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January 27, 2006

Norman Shopay Project Manager California Department of Toxic Substances Control Geology and Corrective Action Branch 700 Heinz Avenue Berkeley, California 94710

Subject: Technical Addendum No. 1 Well Installation Work Plan for Interim Measures Performance Monitoring Program PG&E Topock Compressor Station, Needles, California

Dear Mr. Shopay:

This letter transmits the *Technical Memorandum No. 1*, *Well Installation Work Plan for Interim Measures Performance Monitoring Program.* The technical addendum is submitted in conformance with Condition 9 in DTSC's January 6, 2006 letter. The technical addendum also includes descriptions of short-term and longer-term staging areas in conformance with Condition 16 in DTSC's January 6, 2006 letter.

Please contact me at (805) 546-5243 if you have any questions on the work plan.

Sincerely,

nd for yvonne Meets ulli

cc. Kate Burger/ DTSC

Enclosure

Technical Addendum No. 1: Well Installation Work Plan for Interim Measures Performance Monitoring, PG&E Topock Compressor Station, Needles, California

Date: January 27, 2006

Introduction

This Technical Addendum No. 1 describes additional groundwater investigations and well drilling activities that will be performed as part of the Interim Measures (IM) field investigations at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station near Needles, California. On November 30, 2005, PG&E submitted to the California Department of Toxic Substances Control (DTSC) a *Well Installation Work Plan for Interim Measures Performance Monitoring Program* (IMPM Work Plan), which described the rationale, locations, and methods for the installation of new groundwater monitoring wells to address expansion and modifications to the IM performance monitoring network in the floodplain area of the Topock site.

The scope of work presented in the IMPM Work Plan was conditionally approved by DTSC in a letter dated January 6, 2006 (hereafter referred to as the "DTSC approval letter"). DTSC's conditional approval required further groundwater investigation, and installation of wells at up to five additional locations in the IM performance monitoring area. This Technical Addendum No. 1 to the IMPM Work Plan is submitted in compliance with Condition 9 of DTSC's approval letter, and describes the proposed locations and well drilling/completion plan and the anticipated schedule for the field work. Per Condition 10 of DTSC's approval letter, a separate Technical Addendum No. 2 will be submitted by February 7, 2006 to describe the proposed hydraulic testing activities for selected wells. The activities in the IMPM Work Plan, and the installation of wells at up to five additional locations in the IM performance monitoring area, are collectively referred to in this Technical Addendum as the "2006 IM drilling program."

Purpose and Contents

This Technical Addendum No. 1 addresses the proposed groundwater investigations and installation activities for the additional IM performance monitoring wells specified in DTSC's approval letter and provides clarifications to the well installation activities described in the IMPM Work Plan. The proposed methods and procedures for well drilling, hydrogeologic logging, depth-specific groundwater sampling, well installation, and reporting, were described in the IMPM Work Plan, and will apply to the 2006 IM drilling program.

This Technical Addendum specifically addresses the following items and activities associated with the 2006 IM drilling program:

- Incorporates DTSC's conditions for implementing the IMPM Work Plan, including installation of an additional well at Site C, limitations on equipment access routes, and requirements for sampling frequency for new wells.
- Makes minor revision to the installation/design plan for monitoring well clusters at Sites A and C that was presented in the IMPM Work Plan (i.e., proposing nested well completion instead of well cluster completions).
- Presents an updated map showing locations, access routes, and staging areas required for all of the well sites identified in the IMPM Work Plan and DTSC's approval letter.
- Presents the proposed well completion detail for the additional groundwater monitoring and hydraulic test wells (Locations 1 to 5) specified in DTSC's approval letter.
- Clarifies the staging area descriptions and geophysical logging activities.
- Presents the anticipated schedule for the installation, development, completion, and sampling of the new groundwater wells in the IM performance monitoring area.

For reference, DTSC's January 6, 2006 approval letter and enclosures are included as Attachment 1 to this Technical Addendum.

2006 IM Performance Monitoring Drilling Program

Well Locations

Figure 1 shows the proposed locations for all wells in the 2006 IM drilling program. Well sites A, B, and C were addressed in the IMPM Work Plan. DTSC's approval letter identified four additional locations and one contingent location for conducting groundwater investigations and installing additional monitoring and hydraulic test wells. The additional IM drilling sites are referred to as Locations 1 to 5 in DTSC's approval letter and on Figure 1.

The additional well sites on United States Bureau of Land Management (BLM) property include Location 1 (west of Park Moabi Road, next to well MW-19), Location 2 (western boundary of the floodplain northeast of well cluster MW-33), and Location 3, a contingent well site on the floodplain at MW-29 (Figure 1). Well sites on Havasu National Wildlife Refuge (HNWR) property include Location 4 (proposed on shoulder of Park Moabi Road, next to well MW-26) and Location 5 (west of Park Moabi Road, next to well MW-12).

Proposed Investigations by Drilling Site

Table 1 presents a summary of the groundwater investigations and well installations to be conducted at the drilling sites in the 2006 IM drilling program, including the installation of six monitoring wells at Sites A, B, and C, seven additional wells at Locations 1, 2, 4, and 5, and, if required by DTSC, two wells at Location 3. Table 1 has been updated and supersedes the initial investigation summary presented in the IMPM Work Plan. The reader is referred to the DTSC approval letter (Attachment 1) and enclosures for the specific rationale and investigation objectives for the additional well Locations 1 to 5.

Site Preparation, Access, and Equipment Staging

This Technical Addendum updates the equipment access routes proposed in the IMPM Work Plan, and supplements the equipment staging area provisions required for this project. Other provisions and procedures for drilling site access, staging areas, equipment decontamination, and management of investigation-derived waste will follow the IMPM Work Plan. Per Condition 18 in DTSC's approval letter, a biological and cultural resource monitor shall be onsite prior to and during the movement and setup of drilling equipment.

Site Preparation for Additional Wells

During January 2006, the additional drilling sites at Locations 1 to 5 were reviewed in the field by the DTSC project manager, and PG&E IM and biological field support staff, to confirm equipment access and site preparation requirements. Based on these field visits, no grading, vegetation removal, or other site preparation needs have been identified for theses wells.

Equipment Access Routes

The IMPM Work Plan proposed primary and secondary (contingent) access routes for drilling operations at floodplain Sites A, B, and C. As required by DTSC, the use of the secondary access route across HNWR is prohibited, and drilling and support equipment will use the primary (northern) access route as shown on Figure 1. The proposed equipment access route for contingent Location 3 is also shown on Figure 1. Prior to drilling commencement, the boundaries of all off-road access routes will be staked.

Staging Areas

Both short and long-term equipment staging areas have been identified for the 2006 IM drilling program. No storage or staging of any equipment or materials associated with this work will occur at the IM-3 treatment plant. Short-term staging areas to support drilling operations include two areas on the western margin of the floodplain adjacent to and south of well cluster MW-35, and two areas on the MW-20 bench, as shown on Figure 1. These areas will be used for staging drilling materials and IDW storage containers required during the drilling and well development activities. Drilling equipment, supplies, and storage bins in the short-term staging areas will be removed within 30 days following completion of well development of the new IM wells.

Long-term staging areas (for general drilling equipment and supplies and core storage) will be established on PG&E Compressor Station property (Figure 1). Prior to driller mobilization, the access and delineation of the proposed staging areas will be confirmed with BLM representatives and onsite PG&E and IM No. 3 operations staff.

Well Drilling, Installation, and Completion

Table 2 summarizes the drilling, sampling and well completion plans for the three drilling sites described in the IMPM Work Plan, and for the additional well locations specified in DTSC's approval letter. Table 2 has been updated to comply with the DTSC approval letter

and this table supersedes the drilling and sampling summary presented in the IMPM Work Plan.

Well Construction Plans for 2006 IM Wells

The methods, procedures and general specifications for well construction described in the IMPM Work Plan will be used for the 2006 IM drilling program. The modifications to the initial well construction plans include installing two wells at Site C and adjusting the grout mixtures for well construction, as required by Condition 4 in DTSC's approval letter. As listed in Table 2, groundwater monitoring wells in the 2006 IM drilling program will each have 10 feet of well screen. The screen lengths for the hydraulic test wells at Locations 1, 2, and 4 will be based on core logs and groundwater grab sampling results. Each hydraulic test well will have a maximum screen length of 40 feet.

