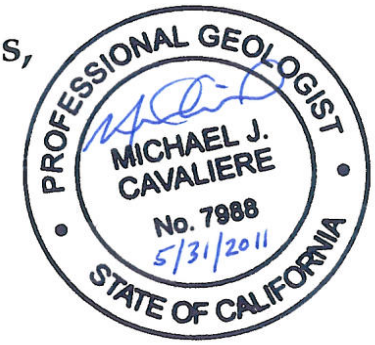
Revised Implementation Plan for Packer Evaluation of the MW-64BR Borehole, PG&E Topock Compressor Station, Needles, California



PREPARED FOR: Pacific Gas and Electric Company

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DATE: December 14, 2010

In an October 13, 2010 email, Pacific Gas and Electric Company (PG&E) was directed by the Department of Toxic Substances Control (DTSC) to provide a schedule and plan for the evaluation of water quality from discrete zones within the MW-64BR borehole using a packer system. Specifically, the direction was included as comment 4 related to the initial data collected as part of a similar packer evaluation in the MW-58BR borehole. Data collection and associated conclusions from the MW-58BR packer evaluation is ongoing. However, DTSC stated that packer evaluation in the MW-64BR borehole should proceed to address concerns that hexavalent chromium (Cr[VI]) concentrations measured in samples collected from the FLUTe liner ports installed in the borehole do not corroborate with the results from samples collected during initial borehole characterization ,and therefore, may not be representative. Cr(VI) concentrations in samples from FLUTe™ liners have been lower than in the grab samples from the open boreholes prior to the installation of the liners.

The technical approach of the evaluation was discussed during the November 4, 2011 weekly technical call. PG&E submitted a draft implementation schedule to both the DTSC and the United States Department of the Interior on November 15, 2010. After review of the first two rounds of samples collected from packer testing in the MW-58BR borehole, DTSC directed PG&E to move forward with the development of the implementation plan for testing in the MW-64BR borehole. This implementation plan was initially submitted to the agencies on November 22, 2010. DTSC transmitted comments on the plan to PG&E via email on December 3, 2010. This revised plan incorporates DTSC comments, which directed a shallower packer installation depth and an expanded list of analyses for groundwater samples. In the December 3, 2010 email, DTSC also directed PG&E to proceed with removal of the Flute liner. The Flute liner was removed during the week of December 6, 2010.

The MW-64BR borehole is a part of the existing bedrock monitoring network for the groundwater plume at the Topock site and is located to the south of the East Ravine, on the northern front of the Chemehuevi Mountains. This borehole is currently outfitted with a FLUTe™ multilevel monitoring system that is designed with three monitoring intervals: water table (approximately 119 feet below ground surface [bgs]) to 150 feet bgs, 175 to 205 feet bgs, and 230 to 257 feet bgs (total depth). Depth intervals between the monitoring zones are sealed against the borehole wall with the FLUTe™ liner. The depths of monitoring and sealed zones were designed to divide the borehole evenly as groundwater flow

characterization of the MW-64BR borehole did not identify any specific intervals of groundwater flow into/out of the borehole. This technical memorandum presents the implementation plan for the MW-64BR packer evaluation as directed by DTSC, and provides a description of the following implementation details:

- FLUTe™ system removal and borehole development
- Packer system design and installation
- Groundwater sample collection and analysis
- Schedule and reporting

FLUTe™ System Removal and Borehole Development

Prior to borehole development and packer installation, the FLUTe™ multilevel monitoring system must be removed. The removal of this system, which requires the use of specialized tools and procedures, will be conducted by pulling up on the bottom of the system and inverting the plastic liner. Removal of the system will be accomplished using a winching system situated on the ground at the well head. Once removed, the system will be examined to determine if it can be re-installed, as determined appropriate.

Once the FLUTe™ system is removed, the borehole will be developed in accordance with the methods and procedures defined in the *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program, Revision 1, Topock Compressor Station, Needles, California* (CH2M HILL, 2005) prior to packer installation. Due to the very low yield of the MW-64BR borehole, development will be conducted by purging the borehole dry and allowing it to recover as much as possible within 24 hours before repeating the cycle.

Packer System Design and Installation

The packer system will be designed for placement and operation within existing MW-64BR borehole. Details related to the borehole construction and data collected from hydraulic testing are presented in Appendix A of the *Final Corrective Measures Study/Feasibility Study Report for SWMU 1/AOC 1 and AOC 10 at the Pacific Gas and Electric Company Topock Compressor Station* (CH2M HILL, 2009). In its current condition, the borehole is constructed with a 6-inch-diameter polyvinyl chloride conductor casing extending from the ground surface to 20 feet below ground surface (bgs). Below 20 feet bgs, the borehole is an open, HQ-sized (approximately 3.8-inch-diameter) bedrock borehole to total depth (257 feet bgs). A conceptual schematic of the packer system and associated equipment to be installed in the borehole is presented in Figure 1.

