

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

MONITORING AND REPORTING
PROGRAM NO. R6V-2006-0023

WDID NO. 6B369107001

FOR

PACIFIC GAS AND ELECTRIC COMPANY
CENTRAL AREA IN-SITU REMEDIATION PILOT STUDY PROJECT

San Bernardino County

I. MONITORING

Pre-Injection Groundwater Monitoring

- A. Clarification of terms: Injection wells and extraction wells comprise the recirculation system at the southern portion of Pilot Study Cell 3, in the upgradient groundwater flow direction (refer to Attachment 1). Groundwater flows to the northwest. North of the recirculation system are two rows of monitoring wells. North of these are two rows of sentry monitoring wells, located 180 and 400 feet in the downgradient groundwater flow direction from injection wells. Contingency wells are located approximately 1,000 feet downgradient from injections wells, just before the pilot study northern boundary.
- B. Collect background data prior to the initial injection to groundwater for the tracer test and in-situ remediation. Sample all monitoring wells and extraction wells for the constituents listed in Table 1. In addition, collect field measurements for pH, specific conductance, temperature, dissolved oxygen, and oxidation-reduction potential (ORP).
- C. The depth to groundwater shall be determined to at least 0.01-foot increments in all wells sampled prior to the initial injection.

Tracer Test

- A. Maintain a log of the volume and concentration of potassium bromide injected in Cell 3. Record the volume of distilled water injected after potassium bromide for dilution, if used. Calculate the diluted concentration of potassium bromide following distilled water injection.
- B. During tracer testing, maintain a log recording the date, time, monitoring or extraction well location, and measured tracer concentration from the bromide ion-specific probe.

- C. Collect groundwater samples from monitoring wells for laboratory confirmation of potassium bromide concentration.

Post-Injection Groundwater Monitoring

- A. The depth to groundwater shall be determined to at least 0.01-foot increments in all monitoring wells identified below 14 days after the initial reagent injection, 1 month, and each month until the end of the pilot study.
- B. All monitoring wells shall be sampled at the mid-screen length 14 days after the initial reagent injection, 1 month, and each month until the end of the pilot study for the constituents in Table 1 below.

Sentry wells and contingency wells, installed downgradient of the treatment zone, shall be used to monitor hexavalent chromium transformation in groundwater. Sentry and contingency wells shall also be used to verify the bioremediation effectiveness, potential mobilized metals, and other constituents.

All groundwater monitoring wells, sentry wells, and contingency wells shall be sampled for the following constituents using the methods provided below:

TABLE 1

Constituents	Analytical Method
Total Chromium	EPA 6010
Hexavalent Chromium	EPA 7199
Bromide, Chloride	EPA 300
Methane	RSK 175
Dissolved Organic Carbon	EPA 415.1
Volatile fatty acids (VFA)*	EPA 300.M
Calcium, Sodium, Magnesium	EPA 200.7
Bicarbonate Alkalinity	EPA 310.1
Phosphorus (as phosphate)	EPA 300
Ammonia	EPA 350.2
Nitrate/Nitrite	EPA 300
Sulfate	EPA 300
Sulfide	EPA 376.1
Dissolved iron	EPA 6010
Manganese	EPA 6010
Arsenic	EPA 6010
PH	EPA 150.1
pH, Bromide, temperature, dissolved oxygen, specific conductance, ORP	Field measurements

Notes:

*Includes lactate acid (lactate), acetate, pyruvate, proronate, butyrate

Contingency Plan

The injection of lactate, whey, and EVO is intended to create a microbial anaerobic environment in the subsurface for stimulating reduction of hexavalent chromium to trivalent chromium. Reducing conditions may mobilize naturally-occurring metals in aquifer material. For instance, like hexavalent chromium, iron, manganese, and arsenic may also reduce and become mobilized in groundwater. In addition, reducing condition may generate gases, such as methane and hydrogen sulfide. Water samples will be collected from the sentry and contingency wells during routine sampling discussed in Item B above. If any of the mobilized metals are found at elevated concentrations at or downgradient of sentry wells or elevated levels of gases are found in any well, the following contingency plan will be implemented:

Mobilized Constituents in Groundwater: In the event that any of the parameters are detected at trigger concentrations (refer to Table 2) at a sentry well, reagent injection will be scaled back by at least half the original amount or volume, or completely halted within 5 working days of receipt of laboratory results. In addition, should any of the parameters be detected at trigger concentrations in the second row of sentry wells, located 400 ft from the recirculation system or biobarrier, the Discharger will notify the Water Board within 5 working days and implement the Contingency Plan for air sparging (refer to Table 3) within 14 days of notification. Air sparging must be in operation within 90 days of notification. Air sparging shall restore the aquifer to pre-pilot study oxygenated conditions and should restore water quality to levels listed in waste discharge requirements, preventing migration away from the pilot study boundaries.

In the event that any of the parameters listed in Table 2 are detected at water quality standards in contingency monitoring wells near the test cell boundaries, the applicant will notify the Water Board within two working days of receipt of laboratory results of violations being detected. Within seven days of notification, the Discharger will submit a proposal to the Water Board to prevent such migration outside the pilot study boundaries. The proposal shall contain a monitoring plan to adequately monitor groundwater outside the pilot study boundaries downgradient of the area where violations were observed.

The proponent shall maintain a field log noting when and how the Contingency Plan is implemented.