Figure 2 shows a schematic diagram for the three-well completion design proposed for floodplain Site A (see Figure 1). This well design is slightly modified from the approach outlined in the IMPM Work Plan by incorporating a "nested" well completion, where all three wells (2-inch-diameter and 1.5-inch-diameter casings) are installed in a single boring. The nested well completion design is proposed for the 2006 IM drilling program to minimize the number of borings and surface well monuments required to meet the project objectives, in response to comments provided by the Fort Mohave tribe in a letter to DTSC dated December 9, 2005.

Installation of a nested three-well completion at Site A will require initially advancing the 10-inch-diameter sonic casing to an intermediate depth, followed by advancement of 8-inch-diameter casing to total depth as shown on Figure 2. A similar nested two-well completion is proposed for floodplain Site C (2-inch-diameter well casings; see Table 2).

The IMPM Work Plan proposed a single well at Site B to serve as a gradient monitoring well while extraction well PE-1 is operating. Figure 3 presents a minor modification to the original well design, which is recommended to allow continuous pressure transducer water level monitoring concurrent with sampling and other performance monitoring. Unlike the nested well design, both the performance monitoring well and water level sounding tube at Site B will be installed in a common filter pack zone, at an elevation equivalent to the PE-1 well completion.

Table 2 provides a summary of the wells that will be installed at Locations 1 through 5. The rationale for these wells is provided in the DTSC letter (Attachment 1). The wells to be installed include:

- Location 1 A 4-inch well for hydraulic testing (Figure 4) and a 2-inch monitoring well (Figure 5).
- Location 2 A 4-inch well for hydraulic testing and a nested well with two 2-inch casings installed in a common borehole (Figure 4).
- Location 3 A nested well with two 2-inch casings installed in a common borehole (Figure 4).
- Location 4 A 4-inch well for hydraulic testing (Figure 4).
- Location 5 A 2-inch monitoring well (Figure 5).

The core log and results of depth-discrete groundwater sampling from the initial boring at all locations will be reviewed with DTSC to select the depth and screen interval for the well(s) at that site. All monitor wells will include a 10-foot screened interval. A maximum screen length of 40 feet is proposed for hydraulic test wells, although a shorter screen may be used if saturated thickness or the thickness of permeable layers is small. The proposed well screen and filter pack specifications are provided on Figures 4 and 5.

Cased-well Geophysical Logging

Per DTSC requirements (Condition 15), cased-well geophysical logs (natural gamma ray and induction) will be collected in the deepest new monitoring or test wells installed at Site A, Site C, and Locations 1, 2, and 3 (if installed). As clarified in DTSC's approval letter, the geophysical logging will be used for hydrogeologic characterization in the IM performance area and will be scheduled soon after well drilling is completed.

Field Work Schedule

The schedule for the drilling and installation of the additional IM Locations 1 to 5 is subject to review and approvals from BLM and HNWR. Review and approvals by San Bernardino County will also be required. A traffic control plan may be required for the proposed well at Location 4, adjacent to Park Moabi Road. Additionally, review and consultation with the California Department of Fish and Game is anticipated for drilling activities at floodplain Locations 2 and 3.

The duration of well installation and completion activities for Sites A, B, and C is estimated to be 4 weeks. The duration of well installation and completion at Locations 1 to 5, including contingent Location 3, is estimated to be an additional 6 weeks.

A kick off meeting will be held at the site prior to the start of the drilling work.

Drilling Sequence

Per DTSC's approval letter, the IM drilling sequence will be prioritized as follows:

- 1. Sites C, A, and B
- 2. Location 2
- 3. Location 3 (if determined to be necessary)
- 4. Location 4
- 5. Location 5
- 6. Location 1

Well Development and Sampling

The groundwater monitoring and test wells installed for the 2006 IM drilling program will be developed, as feasible, during the drilling mobilization, following the procedures in the IMPM Work Plan. Initial sampling will occur a minimum of 2 days after well development. Scheduling of well development and sampling will be coordinated with BLM, HNWR, and PG&E onsite personnel to allow for groundwater sampling. If possible, two monthly sampling events will be performed for wells at Sites A and C prior to March 30, 2006. If there is insufficient time to perform monthly sampling events, only one round of sampling will be performed prior to March 30.

Transducer Installation and Hydraulic Testing

Dedicated pressure transducers will be installed in the new IM groundwater monitoring wells after initial water quality sampling. The new monitoring wells will be incorporated in the hydraulic monitoring network for the ongoing IM performance monitoring program. The anticipated schedule for conducting the hydraulic testing of new test wells at Locations 1, 2, and 4 will be provided in Technical Addendum No. 2.

Certification

This work plan was prepared by CH2M HILL under the supervision of the professional whose seal and signature appears hereon, in accordance with currently accepted professional practices; no warranty, expressed or implied, is made.

and Better

Paul F. Bertucci Certified Engineering Geologist



Tables

TABLE 1Proposed Groundwater Investigations and Well Installations - Includes Additonal Well SitesWell Installation Work Plan for IM Performance MonitoringPG&E TopockCompresor Station

Drill Site ID Location	Objective	Proposed Investigations	Rationale
Site A (MW-44) approx. 170' north of PE-1	Delineation & Characterization Gradient Monitoring Well	Continuous-core hydrogeologic logging; confrim bedrock Depth-discrete groundwater sampling Install 3 monitoring wells (mid-depth & lower intervals) Initial water quality characterization (2 events) Cased-well geophysics (after sampling) Incorporate wells in hydraulic monitoring network	Delineate plume limit northwest of MW-34-100 New well for PE-1 performance monitoring
Site B (MW-45) approx. 15' east of PE-1	Gradient Monitoring Well Selected-core hydrogeologic logging Install 1 monitoring well (lower interval) Initial water quality characterization Incorporate well in hydraulic monitoring network		New well for PE-1 performance monitoring
Site C (MW-46) approx. 90' west of MW-28	Delineation & Characterization	Continuous-core hydrogeologic logging; confrim bedrock Depth-discrete groundwater sampling Install 2 monitoring wells (lower interval) Initial water quality characterization (2 events) Cased-well geophysics (after sampling) Incorporate wells in hydraulic monitoring network	Delineate plume limit in central floodplain area

Additional Wells for 2006 IM Drilling Program

Location 1	Delineation & Characterization	Continuous-core hydrogeologic logging; confrim bedrock	see DTSC 1/6/06 letter and enclosures
		Depth-discrete groundwater sampling	
		Install 1 monitoring well (mid-depth or lower intervals)	
		Install 1 hydraulic test well (interval to be selected)	
		Initial water quality characterization	
		Cased-well geophysics (after sampling)	
		Incorporate wells in hydraulic monitoring network	

TABLE 1Proposed Groundwater Investigations and Well Installations - Includes Additonal Well SitesWell Installation Work Plan for IM Performance MonitoringPG&E TopockCompresor Station

Drill Site ID Location	Objective	Proposed Investigations	Rationale
Location 2	Delineation & Characterization	Continuous-core hydrogeologic logging; confrim bedrock Depth-discrete groundwater sampling Install 2 monitoring wells (upper and mid- or lower intervals) Install 1 hydraulic test well (interval to be selected) Initial water quality characterization Cased-well geophysics (after sampling) Incorporate wells in hydraulic monitoring network	see DTSC 1/6/06 letter and enclosures
Location 3	Contingency Site for Delineation contingent on results at Site C & Location 2	Continuous-core hydrogeologic logging; confrim bedrock Depth-discrete groundwater sampling Install 2 monitoring wells (mid-depth & lower intervals) Initial water quality characterization Cased-well geophysics (after sampling) Incorporate wells in hydraulic monitoring network	see DTSC 1/6/06 letter and enclosures
Location 4	Delineation & Characterization	Continuous-core hydrogeologic logging; confrim bedrock Depth-discrete groundwater sampling Install 1 monitoring / test well (base Alluvial Aquifer) Initial water quality characterization Incorporate well in hydraulic monitoring network	see DTSC 1/6/06 letter and enclosures assess if future bedrock well is warranted
Location 5	Characterization	Continuous-core hydrogeologic logging; confrim bedrock Depth-discrete groundwater sampling Install 1 monitoring well (base Alluvial Aquifer) Initial water quality characterization Incorporate well in hydraulic monitoring network	see DTSC 1/6/06 letter and enclosures assess if future bedrock well is warranted

NOTES:

1. See Figure 1 for proposed locations for additional well Locations 1 through 5

2. All drilling and well installation to be performed using rotosonic drilling method; all terrain sonic drill rig required for floodplain drilling sites

TABLE 2Drilling and Sampling Plan - Includes Additional Well SitesWell Installation Work Plan for IM Performance MonitoringPG&E TopockCompresor Station

