications:

- The Contractor shall employ skilled, experienced competent workers who are familiar with trenchless good practices.
- Contractor workers shall be experienced in detecting not only spills and IRs, but equally importantly, the early warning signs of impending IRs. Early warning signs include circulation loss, drilling fluid pressure spikes, and large increases in drilling fluid weights and viscosities.
- Contractor personnel will be familiar with the containment and cleanup equipment and procedures for using the equipment to avoid contact of slurry with sensitive features.

Prior to launch of trenchless construction, measures that will be implemented include:

- PG&E's representative will participate in an on-site briefing by the Contractor on roles and responsibilities to ensure that Contractor personnel understand their roles and responsibilities for construction and housekeeping good practices, monitoring, containment, cleanup, and documentation of incidents. PG&E's representative will also participate in a briefing of the Contractor personnel on locations of sensitive resources and will flag all such features. Flagging will remain in place for the duration of the construction.
- All members of the Contractor's staff and PG&E's representatives shall be responsible and alert to spills and IRs and shall report any incident immediately upon detection.
- Temporary construction fencing will be used as necessary to identify the agreed-to limits of disturbance and to exclude equipment from sensitive areas.
- All equipment or vehicles driven or operated within or adjacent to the site shall be checked and maintained daily to prevent leaks of hazardous materials.
- Containment and cleanup equipment will be onsite or available within one (1) hour if offsite. Equipment at each trenchless site shall include the following:
    - Heavy weight plastic gravel-filled and sealed bags
    - Splash board: multiple layers of a heavy plastic
    - Several 5-gallon hard plastic pails
    - Wide heavy-duty push brooms
    - Flat blade shovels
    - Silt fence and T-posts or straw bales, as appropriate
    - Bundles of absorbent pads to use with plastic sheeting for placement beneath motorized equipment while in operation.
    - Straw logs (wattles of fiber rolls)
    - Portable pumps (2 minimum)
    - Appropriate lengths of hose
    - Vacuum trailers or trucks (800 to 3,000-gallon) will be available for response within one (1) hour of the incident's detection
    - Siltation screens to contain returns
    - 55-gal barrels with both ends removed, and a method to anchor the barrels to the ground
    - Turbidity curtain
    - Communications equipment (walkie talkies, cell phones)

During construction, mitigation measures against inadvertent returns include:

- PG&E's onsite construction inspector will be experienced and will closely monitor the slurry separation plant and other equipment, and will observe the work area perimeter, as well as slurry composition, pumping pressures, and flow rates.
- The inspector shall be vigilant in monitoring and detecting spills and IRs.
- Frequent monitoring of potential sources and locations of spills to provide early warning of releases.
- Frequent walking of the bore alignment to monitor for IRs to enable rapid containment and clean-up response.
- Continuous observations at rig of drilling fluid returns at the pit and drilling fluid levels in tanks, as well as comparison of the volume being pumped downhole to the hole volume. If drilling fluid circulation slows appreciably or is lost, the driller shall take appropriate measures, which may include retraction and re-drilling, injecting lost circulation materials, and/or drilling slowly past the problem area using minimum fluids necessary to proceed.
- Monitoring for back pressure in the drill pipes when connections are broken which can be a sign of a plugged annulus and result in increased drilling fluid pressures. The drill rig operator shall take appropriate measures to relieve backpressures, including retraction and re-drilling portions of the bore, if necessary.
- The drill rig workers shall observe and report all such incidences to the drill rig operator.

Containment, Cleanup, and Documentation

In the event of an IR or surface spill, PG&E's representative will be notified immediately to ensure adequate response actions are taken and notifications are made. PG&E and its representatives will conduct an evaluation of the situation. The PG&E representative will document the spill/IR incident with photographs before cleanup operations begin. If the IR is minor, easily contained, and not threatening to sensitive resources, trenchless operations may continue with continued observation of the situation and concurrent containment and cleanup. If sensitive resources are threatened trenchless operations will cease, and a response plan will be implemented. Emergency actions will be taken to the extent determined by PG&E's representative to be necessary to alleviate the threat to the sensitive resource without imposing additional threats to sensitive features associated with the cleanup activities. PG&E's representative will notify the appropriate permitting and regulatory agency(ies) within 24 hours and additional follow-up response actions may be developed in coordination with agency representatives. The PG&E representative will photograph the area after completion of cleanup activities to document conditions.