Mobilization to the field for packer system installation will be conducted as soon as possible following FLUTe™ system removal, open borehole development, and packer system fabrication. Installation of the packer and associated equipment will be accomplished using a truck-mounted well development rig. The site will be accessed using the existing access route (unpaved pipeline access road) through United States Fish and Wildlife Service property. The general procedure for installation of the packer system and associated seal testing is provided below:

1. **Verification of Borehole Condition**. Prior to installation of the packer system, the depth to groundwater and the total depth of the borehole will be confirmed.

2. **Installation of Packer System**. The packer system will be lowered into the borehole on sections of flush-threaded polyvinyl chloride riser pipe. Given the outside diameter of the deflated packer (approximately 3.4 inches), it is likely that the packer will contact the 3.8-inch-diameter borehole wall during installation. The installation process will proceed slowly to minimize disturbance to the borehole; however, as is the case any time equipment is placed in an open rock borehole, there is risk of the loss of tools or collapse of the borehole during the installation, operation, or removal of the packer system.

3. **Inflation of Packer and Testing of the Seal**. Once the packer is installed to 150 feet bgs, the packer will be inflated using compressed nitrogen. Nitrogen pressure in the packer will be set to a value that will allow drawdown of the water in the upper interval of the well without exceeding the maximum inflation pressure in the packer as specified by the manufacturer. Nitrogen pressure will be monitored with a gauge at the surface. Water level response within the borehole, both above and below the packer, will be monitored with pressure transducers. The competence of the seal between the inflated packer and the borehole wall will be tested by pumping from below the packer and monitoring water level response in both zones. An immediate decrease in water level in the zone above the packer when pumping from below the packer may suggest leakage between the packer and th**e** borehole wall, whereas a more subdued response may indicate leakage through the formation around the packer. In the event leakage between the borehole wall and the packer is observed, the placement of the packer within the borehole will be adjusted. Similarly, if leakage that is believed to be occurring through the formation is observed, the placement of the packer will be adjusted; however, after several adjustments are attempted, it may be determined that some leakage through the formation cannot be prevented. It is not unusual for flow through fractures to result in some leakage around packers in rock boreholes.

4. **Development of the Separated Zones**. Once the upper and lower monitoring zones are established, pumping will be conducted from above and below the packer to remove the standing mixed formation water present in each zone. This pumping will be conducted in accordance with the methods and procedures defined in the *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program, Revision 1, Topock Compressor Station, Needles, California* (CH2M HILL, 2005).

The target depth for packer inflation is approximately 150 feet bgs, which corresponds to the bottom of the upper monitoring zone of the FLUTe™ multilevel system when it was in place. Further, the interval above the packer will be of similar elevation to the depth interval monitored by adjacent monitoring well MW-61. However, based on the installation and seal testing procedure detailed in the bullets above, it may be necessary to adjust the actual depth of packer inflation by several feet to establish proper hydraulic separation of the upper and lower zones.

Groundwater Sample Collection and Analysis

Prior to packer installation, groundwater samples will be collected from the end of the last purge cycle during open borehole development pumping. During packer testing, the zones above and below the packer will be sampled in accordance with the methods and standard operating procedures used for the Topock Groundwater Monitoring Program.

Groundwater will be purged from the zones above and below the packer using the Blatypus™ pumping system developed by Besst, Inc., which operates similar to a bladder pump but does not use a flexible bladder. This pumping system will also be used to collect groundwater from the packed borehole. The Blatypus™ is available in small (7/8-inch) diameter, which will allow it to fit in the annular space around the packer support pipe in the upper zone. A second Blatypus™ pump will be lowered through the packer support pipe to sample the lower zone. Per the Topock Field Procedures Manual (CH2M HILL, 2005), field measurements for standard parameters, including specific conductance, pH, oxidation-reduction potential, temperature, turbidity, and dissolved oxygen, will be collected during the purging process.

The initial groundwater samples from above and below the packer will be collected immediately following completion of development activities. Samples will be analyzed at an off-site laboratory for total chromium, Cr(VI), total organic carbon, VOCs (Method 8260), nitrate, TDS, chloride, and arsenic. Consistent with the Topock Field Procedures Manual (CH2M HILL, 2005), the samples collected for total chromium and arsenic will be filtered in the field, and samples collected for Cr(VI) analysis will be filtered in the laboratory before analysis.

Following collection of the initial sample after packer installation and development, the packed intervals will be sampled for a second time approximately 2 weeks later. PG&E will consult DTSC regarding the requested sample collection frequency, or other alternative action (e.g., movement of the packer to a different depth), after the second set of samples have been collected.