		Estimated	Core L	ogging and Sampling	g - Pilot Hole	Proposed Well Installations	
Drill Site ID	Approximate Surface Elevation feet MSL	Depth Miocene Bedrock feet bgs	Target Drilling Depth feet bgs	Interval for Core Log & Archive feet bgs	Intervals Targeted for Groundwater Grab Sampling feet bgs	Alluvial Aquifer Completion	Well Construction
Site A (MW-44)	467	120	130	20 - total depth	46 - 56 66 - 76 86 - 96 106 - 116 total depth	Mid-Depth Interval Lower Interval Base of Alluvial Aquifer	single nested wells 1.5" PVC - 10' screen 1.5" PVC - 10' screen 2" PVC - 10' screen
Site B (MW-45)	470	95	105	70 - total depth	no sampling location characterized	Lower Interval	Paired 2" & 1" PVC - 10' screens dual well for gradient & sampling
Site C (MW-46)	472	160	170	20 - total depth	46 - 56 66 - 76 86 - 96 106 - 116 126 - 136 146 - 156 total depth	Lower Interval Base of Alluvial Aquifer	single nested wells 2" PVC - 10' screen 2" PVC - 10' screen
Additional We	lls for 2006	SIM Drillin	na Proaram				
Location 1	499	190	200	20 - total depth	66 - 76 86 - 96 106 - 116 126 - 136 146 - 156 166 - 176 total depth	to be determined to be determined	2" PVC monitoring well - 10' screen 4" PVC test well - up to 40' screen
Location 2	480	210	220	20 - total depth	46 - 56 66 - 76 86 - 96 106 - 116 126 - 136 146 - 156 166 - 176 186 - 196 total depth	Upper Interval to be determined to be determined	single nested wells 2" PVC - 10' screen 2" PVC - 10' screen 4" PVC test well - up to 40' screen

TABLE 2 Drilling and Sampling Plan - Includes Additional Well Sites Well Installation Work Plan for *IM Performance Monitoring PG&E TopockCompresor Station*

		Estimated	Core L	ogging and Sampling	J - Pilot Hole	Propose	d Well Installations
Drill Site ID	Approximate Surface Elevation feet MSL	Depth Miocene Bedrock feet bgs	Target Drilling Depth feet bgs	Interval for Core Log & Archive feet bgs	Intervals Targeted for Groundwater Grab Sampling feet bgs	Alluvial Aquifer Completion	Well Construction
Location 3 (contingent site)	483	240	250	20 - total depth	46 - 56 66 - 76 86 - 96 106 - 116 126 - 136 146 - 156 166 - 176 186 - 196 206 - 216 total depth	Mid-Depth Interval Lower Interval	<i>single nested wells</i> 2" PVC - 10' screen 2" PVC - 10' screen
Location 4	503	135	145	20 - total depth	66 - 76 86 - 96 106 - 116 total depth	to be determined	4" PVC test well - up to 40' screen
Location 5	483	50	60	20 - total depth	26 - 36 46 - 56 total depth	Base of Alluvial Aquifer	2" PVC - 10' screen

NOTES:

 See Figure 1 for proposed locations for all drilling sites. See Figures 2 through 5 for schematic well construction diagrams. See 11/30/05 Well Installation Work Plan for drilling and depth-specific groundwater sampling methods. Additional well Locations 1 to 5 included in the 2006 IM drilling program per DTSC 1/6/06 letter.

- 2. Depth-specific groundwater grab samples to be collected from 10-foot open-borehole intervals using Isoflow [™] system Target intervals are listed for general planning and subject to drilling conditions.
- 3. Groundwater grab samples will be analyzed for Cr(VI) with IM-3 treatment plant laboratory (HACH analytical method) and field water quality parameters. Supplemental groundwater samples (field-filtered and preserved) will be collected for Cr(T) laboratory analysis if confirmation of Cr(VI) HACH method results is required.
- 4. Well screen intervals will be selected in consultation with DTSC based on core log and results of groundwater grab sampling.
- Per DTSC 1/6/06 letter, one of the wells to be installed at Locations 1, 2 and 4 to be used for hydraulic testing. Hydraulic test wells to be 4" diameter polyvinyl chloride (PVC) with screen length to be based on drilling and sampling results.

Figures



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Attachment 1 DTSC Approval Letter, dated January 6, 2006





Department of Toxic Substances Control



Alan C. Lloyd, Ph.D Agency Secretary Cal/EPA 700 Heinz Avenue, Suite 100 Berkeley, California 94710-2721 Arnold Schwarzenegger Governor

January 6, 2006

Ms. Yvonne Meeks Portfolio Manager - Site Remediation Pacific Gas and Electric Company 4325 South Higuera Street San Luis Obispo, CA 93401

CONDITIONAL APPROVAL OF THE DRAFT WELL INSTALLATION WORK PLAN FOR INTERIM MEASURES PERFORMANCE MONITORING PROGRAM, DATED NOVEMBER 30, 2005, PACIFIC GAS AND ELECTRIC COMPANY, TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA (EPA ID NO. CAT080011729)

Dear Ms. Meeks:

The Department of Toxic Substances Control (DTSC) has completed our review of the Draft Work Plan for Interim Measures Performance Monitoring Program (Workplan) dated November 30, 2005. The DTSC Northern California Geological Services Unit (GSU) has reviewed and provided technical comments on the Workplan in a memorandum dated December 23, 2005. A copy of the GSU memorandum is included as Enclosure 1 and was previously provided to Pacific Gas and Electric Company (PG&E) and the Consultative Workgroup (CWG) on December 23, 2005.

DTSC has reviewed our obligations under the California Environmental Quality Act (CEQA) and has considered comments provided by stakeholders. DTSC has determined that the scope of work and activities proposed are consistent with the previous Interim Measures No. 2 Notice of Exemption (NOE) dated February 10, 2004, Interim Measures No. 3 NOE dated June 30, 2004, and the DTSC Interim Measures No. 3 Conditional Approval letter dated June 30, 2004.

In addition to the scope of work identified in the Workplan, DTSC is also requiring PG&E to install wells at up to five additional locations. These locations are shown on a figure included in Enclosure 1 and consist of four locations and one contingent location. The objective of the additional locations is to acquire data that will:

a) evaluate the reduction or reversal of the flow of contaminated groundwater toward the river;

- b) evaluate the reversal of groundwater gradient away from the river;
- c) analyze the influence of wells that may be used for longer term flow reversal or containment;
- d) evaluate hydraulic control of the plume boundary near the river to achieve a net reversal of groundwater gradient away from the river;
- e) evaluate additional extraction well locations and their sphere of influence; and
- f) evaluate the influence of extraction on the existing groundwater plume for evaluating the interim measure performance.

GSU described the rationale for each location in Enclosure 1 and has provided a summary of the rationale for each location as Enclosure 2 of this letter. Upon completion of the installation and sampling of all wells DTSC will consider establishing an appropriate data cut-off date for information to be included in the revised RCRA Facility Investigation (RFI) report.

DTSC is providing conditional approval of the scope of work identified in the Workplan and for up to five additional well locations as follows:

- 1. PG&E shall install two wells at Site C rather than the single proposed well. See Comment 2 of Enclosure 1 for further discussion.
- 2. PG&E is prohibited from using the secondary access route shown on Figure 3-2 of the Workplan as a contingency access route to Site A and Site B drilling locations.
- 3. As feasible, PG&E shall sample wells installed at Sites A and C at least two times prior to March 30, 2006. Thereafter, the wells shall be sampled on a monthly basis for at least three months as part of the Interim Measures Performance Monitoring Program.
- 4. PG&E shall install at least two new monitoring wells at Location 1, adjacent to existing well MW-19. At least one well shall be installed with a larger diameter casing that is capable of supporting hydraulic testing.
- PG&E shall install at least three new monitoring wells at Location 2, along Park Moabi Road and approximately midway between the existing MW-31 and MW-35 well clusters. The design of this well cluster shall be capable of support hydraulic testing.
- 6. If determined to be necessary by DTSC, upon reviewing field results observed at Location 2 or Site C, PG&E shall be prepared to install a well cluster at Location 3 to augment or replace existing well MW-29.
- 7. At Location 4, PG&E shall advance a boring adjacent to existing well MW-26 to verify the depth of the fanglomerate bedrock and shall use the same investigation

Ms. Yvonne Meeks January 6, 2006 Page 3 of 5

> techniques as described in the Workplan (i.e., drilling method, continuous logging, Isoflow® sampling). If a sufficient thickness of saturated Alluvial Aquifer is determined to be present above the top of the fanglomerate and below the MW-26 screen interval (i.e., five to ten feet), as determined by DTSC, PG&E shall be prepared to install a new monitoring well to monitor that zone. If an appropriate thickness of sediments is present, as determined by DTSC, PG&E shall design the well to support aquifer testing. As feasible, the borehole shall penetrate several feet into the fanglomerate unit to determine whether a water-bearing zone is present. If determined to be present, PG&E shall plan to include installation of a bedrock well at this location in the future as a data collection activity in the Groundwater Corrective Measures Study Workplan.