The response of the field crew to an IR will be immediate and in accordance with procedures identified in this plan. The Contractor shall work without interruption until the emergency situation no longer poses a threat. All appropriate emergency actions that do not pose additional threats to sensitive resources will be taken.

Upland Release

For terrestrial frac-outs in the project area, an earth or sandbag dike or berm will be constructed around it for containment. Alternatively, a barrel may be placed around the spill or IR to entrap released drilling fluid. On-site materials consisting of industrial grade PVC mesh with steel T-posts and natural straw bales may also be installed around the frac-out areas to contain the fluid. Any existing berms, barriers, or silt fence established to protect sensitive resources will be strengthened, as necessary, to contain drilling fluids and prevent their encroachment on sensitive biological and cultural resources. Off-site response equipment in readily accessible locations (e.g. portable pumps and fully equipped vacuum trailers or trucks) will be mobilized to recover larger releases of drilling fluid. The cause of the spill or fluid loss will be identified, and corrective actions shall be immediately undertaken by the Contractor to avoid recurrence. Containment measures should remain in place for as long as necessary to protect against further releases in the same area.

Riparian or Waterbody Release

If an IR is detected in shallow water or wetland, the slurry will be contained and removed by installing containment around the IR using sandbags, silt fence, or an open-ended barrel and extending the containment above the water surface. The slurry inside the containment will then be removed using a vacuum pump and tank. The containment may remain in place after all slurry has been removed, until the bore is completed, or until there is no further risk of IRs at that location, per direction by PG&E's representative. The containment will be completely removed before demobilization. The containment and cleanup will be closely coordinated with all applicable agencies by PG&E's representative.

If an IR is detected in the Sacramento River, a containment measure such as a turbidity curtain will be installed. Once the slurry is contained, further response to the IR, including appropriate cleanup activities, will be determined in coordination with all applicable agencies. The containment may remain in place during HDD activities per direction by PG&E's representative but will be completely removed before demobilization.

Actions that would require encroachment on waterways, marsh, wetlands, or other exclusion areas will not be undertaken without concurrence of appropriate regulatory representatives unless such action is deemed by a PG&E representative as essential to prevent significant impact to a sensitive resource, and then only in a manner that protects the environment. Access to the inadvertent return release area will be via existing roads and temporary work easements approved by the PG&E representative. Additional access needed to perform cleanup activities will be coordinated with and require the approval of the regulatory agencies if it will impact sensitive areas. The cause of the spill or fluid loss will be identified, and corrective actions shall be immediately undertaken by the Contractor to avoid recurrence.

Roles and Responsibilities

PG&E has overall responsibility for implementing this Plan. PG&E's duties relate to the entire segment within the regulatory agencies' jurisdictions. PG&E may delegate day-to-day

responsibility to the Engineer or other designated representative for the implementation of the plan. PG&E and its designated representative, together with the Contractor, shall be responsible for monitoring, detection, containment, cleanup, and documentation of any spills or IRs, and shall be responsible for prompt notification of all permitting and regulatory agencies and stakeholders. PG&E's representatives shall also be responsible for communication and coordination of Contractor's efforts during any containment and cleanup operation. The PG&E representative shall regularly visit the site to ensure compliance by the Contractor. During these routine inspections, the PG&E representative shall monitor high risk locations to mitigate the risk of potential spills or IRs.

The Contractor shall regularly monitor and inspect work areas to detect any spills or IRs. If the Contractor observes spills or IRs, the PG&E representative should be notified as soon as possible by the Contractor. PG&E's representative will be responsible for coordinating with response, cleanup, and regulatory personnel to ensure proper containment, cleanup, and disposal of recovered material and the timely reporting of the incident.