Schedule and Reporting

Per the estimated project timeline submitted to the agencies on November 15, 2010, PG&E will expedite the major elements of this project such that the laboratory analytical results for the initial groundwater samples from above and below the packer are provided to the agencies by the third week in January 2011. The results from the sample collected after open borehole development will be available 1-2 weeks after sample collection. Following agency approval of this implementation plan, PG&E will continue to finalize a field mobilization date. PG&E will inform the agencies of the field mobilization date for each phase of work once the date is determined. An estimated duration of four weeks will be required to remove the FLUTe™ system, develop the open borehole, install the packer system, develop the packed zones, and collect the initial samples.

PG&E will provide the final laboratory analytical results for groundwater samples collected as part of this evaluation for discussion during the weekly technical calls as the data become available.

References

CH2M HILL. 2005. *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program, Revision 1, Topock Compressor Station, Needles, California.* March 31.

_____. 2009. *Final Corrective Measures Study/Feasibility Study Report for SWMU 1/AOC 1 and AOC 10 at the Pacific Gas and Electric Company Topock Compressor Station.* December.

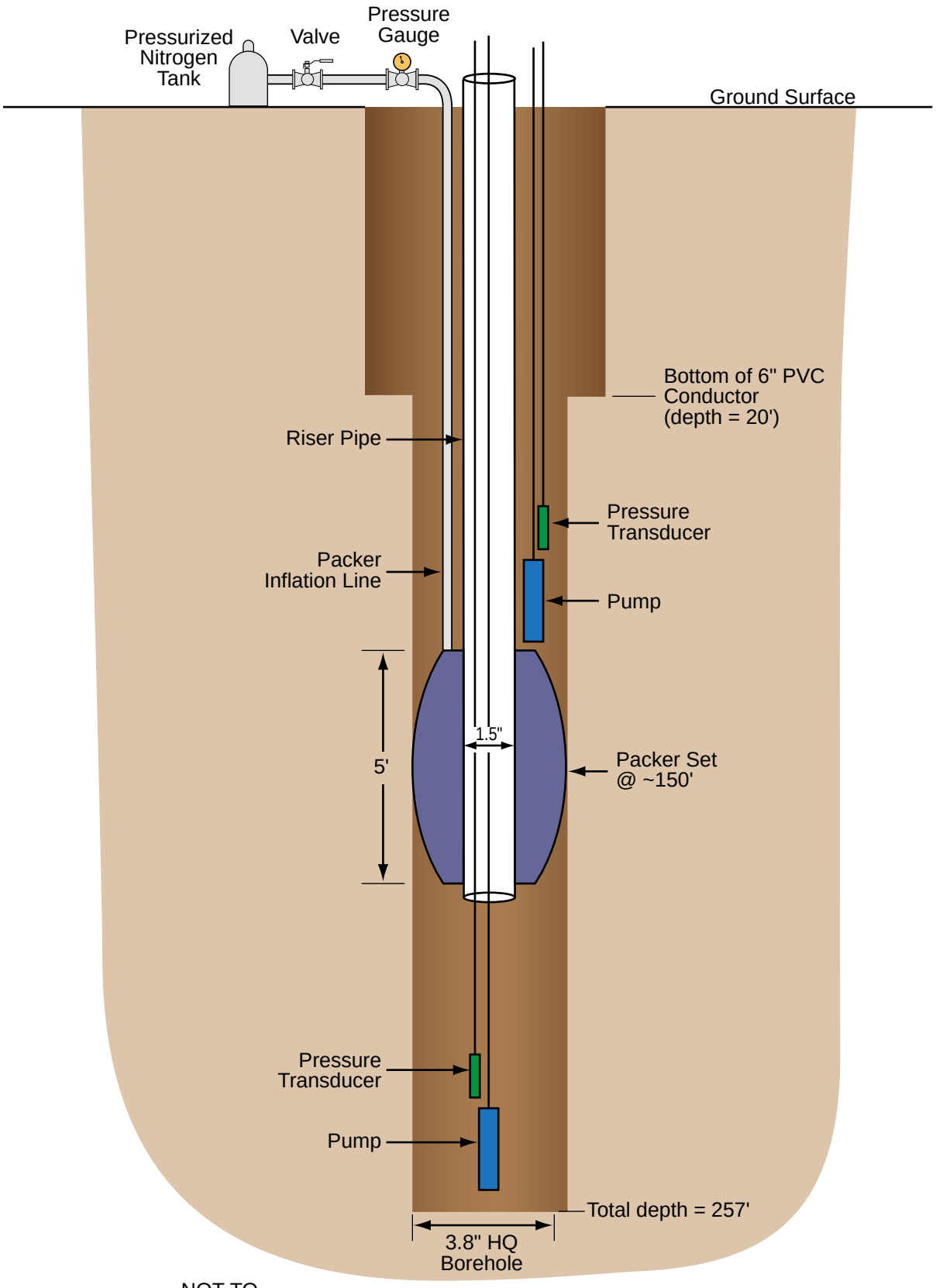

FIGURE 1
Conceptual Packer Design
Implementation Plan for Packer Evaluation of the MW-64BR Borehole
PG&E Topock Compressor Station
Needles, California