- 8. At Location 5, PG&E shall drill adjacent to existing well MW-12 to verify the depth of the fanglomerate bedrock and shall use the same investigation techniques as described in the Workplan (i.e., drilling method, continuous logging, Isoflow® sampling). If a sufficient thickness of saturated Alluvial Aquifer and fanglomerate is encountered below the MW-12 screen interval (i.e., five to ten feet), PG&E shall be prepared to install a new monitoring well to monitor that zone. As feasible, the borehole shall penetrate several feet into the fanglomerate unit to determine whether a water-bearing zone is present. If determined to be present, PG&E shall include installation of a bedrock well at this location as a future data collection activity in the Groundwater Corrective Measures Study Workplan.
- 9. No later than January 27, 2006, PG&E shall submit Technical Addendum 1 to the Workplan that describes the approach for installing the wells at Locations 1, 2, 3, 4, and 5, the anticipated well completion details, an anticipated schedule for installing, developing, and sampling wells and an anticipated schedule for installing transducers in the new wells. Technical Addendum 1 shall include the proposed access route for contingent Location 3. The preparation and submission of this technical addendum is not required prior to commencement of drilling at locations A, B and C. Drilling at these locations can occur upon receipt of necessary approvals (Condition 11), notification (Condition 12), staging area description (Condition 16), and kick-off meeting (Condition 17) as described below.
- 10. No later than February 7, 2006, PG&E shall submit Technical Addendum 2 to the Workplan that describes the approach for hydraulic testing of wells at Locations 1, 2, and 4 (if installed and DTSC determines to be appropriate). Technical Addendum 2 shall include the proposed methods, logistical considerations, and an anticipated schedule for conducting the aquifer testing. The schedule should consider the closure date for data collection for the groundwater portion of the RCRA Facility Investigation and Remedial Investigation Report.

Ms. Yvonne Meeks January 6, 2006 Page 4 of 5

For the activities conditionally approved and required by this letter,

- 11. PG&E shall obtain all necessary approvals and/or authorizations from applicable federal, state, county, and local agencies as required. Prior to commencing any field activities, PG&E shall provide written notification to DTSC listing all applicable permits and/or approvals that have been obtained.
- 12. PG&E shall provide a minimum of seven (7) days notice prior to commencing any field activities.
- 13. As feasible, PG&E shall prioritize the sequence of well installation as follows:
 - i. Sites A, B, and C;
 - ii. Location 2;
 - iii. Location 3 (if determined to be necessary);
 - iv. Location 4;
 - v. Location 5; and
 - vi. Location 1.
- 14.PG&E shall adjust the grout mixtures to be used for well construction as discussed in Comment 5 of the Enclosure 1.
- 15. PG&E shall conduct geophysical logging of the deep borings at Sites A and C and Locations 1, 2, and 3. These activities are not required to support selection of the shallower screened intervals at these sites and the geophysical logging can be conducted shortly after the wells are completed.
- 16. Prior to the commencement of drilling activities, PG&E shall provide a more detailed description of the short-term and longer-term staging areas that considers the scope of work identified in the Workplan and the additional well installation identified by DTSC in this letter.
- 17. Prior to the start of field activities, PG&E shall schedule and host an onsite preconstruction kick-off meeting. PG&E shall provide DTSC a minimum of seven (7) notice of the meeting date.
- 18. A biological and cultural resource monitor shall be onsite prior to and during the movement and setup of drilling equipment.

DTSC is also requiring the following three (3) additional tasks related to inactive water supply wells PGE-06, PGE-07 and painting of well monuments and bollards.

19. PG&E shall evaluate the potential vertical migration pathway from the Alluvial Aquifer to bedrock units that is enabled by the design of well PGE-07. No later than February 17, 2006, PG&E shall submit a technical memorandum providing recommendations whether this well should be reconstructed or decommissioned. If Ms. Yvonne Meeks January 6, 2006 Page 5 of 5

the recommendation is for well reconstruction or decommissioning, DTSC will require PG&E to provide a workplan for well PGE-07 at the same time.

- 20. No later than February 28, 2006, PG&E shall submit a technical memorandum that evaluates the usefulness of well PGE-06 for the site monitoring program and as part of the groundwater remedy. The technical memorandum should provide a recommendation as to whether this well should be decommissioned. If the recommendation is for well decommissioning, DTSC will require PG&E to provide a well decommissioning workplan for well PGE-06 at the same time.
- 21. As previously stated in DTSC's letter dated May 3, 2005 "Well monuments and bollards shall be painted Desert Tan except in areas adjacent to roads where the monuments and bollards shall be painted yellow for safety visibility". PG&E was to submit a schedule for these activities. However, since the May 3, 2005 DTSC letter there has been some additional discussions regarding paint colors to lessen the visual impacts. As a test, MW-25 was painted Desert Tan. Based on the results of this test DTSC has determined that PG&E shall complete the painting of well monuments and bollards by March 15, 2006. Monitoring wells and bollards in the floodplain and upland areas shall be painted Desert Tan. Monitoring wells and bollards in areas adjacent to roads shall be painted yellow for safety visibility.

If you have questions, please contact me at (510) 540-3943.

Sincerely,

Norman Shepay

Norman Shopay, P.G. Project Manager Geology, Permitting and Corrective Action Branch

nts/193c

Enclosure 1: GSU Technical Memorandum, Well Installation Work Plan for Interim Measures Performance Monitoring Program, Dated December 23, 2005

Enclosure 2 Summary of Rationale for Additional Well Locations

cc: PG&E Topock Consultative Workgroup Members – Via e-mail



Alan C. Lloyd, Ph.D. Agency Secretary Cal/EPA



Department of Toxic Substances Control



8800 Cal Center Drive Sacramento, California 95826-3200

. Arnold Schwarzenegger Governor

MEMORANDUM

TO: Norman Shopay, P.G. Project Manager Hazardous Waste Management Program, Berkeley Regional Office

FROM: Kate Burger, Ph.D., P.G. Common Shopay For K.B. Engineering Geologist, Northern California Geological Services Unit Hazardous Waste Management Program, Sacramento Regional Office

DATE: December 23, 2005

SUBJECT: Well Installation Workplan, Floodplain Interim Measure Performance Monitoring Program, PG&E Topock Compressor Station, Needles, San Bernardino County, Project No. 22120/540015-48/36-HWMP

DOCUMENT REVIEWED

Draft Well Installation Work Plan for Interim Measures Performance Monitoring Program, PG&E Topock Compressor Station, Needles, California. Prepared by CH2M Hill. Dated November 30, 2005.

INTRODUCTION

The Northern California Geological Services Unit (GSU) of the Department of Toxic Substances Control (DTSC) has reviewed the above-referenced well installation workplan (Workplan). Pacific Gas and Electric Company (PG&E) is submitting the workplan as required by the October 17, 2005 DTSC letter providing conditional approval of extraction well TW-3D. The work described in the Workplan will provide additional wells that are needed to assess hydraulic gradients associated with the expanded groundwater extraction system and to provide better definition of the plume position to the north and northwest of the MW-34 well cluster. Both of these objectives must be addressed in order to assess the floodplain interim measure (IM) performance. DTSC provided the Workplan to the Consultative Workgroup (CWG) on December 1, 2005 and discussed the Workplan with CWG members in a December 2, 2005 conference call. DTSC received written comments from the Fort Mojave Indian Tribe on December 9, 2005 and GSU has reviewed and considered theses comments.

As you requested, in addition to reviewing the scope of work identified in the Workplan, GSU is providing options for additional well locations for your consideration in the approval of this workplan. Also, GSU is recommending the decommissioning of well PGE-07 and an evaluation of the continued usefulness of well PGE-06 for the project.

This memorandum provides the GSU comments and recommendations. If you have questions, please contact me at (916) 255-6537.