To be effective in a response to an uncontrolled release of slurry or drilling mud, PG&E's representative will be familiar with trenchless construction activities, including:

- Implementation of good practices to avoid potential spills or inadvertent returns.
- Proximity of trenchless activities to sensitive areas (i.e. levees, highways, waterways, protected species habitat, seasonal wetlands, cultural resources, and other environmentally sensitive areas)
- Location and condition of spill or IR response equipment. Equipment shall be onsite or capable of being onsite within one (1) hour of detection and notification

PG&E's representative will be knowledgeable regarding the implementation of this plan and have the authority to direct Contractor's work and commit resources (personnel and equipment) necessary to implement this plan. PG&E's representative will ensure that a copy of this plan is available onsite to construction crews and shall ensure that all workers have been informed by the Contractor about the environmentally sensitive areas and key elements of this plan before construction begins.

<u>Notification of Appropriate Agencies</u>
If a surface spill or IR threatens sensitive site features, environmental, biological, or cultural resources identified on-site, the agencies listed in Attachment A will be immediately notified by the PG&E representative.

Summary

This Hazardous Surface Spill and IR Contingency Plan establishes the planning and operational procedures as well as roles and responsibilities for the prevention, containment, and cleanup of spills and IRs associated with trenchless operations during the Pacific Gas and Electric's R-1402, L-

130 Replacement HDD Crossing of the Sacramento River. Contractors and Subcontractors must adhere to this plan during all HDD operations.

References

Bennett, R.D., Wallin, K. (2008), “Step by Step Evaluation of Hydrofracture Risks for HDD Projects”, Proceedings of 2008 No-Dig Conference, Dallas, Texas

Delft Geotechnics, (1997). “A Report by Department of Foundations and Underground Engineering Prepared for O’Donnell Associates of Sugarland, TX.”

Lan, H., Moore, I.D. (2016). “Practical Criteria for Borehole Instability in Saturated Clay during Horizontal Directional Drilling”, Proceedings of 2016 No-Dig Conference, Dallas, Texas.

Staheli, K., Bennett, R.D., O’Donnell, H., Hurley, T., (1998). “Installation of Pipelines Beneath Levees Using Horizontal Directional Drilling”, U.S. Army Corps of Engineers Technical Report, CPAR-GL-98-1, April 1998.

Luger, H.J., and Hergarden H.J.A.M., (1988). “Directional Drilling in Soft Soil: Influence of Mud Pressures”, International Society of Trenchless Technology, NoDig Conference.

Attachment A
Surface Spill and IR Notification List

In the event of a hazardous surface spill or IR incident, the PG&E Land Planner should be notified immediately. If the PG&E Land Planner is unreachable, contact one of the alternate PG&E contacts listed below:

PG&E Land Planner
Name: Sean Poirier
Phone: (925) 786-2655
e-mail: SMPX@pge.com

PG&E Project Manager
Name: Jessica Lam
Phone: (415) 407-0533
e-mail: J2N7@pge.com

PG&E Project Engineer
Name: Danny Lee
Phone: (925) 951-3428
e-mail: D2LM@pge.com

If there has been an inadvertent return of drilling fluid s to the surface, or if any risk to the integrity of the levee is identified, the US Army Corps of Engineers and Central Valley Flood Protection Board will be notified. The PG&E Land Planner, or alternate PG&E contact, will notify agencies as warranted by the situation and applicable permit conditions. Agency contact information is listed below:

National Response Center
Phone: (800) 424-8802

California Office of Emergency Services
Phone: (800) 852-7550

California State Lands Commission
Phone: (562) 590-5201

US Army Corps of Engineers – Sacramento District Headquarters
Phone: (916) 557-5100

US Coast Guard Rio Vista Station
Phone: (707) 374-2871

California Department of Fish and Wildlife
Phone: (916) 445-9338

Regional Water Quality Control Board
Phone: (916) 464-3291
Central Valley Flood Protection Board
Phone: (916) 574-0609