TABLE 2
Contingency Plan Threshold Concentrations

Parameter	Aqueous Concentration (mg/L)
Reagents or VFAs ¹	10
Arsenic ²	0.01
Manganese ¹	*
Iron (Fe ²⁺ and Fe ³⁺) ³	0.3

Note:

¹Volatile Fatty Acids; includes lactic acids, acetate, pyruvate, propionate, and butyrate.

Standard based on bench-scale study results.

²Federal Primary MCL for drinking water

³California Secondary MCL for drinking water

*Concentration limit to be set based upon the maximum background concentration detected in groundwater prior to initial injection of reagents and showing increasing trend of 25 percent or greater

TABLE 3
Contingency Plan Schedule

Task	Schedule
Scale back or halt reagent injections	Within 5 days of lab results for sentry wells
Implement air sparging ¹	Within 14 days of notification to Water Board for second row sentry wells
Activate air sparging in groundwater	Within 90 days of notification to Water Board for second row sentry wells
Notify Water Board	Within 2 days of lab results showing exceedence of MCLs at contingency wells
Submit proposal to prevent migration outside of pilot study boundaries and to conduct additional monitoring	Within 7 days of notification to Water Board for contingency wells

¹prepare designs, apply for drilling permit, order necessary parts and equipment, etc.

Mobile Air Monitoring Program

Air monitoring shall be conducted in accordance with the following air monitoring program to evaluate the potential production of gases created from anaerobic reducing conditions. Air monitoring shall include a hand-held instrument that is capable of detecting hydrogen sulfide at a concentration of one part per billion. Odors shall be recorded in a log to document potential nuisance conditions.

Monitor for gases in general atmosphere and in monitoring wells and extraction wells prior to collecting water elevation data and groundwater samples. If air monitoring indicates that a gas is present, additional air sampling shall be conducted to determine risk to field personnel. If a risk is indicated, appropriate safety equipment shall be worn before proceeding to ventilate wells. After wells are ventilated, conduct air monitoring until safe levels are reached for at least 5 minutes. If gas levels or odors do not recede, reagent injections shall be reduced or halted until air monitoring indicates gases are at safe levels and odors have been abated.

III. REPORTING REQUIREMENTS

1. Beginning **October 30, 2006**, the Discharger shall submit quarterly status reports describing pilot study activities. The reports shall list the type, volume, and concentrations of discharges to groundwater. The reports shall describe instances of violation of the waste discharge requirements, equipment failures, and unexpected environmental impacts. The reports shall state whether or not adverse impacts have occurred in groundwater requiring implementation of the Contingency Plan. Lastly, the reports shall describe planned activities during the next three months of the pilot study. The reports shall be prepared by, or under the supervision of, either a California Registered Geologist or a California Registered Civil Engineer. Subsequent quarterly reports are **due on January 30, April 30, July 30, and October 30 of each year.**
2. **Within 60 days upon completion of the pilot study**, submit to the Water Board a final pilot study report. The report shall describe the type, concentration, and volume of all chemical and compounds injected into the subsurface during the pilot test. The report shall contain the results of sampling and laboratory analysis of samples collected during the pilot study. The report must include a map showing the location of pilot test cells, injection wells, monitoring wells, and extraction wells. The results of sample analysis of monitoring parameters from monitoring and extraction wells shall be reported in tabular and graphic form, as well as discussed in the text of the report. The report must state whether any portion of the Contingency Plan was implemented during the pilot study and, if so, provide details. The report shall describe the findings of the tracer test(s) and conclusions about groundwater flow conditions. The report shall also describe the findings and conclusions of in-situ remediation of hexavalent chromium and other possible by-products.

The final pilot study report must include a discussion of any violations of the WDRs and a description of action(s) taken to correct those violations. If no violations occurred, this shall be so stated. The report shall be signed by a principal executive officer at the level of vice-president, or higher, or their designated representative who is responsible for the overall operation of the facility. The report shall contain a statement that, under penalty of

perjury, to the best of their knowledge the report is true, complete, and correct.

B. Unscheduled Reports To Be Filed With The Water Board

The following reports shall be submitted to the Water Board pursuant to Section 13267 of the California Water Code (CWC) as specified below.

1. Notice of Evidence of a Release

Should a release of extracted groundwater containing chromium occur to ground surface, the Discharger shall:

- a. Immediately notify the Water Board verbally as to the monitoring point(s) and constituent(s) or parameter(s) involved;
- b. Provide written notification by certified mail within seven days of such determination (Section 2550.8(j)(1), Article 5, Chapter 15, Title 23, California Code of Regulations). The notification should state the cause of the release, the volume released, whether personnel was affected, and how the release was abated or corrected.

2. Evaluation Monitoring

The Discharger shall, within 90 days of verifying a release, submit a technical report pursuant to Section 13267(b) CWC, proposing an Evaluation Monitoring Program. If the Discharger decides not to conduct verification procedures, or decides not to make a demonstration that a source other than the Facility is responsible for the release, the release will be considered verified.

3. Engineering Feasibility Study Report

The Discharger shall, within 180 days of verifying the release, submit an Engineering Feasibility Study (Section 2550.8(k)(6) of Article 5) to preliminarily propose methods for corrective action.

Ordered by:



HAROLD J. SINGER
EXECUTIVE OFFICER

Dated: June 14, 2006

Attachment: Figure of Well Locations

(LSD:PG&E Central Area WDRM&R 606)