SCOPE OF WORK PROPOSED IN WORKPLAN

DTSC identified the performance monitoring requirements for the IM in a February 14, 2005 letter. The three gradient well pairs established in the performance monitoring requirements were based on a single groundwater pumping center on the MW-20 bench. Groundwater extraction from well PE-1 will create another pumping center in the floodplain area. This second pumping center requires additional wells that can be used to assess the performance of the IM.

PG&E proposes to install wells at the following three locations:

- Site A (170 feet north of well PE-1). Three wells will be installed at this location to form well cluster MW-44. The wells will be screened in the middle and lower depth intervals of the Alluvial Aquifer. One of the lower depth interval wells will be used as part of a gradient well pair in the vicinity of extraction well PE-1. This well cluster may also provide delineation of the chromium plume in the area north to northwest of well MW-34-100. The Site A location was selected based on the groundwater flow model projections of flow conditions under groundwater extraction from both the MW-20 bench and well PE-1. The location has been adjusted to prevent damage to vegetated areas in the vicinity. Because of this adjustment and the possibility that actual groundwater flow conditions may differ from the groundwater flow model projections, well cluster MW-44 may not be optimally located to assess gradients induced by extraction well PE-1.
- Site B (15 feet east of well PE-1). A single well (well MW-45) will be installed in the lower depth interval of the Alluvial Aquifer to serve as the central well in gradient well pairs used to assess gradients induced by extraction well PE-1.
- Site C (90 feet west of the MW-28 well cluster). One or two wells will be installed at this location (well or well cluster MW-46) to provide better control on gradient mapping in the lower depth interval of the Alluvial Aquifer. PG&E proposes to install a second well only if permeable zones are identified in the oldest alluvium unit (Toa1). Depending on the findings at well cluster MW-44, an additional well or additional wells at this location may also provide further chromium plume delineation. This well or well cluster is intended to augment the data from well cluster MW-28. The location is adjusted westward because of the soft sand conditions encountered near the MW-28 well cluster and to avoid disturbance of nearby vegetation.

Comments and Recommendations

GSU recommends approval of the Workplan, provided that the following Comments 2, 3, 4, and 5 are addressed during implementation of the proposed activities. GSU considers the scope of work outlined in the Workplan to be the most crucial locations to be installed during this investigation.

- With the activation of extraction wells TW-3D and PE-1, DTSC will need to reevaluate the performance monitoring requirements established in the February 14, 2005 DTSC letter. The reassessment should consider: the use of extraction well TW-2D (in lieu of well MW-20-130 or MW-31-135) as a central well for gradient well pairs used to assess pumping at the MW-20 bench; new well pairs established to evaluate extraction well PE-1; use of a well at Site C as part of a gradient well pair; and the target gradient to be maintained by each gradient well pair. GSU suggests that the reevaluation be deferred until several months of water level data are available from existing and proposed floodplain wells while the pumping from wells TW-3D/TW-2D, TW-3D/TW-2D/PE-1, or TW-3D/PE-1.
- 2. The Workplan proposes to install one well at Site C with a second well contingent upon identification of "a substantial thickness of permeable alluvium". Given the thickness of the lower depth interval of the Alluvial Aquifer in this area and the concern that the chromium plume may be migrating along the top of the hard fanglomerate surface, GSU believes that two wells will be needed at this location. The lower part of the Alluvial Aquifer observed in the MW-28 borehole is described as a wet, well-graded, sandy gravel which suggests that a transmissive unit is present. Elsewhere at the site, PG&E has installed wells in apparently low permeability alluvium, which yield groundwater with significant chromium concentrations (e.g., MW-37D screens a moist sandy gravel). Ultimately, the screened intervals selected for this location should consider the groundwater lsoflow sampling results and the geophysical logging to be performed at the time of drilling activities. GSU recommends that a DTSC representative be present to observe drilling at this location to provide input regarding the selected screened intervals.
- 3. The Workplan indicates that cased-well geophysical logging (natural gamma ray and induction) will be conducted in the deepest well at Sites A and C. The Workplan does not clearly indicate the timing for the geophysical logging. From a discussion with CH2M Hill on December 1, 2005, GSU understands that the geophysical logging will be conducted in a timeframe that will support selection of the shallower screened intervals at Site A and Site C.
- 4. The Workplan indicates that either a 30 percent solids bentonite grout or a cement mixture will be used as the annular grout. The bentonite grout should be mixed in accordance with manufacturer specifications. The cement mixture should be mixed with no more than 6.5 gallons of water (rather than the 8 gallons cited in the Workplan) for the cement and bentonite powder ratio stated in the Workplan.
- 5. PG&E should monitor wells installed at Sites A and C at least two times prior to March 30, 2006. Thereafter, as part of the IM performance monitoring program, PG&E should monitor wells installed at Sites A and C at a monthly frequency for three months. A decision regarding appropriate sampling frequency for these wells should be made after reviewing the monthly data.

ADDITIONAL WELL LOCATIONS FOR CONSIDERATION

GSU understands that as part of this field mobilization, DTSC is also interested in acquiring data that would provide:

- a. further basis for evaluating the IM performance;
- b. further basis for evaluating groundwater remedial alternatives in the Groundwater Corrective Measures Study; and
- c. a means of expediting the groundwater remedy selection.

GSU has identified the following rationale for additional well locations to support this data acquisition.

- A. Additional measurement points to allow assessment of the hydraulic gradients induced by groundwater extraction and injection. Additional measurement points in some areas will allow groundwater flow conditions to be assessed empirically rather than relying on groundwater flow model predictions.
- B. Better delineation of the mapped groundwater plume extent (i.e., the 20 and 50 parts per billion (ppb) contour positions). Improved interpretation of the plume extent will allow refinement of the area that will need to be addressed by the groundwater remedy.
- C. Better vertical characterization of the chromium plume distribution and geochemical conditions (i.e., oxidation/reduction potential, dissolved oxygen, total dissolved solids). The additional vertical characterization will assist with the assessment of *in situ* treatment feasibility and target screen positions for a pump-and-treat system. For some areas north of the MW-20 bench, the existing data set may rely too heavily on chromium and geochemical distributions observed at certain wells (e.g., MW-31 well cluster).
- D. Hydraulic testing locations to allow assessment of hydrogeologic conditions where limited data is available and at locations that could be considered as potential pumpand-treat centers. Geo/Hydro Technical Workgroup (TWG) members have had repeated discussions about the need for additional hydraulic data to the north of the MW-20 bench.
- E. Better definition of the nature and depth of the bedrock surface, especially north of the MW-20 bench. Better bedrock definition is needed for understanding the groundwater flow conditions and for considering the design depth of any physical barriers that might be considered as part of the groundwater remedy.
- F. Monitoring points that would enable further assessment of potential plume migration pathways that would need to be considered as part of the evaluation of the groundwater remedy.

Recommended Locations

GSU is recommending up to five additional well locations as (1) deeper wells adjacent to an existing shallow well or (2) a new well cluster or well nest. As shown on the attached figure, with the exception of contingent Location 3, the recommended locations lie along Park Moabi Road or are readily accessible from Park Moabi Road. GSU believes that the suggested locations will support important, multiple technical functions (as identified in the above-noted rationale and in the discussion of each location below), without additional disturbance to sensitive upland areas. GSU is making these recommendations without consideration of whether all suggested locations are feasible for this field mobilization. Hence, some locations may need to be deferred as a data collection activity during the Groundwater Corrective Measures Study.

Location 1. Augment existing shallow well location MW-19 by installing middle and deep depth interval wells in the Alluvial Aquifer. This location lies just west of Park Moabi Road and along the road leading to the existing treatment plant. The purpose of this well cluster would be to collect data to address Rationale A, C, D, E, and F (see above).

Over the past several years, CWG members have discussed this location as a desirable for both a monitoring well cluster (or nested well pair) and as a potential extraction well location (e.g., PE-3). GSU notes that the alternative to this location is to drill further west in the upland area. However, GSU believes that the stated technical objectives can be met at this location and thus avoid disturbance of the upland area.

With regards to Rationale F, GSU believes that this location is needed to provide additional assessment of the hexavalent chromium concentrations observed at well MW-37D within Bat Cave Wash. The October 2005 hexavalent chromium concentration for this well is 1,800 micrograms per liter (μ g/L) the highest concentration reported to-date. Based on the groundwater flow field predicted by recent groundwater flow model simulations, GSU does not consider the next well cluster to the north of MW-37D (well cluster MW-41) to provide an adequate assessment of the plume migration pathway from this well. Additional wells at this location would allow assessment of the direction of chromium plume migration (eastward from MW-37D) that is predicted by the groundwater flow model.

Location 2. Install a three well cluster or nest along Park Moabi Road, approximately halfway between the MW-31 and MW-35 well clusters. The purpose of this well cluster or nest would be to collect data to address Rationale A, B, C, D, E, and F (see above).

GSU notes that the alternative to this location is to drill further west in the upland area. However, GSU believes that the stated technical objectives can be met at this location and thus avoid disturbance of the upland area.

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With regards to Rationale F, GSU believes that this location is also needed to provide additional assessment of the hexavalent chromium concentrations observed at well MW-37D within Bat Cave Wash. Wells at this location would allow further refinement of the chromium plume migration (generally eastward from Bat Cave Wash) that is predicted by the groundwater flow model.

- Location 3. Contingent location. Replace or augment existing well MW-29 (shallow depth interval well in Alluvial Aquifer) with a well cluster or nest that screens multiple zones in the Alluvial Aquifer. A decision as to whether this location is needed should be contingent upon the findings at the Location 2 and potentially Site C. The purpose of this well cluster would be to collect data to address Rationale A, B, C, and E (see above).
- Location 4. Augment existing well location MW-26 (screens shallow depth interval of Alluvial Aquifer) with one or two additional wells screened in the lower portion of the Alluvial Aquifer and upper bedrock (if permeable zones are determined to be present). This location is on Havasu National Wildlife Refuge property and lies along Park Moabi Road. Over the past several years, CWG members have discussed this location as a desirable for both a monitoring well cluster (or nested well pair) and as a potential extraction well location (e.g., PE-2). The purpose of this well cluster would be to collect data to address Rationale A, B, C, and D (see above).
- Location 5. Install a shallow bedrock well adjacent to monitoring well MW-12 which screens the saturated portion of the Alluvial Aquifer (approximately 25 to 47 feet below ground surface) and the reported top of the red fanglomerate (approximately 47 to 50 feet below ground surface). This location lies in a low-lying area immediately west of Park Moabi Road and is on Havasu National Wildlife Refuge property. The purpose of this additional well would be to collect data to address Rationale A, B, C, E and F (see above).

With regards to Rationale F, GSU review of the RCRA Facility Investigation/Remedial Investigation Report (RFI/RI Report) has identified concerns with Area of Concern (AOC) 11 in which well MW-12 is located. These concerns include:

(a) Elevated arsenic, molybdenum, and pH concentrations are observed in well MW-12 groundwater which suggest some impact.

(b) This is a low-lying area that has received long-term runoff from compressor station operations.

(c) The investigation efforts to-date have not fully evaluated this AOC.
(d) The log for well MW-12 indicates that the red fanglomerate is a <u>wet</u> silty sand. Hence, the depth of permeable materials containing chromium and other metals has not been identified.

(e) Other wells in the vicinity of MW-12 may not be adequate to fully characterize the nature of the bedrock in this area. The fanglomerate at

well MW-21 is described as a poorly-graded gravelly sand (no moisture description provided, but low recharge well during sampling efforts). The fanglomerate at well MW-22 was encountered via hand auger and a description of the unit is not available.

(f) GSU does not believe that this is an area that is currently being considered as a potential location to be addressed by the groundwater remedy.

WELLS RECOMMENDED FOR DECOMMISSIONING

In reviewing the site-wide groundwater monitoring program and the RFI/RI Report, GSU has identified concerns with the well completion for inactive water supply well PGE-07. This well is located on the MW-24 bench immediately north of the compressor station. As illustrated by Figure 2-11 of the RFI/RI Report, well PGE-07 screens across the base of the Alluvial Aquifer, through the Miocene fanglomerate, and into the top of the pre-Tertiary bedrock. Monitoring at nearby well MW-24B (screens near base of the Alluvial Aquifer) indicates hexavalent chromium concentrations range from 4,790 to 5,640 μ g/L. By screening across the base of the impacted Alluvial Aquifer and through the bedrock units, the design of well PGE-07 potentially allows downward migration of the chromium plume. GSU urges that this well is decommissioned to remove this vertical pathway. Data lost from the well can be replaced by the existing MW-24 well cluster (i.e., MW-24A, MW-24B, MW-24BR).

GSU recommends that PG&E evaluate the continued necessity of inactive water supply well PGE-06, which is also located in the MW-24 bench. Well PGE-06 is screened in the shallow and middle depth intervals of the Alluvial Aquifer (110 to 180 feet below. ground surface) and reports hexavalent chromium concentrations on the order of 1,630 to 2,070 μ g/L. The PGE-06 well screen interval overlaps the screen interval for nearby well MW-24A (104 to 124 feet below ground surface, hexavalent chromium concentrations of 2,960 to 3,390 μ g/L). Based on the water quality and hydraulic data that can be obtained from the MW-24 well cluster, GSU does not believe that there is a compelling need for well PGE-06 as part of the site-wide groundwater monitoring program. However, another factor to consider in the decision to decommission this well is whether the well would have some use during the groundwater remedy, whether as a pump-and-treat center or as part of an *in situ* treatment effort. Hence, the GSU recommendation is for PG&E to evaluate the continued usefulness of this well for the project, whether as part of the site-wide monitoring program or as part of the site-wide monitoring program or as part of the site-wide monitoring program.

Peer reviewed by: Alfredo Zanoria, CEG, CHG

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ENCLOSURE NO. 2 – SUMMARY OF RATIONALE FOR ADDITIONAL WELL LOCATIONS¹ Page 1 of 7

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Location ²	Location Description	General Rationale ³	DTSC Rationale ⁴	Geo/Hydro Technical Workgroup (TWG) Input⁵	Stakeholder Comments on RFI/RI Report That Support Well Locations
1	Adjacent to MW-19, just off Park Moabi Road. 2 new wells: screening middle and lower depth interval of Alluvial Aquifer as well cluster/ nest.	ACDEF	 -Eastern control on hexavalent chromium (Cr(VI)) concentrations observed at MW-37D in Bat Cave Wash (BCW) (1,800 parts per billion (ppb) in October 2005). The alternative is to drill on the upland area to west, which DTSC does not consider to be a viable option. -Allows better vertical characterization of chromium (Cr) plume and geochemical conditions as transition from upland to floodplain. Data will be useful for <i>in situ</i> treatment, pump-and-treat system, and physical barrier design. -With proper design of new wells, location will provide a hydraulic testing point to assess aquifer conditions north of the MW-20 bench. Will provide data to consider for <i>in situ</i> treatment, pump-and-treat, and physical barrier design. -Gradient measurement point in relative close proximity to MW-20 bench and floodplain <i>in situ</i> pilot test. Also allows assessment of effects on injection on groundwater flow and plume movement. 	-The TWG selected this as a potential extraction well location, PE-3. -TWG members strongly advocated this location for further characterization for the following reasons: *more hydraulic characterization is needed to assess aquifer thickness and conditions before designing a pumping well at this location; *members had reservations regarding incomplete characterization of plume in this area such that they would not want to put in a pumping well that potentially draws the Cr plume northward; *additional characterization in northern portion of floodplain is needed to support final remedy selection. -Location supports U.S. Geological Survey (USGS) and GSU recommendation for drilling in northern floodplain area to assess vertical plume distribution and lateral migration pathways from BCW toward floodplain. USGS believes that existing interpretation of vertical plume configuration and geochemical conditions relies to heavily on MW-31 cluster. -RWQCB advocates largest possible influence on the plume (mass removal and hydraulic containment), such as a pumping well would provide at this location.	The following U.S. Department of Interior (DOI) comments support additional well installation at Location 1: 28, 32, 33, 41, 47, 137, 140, 133, and 168. For your reference, portions of these comments are included as Note 6 of this enclosure. The following Arizona Department of Environmental Quality (ADEQ) comments support additional well installation at Location 1: General Comment, 1.2.1, 9.1.5, and 13.5. For your reference, portions of these comments are included as Note 7 of this enclosure.

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Location ²	Location Description	General Rationale ³	DTSC Rationale ⁴	TWG Input⁵	Stakeholder Comments on RFI/RI Report That Support Well Locations
2	Along Park Moabi Road, midway between MW-31 and MW-35 well clusters New 3 well cluster/nest screening upper, middle, and lower depth intervals of Alluvial Aquifer	ABCDEF	 -A bedrock control point is needed to assess Alluvial Aquifer thickness. Latest top of Miocene bedrock elevation contour map indicates that <u>all</u> bedrock depths along Park Moabi Road and north of the MW-20 bench are estimates. Need to know top of bedrock to evaluate whether a physical barrier is feasible, particularly if the barrier would be constructed along the road. -Eastern control on Cr(VI) concentrations observed at MW-37D in Bat Cave Wash (1,800 ppb). The alternative is to drill on the upland area to west, which DTSC does not consider to be a viable option. -Allow better vertical characterization of Cr plume and geochemical conditions as transition from upland to floodplain. -Allow better resolution of plume position to be addressed by groundwater remedy. Position of contours on current plume maps are estimated using MW-31 and MW-35 well clusters (~1300 feet apart) -With proper design of new wells, location will provide a hydraulic testing point to assess aquifer conditions north of the MW-20 bench. Will provide data to consider for <i>in situ</i> treatment, pump-and-treat, and physical barrier design. -Gradient measurement point where can observe effects of extraction, injection, and floodplain, in situ pilot study. 	-MW-35 well cluster was originally to be installed at this location. -Members advocated this location for the following reasons: *more hydraulic characterization is needed to assess aquifer thickness and conditions in northern floodplain area; *additional characterization in northern floodplain area is needed to support final remedy selection. -Location supports USGS/GSU recommendation for drilling in north floodplain area to assess vertical plume distribution and lateral migration pathways from Bat Cave Wash (MW-37) toward floodplain (MW-31)	The following DOI comments support well installation at Location 2: 28, 32, 33, 41, 47, 137, 140, 133, and 168. For your reference, portions of these comments are included as Note 6 of this enclosure. The following ADEQ comments support additional well installation at Location 2: General Comment, 1.2.1, 9.1.5, and 13.5. For your reference, portions of these comments are included as Note 7 of this enclosure.

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Location ²	Location Description	General Rationale ³	DTSC Rationale ⁴	TWG Input ⁵	Stakeholder Comments on RFI/RI Report That Support Well Locations
3	Contingent location, adjacent to MW-29, northern part of floodplain New 2 to 3 well cluster/nest screening upper, middle, and lower depth intervals of Alluvial Aquifer. The number of new wells is uncertain because well MW-29 screens shallowest portion of Alluvial Aquifer and does not really provide useful data. (Note: Contingent because only would install if encountered unexpected plume conditions at Location 2 or Site C.)	ABCE	 -If installed, this would be a key gradient measurement point in northern portion of floodplain area. -If installed, would be a plume assessment point adjacent to river. -If installed, would allow vertical characterization of Cr plume and geochemical conditions near river. -If installed, the well will provide an additional bedrock control point to be considered by the remedial design. 		The following DOI comments support additional well installation at Location 3: 28, 32, 33, 41, 47, 137, 140, 133, and 168. For your reference, portions of these comments are included as Note 6 of this enclosure. The following ADEQ comments support additional well installation at Location 3: General- Comment, 1.2.1, 9.1.5, and 13.5. For your reference, portions of these comments are included as Note 7 of this enclosure.

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Location ² Location Description	General Rationale ³	DTSC Rationale ⁴	TWG Input⁵	Stakeholder Comments on RFI/RI Report That Support Well Locations
4 Adjacent to MW-26, along Park Moabi Rd, on HNWR New well screening saturated sediments below MW-26 (if sufficient thickness present) Depending on nature of bedrock, DTSC may also request additional well <u>as a data collection activity under the Groundwater Corrective Measures Study Workplan.</u>	ABCD	 -Cr(VI) concentrations in MW-26 range from 3000- 3800 ppb. MW-26 screens the shallow Alluvial Aquifer (although it is likely thin here). The concern that there is deeper contamination than what is monitored by well MW-26. The latest structural contour map indicates that the top of the fanglomerate is estimated at this location. Hence, there is a need to verify nature and position of the bedrock. -Drilling at this location will verify the bedrock position and the thickness of saturated sediments beneath the zone screened by well MW-26. (Note: DTSC does not consider it necessary to mobilize a different type of drilling rig for this location during this field mobilization. DTSC is interested in a demonstration that the top of the fanglomerate is accurately identified and whether permeable, wet zones are present below the MW-26 screen interval.) -If a deeper monitoring well is installed below MW-26, the well would allow vertical plume definition. -If an additional well is installed and appropriately designed, it will provide a useful hydraulic testing location with which to assess aquifer properties and the location potential as a pumping center. (Note: Location coincides 	-The TWG selected this as a potential extraction well location, PE-2.	Support Well Locations The following DOI comments support additional investigation and well installation at Location 4: 28, 32, 33, 41, 47, 137, 140, 133, and 168. For your reference, portions of these comments are included as Note 6 of this enclosure. The following ADEQ comments support additional well installation at Location 4: General Comment, 1.2.1, 9.1.5, and 13.5. For your reference, portions of these comments are included as Note 7 of this enclosure.
		with potential extraction well location PE-2.) -If an additional well is installed, it will provide a useful gradient		

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Location ²	Location Description	General Rationale ³	DTSC Rationale ⁴	TWG Input ⁵	Stakeholder Comments on RFI/RI Report That Support Well Locations
5	Adjacent to MW-12, HNWR New well screening saturated sediments below MW-12 (if sufficient thickness present) Depending on nature of bedrock, DTSC may also request additional well <u>as a data</u> <u>collection</u> <u>activity under</u> <u>the part of</u> <u>Groundwater</u> <u>Corrective</u> <u>Measures Study</u> <u>Workplan</u> .	ABCEF	-AOC 11 is a low-lying area that has received long-term compressor station runoff, but remains uninvestigated by the RFI/RI. Unusual groundwater chemistry is observed in at MW-12 (As, Mo, pH), which is located within this AOC. The MW-12 log indicates that the fanglomerate is a wet silty sand. There is concern that there is additional groundwater contamination in this area. Need to answer this question very soon so that the additional groundwater pathway is identified (if present) and incorporated into the spatial scope of the groundwater remedy. -If a well is installed, it will provide the plume characterization (nature and extent) needed to support the CMS and remedy selection. -The additional investigation will provide a better understanding of the bedrock in this area. (Note: DTSC does not consider it necessary to mobilize a different type of drilling rig for this location during this field mobilization. DTSC is interested in a demonstration that the top of the fanglomerate has been accurately identified and whether permeable, wet zones are present below the MW-12 screen interval.)		The following DOI comments support additional investigation and well installation at Location 5: 28, 32, 33, 41, 47, 101, 121, 133, - 137, 140, and 168. For your reference, portions of these comments are included as Note 6 of this enclosure. The following ADEQ comments support additional well installation at Location 5: General Comment, 1.2.1, 9.1.5, - 12.3.3, and 13.5. For your reference, portions of these comments are included as Note 7 of this enclosure.

Notes:

1. This table was prepared by the DTSC Geological Services Unit (GSU).

2. Well locations are shown on figure included as last page of Enclosure 1, GSU Technical Memorandum, Well Installation Work Plan for Interim Measures Performance Monitoring Program, Dated December 23, 2005.

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Notes (Continued):

- 3. General rationale as presented in Enclosure 1.
 - A. Additional measurement points to allow assessment of the hydraulic gradients induced by groundwater extraction and injection. Additional measurement points in some areas will allow groundwater flow conditions to be assessed empirically rather than relying on groundwater flow model predictions.
 - B. Better delineation of the mapped groundwater plume extent (i.e., the 20 and 50 ppb contour positions). Improved interpretation of the plume extent will allow refinement of the area that will need to be addressed by the groundwater remedy.
 - C. Better vertical characterization of the chromium plume distribution and geochemical conditions (i.e., oxidation/reduction potential, dissolved oxygen, total dissolved solids). The additional vertical characterization will assist with the assessment of *in situ* treatment feasibility and target screen positions for a pump-and-treat system. For some areas north of the MW-20 bench, the existing data set may rely too heavily on chromium and geochemical distributions observed at certain wells (e.g., MW-31 well cluster).
 - D. Hydraulic testing locations to allow assessment of hydrogeologic conditions where limited data is available and at locations that could be considered as potential pump-and-treat centers. TWG members have had repeated discussions about the need for additional hydraulic data to the north of the MW-20 bench.
 - E. Better definition of the nature and depth of the bedrock surface, especially north of the MW-20 bench. Better bedrock definition is needed for understanding the groundwater flow conditions and for considering the design depth of any physical barriers that might be considered as part of the groundwater remedy.
 - F. Monitoring points that would enable further assessment of potential plume migration pathways that would need to be considered as part of the evaluation of the groundwater remedy.
- 4. DTSC rationale expands upon what is presented in Enclosure 1.
- 5. As documented in meeting minutes from the August 16, 2005 TWG meeting.
- Selected DOI comments (dated July 1, 2005), entitled "Document Review and Comment Resolution Sheet, PG&E Topock Compressor Station Draft RCRA Facility Investigation and Remediation Investigation Report (dated February 2005)". [Note: Portions of the comments are particularly relevant to the additional well locations are underlined for emphasis.]
 - 28) Report Reference: Page 2-7, Section 2.3.4. Comment: "...The RFI should avoid oversimplifying statements such as these and provide more detailed discussions of its data. For example, the thickness of the alluvial aquifer in the floodplain is as much as 130 ft (MW-28-90) and this to the south to as thin as 5 ft in MW-22...Because the bedrock surface is a significant hydraulic boundary and controls the flow of groundwater, it needs to be discussed in detail within the RFI. A top of bedrock map and/or an isopach of the Alluvial Aquifer need to be presented in the RFI. This would easily present the location of potential hydrologic boundary relevant to containment of the plume, particularly where the Miocene conglomerate pinches out within the site. Such a map further highlights possible data gaps in the current distribution of monitoring wells..."
 - 32) Report Reference: Page 2-10, Section 2.5.2.2. Comment: "...To better represent the data collected, and the spatial distribution of monitoring wells, separate maps of wells completed in the various hydrostratigraphic units (upper, middle, lower) should be provided as well as for the bedrock information...<u>The RFI needs to generate separate maps for each unit, e.g., the upper, middle, lower Alluvial Aquifer, as well as the bedrock zones. A basis for separation of these units should be provided. This will provide a better understanding and potentially identify data gaps..."</u>
 - 33) Report Reference: Page 2-11, Section 2.5.2.2. Comment: "...The last sentence mentions that a buried bedrock ridge (paleoridge or fault block) extends northward from the Chemehuevi Mountains. <u>A contour map depicting the bedrock surface (the surface of the Tmc) needs to be incorporated into this RFI. This map would provide useful information regarding the location and depths to this important hydraulic boundary and where potential data gaps exist. In addition, an isopach of the saturated zone of the Alluvial Aquifer needs to be incorporated into the RFI. The RFI needs to discuss the deepening of the bedrock surface to the west (MW-40D)..."</u>
 - 41) Report Reference: Page 2-12, Section 2.5.3. Comment: "...<u>The RFI needs to explain what these greater pumping rates are possible in these two wells [TW-1 and TW-2], otherwise it can be inferred that these locations are not representative of the Alluvial Aguifer..."</u>
 - 47) Report Reference: Page 2-14, Section 2.5.3.2. Comment: "...<u>The RFI needs to accurately represent the spatial distribution of TDS results as well as other indicator parameters that will assist in evaluating the lateral extent of groundwater impacts and the overall dynamics of the groundwater flow regime. TDS and other parameters are useful indicators and therefore should be mapped in detail per the relative aquifer depths or well completions in order to accurately assess a parameters spatial distribution. Isopleths of various groundwater quality parameters need to incorporated into the RFI, and be constrained to specific zones of the aquifer, e.g., shallow, middle, deep, and bedrock as needed..."</u>
 - 101) Report Reference: Page 11-1, Section 11.0. Comment: "For AOCs that don't identify the groundwater as a complete exposure pathway: The groundwater is known to have been impacted by the activities and releases from the facility but the actual sources are only speculative. Why wouldn't all the identified AOCs or SWMUs be considered potential sources of groundwater contamination until the data supports elimination of this pathway?..."
 - 101) Report Reference: Page 11-5, Section 11.7. Comment: "The East Ravine is located along the detachment fault which is known to be fractured. Though the depth to bedrock beneath this AOC is not provided in the RFI, it could be assumed to be relatively shallow (see Figure 2-4) as the bedrock (Tmc) surface rises to the south and is exposed...Several aerial photographs show standing water within these impoundments (1964 and 1967) and the USGS topographic map shows them as water bodies. <u>Based upon the available evidence, including the limited number of sediment samples, there is a potential groundwater pathway associated to these impoundments. This pathway needs to be characterized..."</u>
 - 121) Report Reference: Page 12-19, Section 12.7.4. Comment: "Conclusions: This section states that the groundwater pathway is incomplete. How do the impoundments that exist in the ravine affect the infiltration of surface water or precipitation? In the other ravines where waste was disposed, the groundwater pathway is considered complete. Why is this ravine different from the Bat Cave Wash? This material may be contributing to or have contributed to the past groundwater contamination. <u>Are there data that show the vertical extent of contamination?</u>"

ENCLOSURE NO. 2 – SUMMARY OF RATIONALE FOR ADDITIONAL WELL LOCATIONS¹ Page 7 of 7

Notes (Continued):

- 133) Report Reference: Section 13. Comment: "The RFI must provide a comprehensive understanding of the groundwater plume and the processes controlling its migration. <u>Moreover, inadequate delineation of the plume and these processes may lead to inadequate IM and CMS/FS designs.</u> To simply define the plume by the spatial distribution of Cr is oversimplifying the potential problem(s). Indicator parameters provide valuable information regarding the transport processes at any site, and mapping and understanding these processes is of high priority. Though many of these indicator parameters are non-toxic, when detected from a known source, they add confidence that a monitoring network (surface water and/or ground water) is property assessing a pathway..."
- 137) Report Reference: Page 13-2. Comment: "...<u>Potentiometric surface maps and isopach maps of the Alluvial Aquifer are needed to assist</u> this discussion, particularly to show where the effects of bedrock occurs and the effects of the <u>River on the flow direction</u>..."
- 140) Report Reference: Page 13-3, Section 13.1.2.2. Comment: "The highest concentrations of Cr(VI) in groundwater seem to be beneath areas where previous discussion suggested that the groundwater is not impacted. Is it believed that the plume, that is expected to have originated from the Bat Cave Wash discharges, has migrated this far [floodplain area]?"
- 168) Report Reference: Page 13-16, Section 13.5. Comment: "Though focusing on information in the area of the IM is important, delineation of the total extent of the plume is essential for a successful remediation design. The RFI needs to delineate the entire plume and focus some attention on the East Ravine...Not only estimating the depth to bedrock, but its 3-dimensional characteristics is extremely important to a successful groundwater remediation design. This should include areas in the western portion of the study area, where the bedrock is assumed to deepen..."
- Selected ADEQ comments (dated June 28, 2005), entitled "Comments on PG&E Topock Compressor Station DRAFT RCRA Facility Investigation (RFI), Vol. 1-3, prepared by CH2MHill, dated February 2005". [Note: Portions of the comments are particularly relevant to the additional well locations are underlined for emphasis.]
 - General Comment (Page 2 of ADEQ Memorandum). Comment: "Concentration contouring Concentration contouring would be very helpful for depicting vertical and horizontal distribution. It would be helpful if the RFI contained concentration contouring for chromium and TDS to depict the vertical and horizontal extent of contamination and to facilitate discussion and the next steps in the Resource Conservation and Recovery Act (RCRA) remedial processes. Concentration contours are very useful in examining the spatial behavior of the plume."
 - Section 1.2.1 (Interim Measures). Comment: "...<u>From an outside perspective, creating and maintaining landward gradients were the primary objectives for the interim measures implemented to date, since plume boundaries were and still are being defined and additional investigation may be needed...The term 'hydraulic control' used here and in Section 9.1.5 is broad. It should be clear that capture is a 3-dimensional goal. The goals should be more clearly stated hydraulic control in both the horizontal and vertical directions in all layers of the site (possibly including bedrock if a connection is found between California and Arizona)..."</u>
 - Section 9.1.5 (Interim Measures). Comment: "...It would be helpful to iterate here and elsewhere that more work will be required in the future to control plume boundaries...additional investigation may be required towards the east...<u>Without additional data regarding the edge of the plume...it is hard to prove or disprove whether the plume boundary is being controlled..."</u>
 - Section 12.3.3 (East Ravine). Comment: "...ADEQ concurs that additional sampling is warranted in this area, <u>especially to determine the vertical</u> extent of elevated concentrations. Even though there are impoundments present to catch runoff, this area topographically drains toward the Colorado River and is located at the interface with bedrock outcrops. Data suggest the need for additional study."
 - Section 13.5 (Data Needs for Groundwater Characterization). Comment: "ADEQ suggests the following additions to this list: ...<u>additional wells for</u> improved water level contouring/equipotential maps, including the deeper portion of the aquifer at the bedrock surface...<u>concentration</u> contouring of Cr(VI) and TDS..."