

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION**

**BOARD ORDER NO. R6V-2007-0032
WDID NO. 6B369107001**

REVISED WASTE DISCHARGE REQUIREMENTS

FOR

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

San Bernardino County

The California Regional Water Quality Control Board, Lahontan Region (Lahontan Water Board), finds:

1. Revised Project

The Lahontan Water Board adopted Waste Discharge Requirements (WDRs) (Board Order No. R6V-2006-0023) at a public hearing on June 14, 2006, to allow the discharge of food-grade reagents and a tracer to groundwater to remediate hexavalent chromium. The reagents included lactate, whey, and emulsified vegetable oil (EVO), and the tracer is potassium bromide. This order revises WDR Order No. R6V-2006-0023 to include: ethanol as an added reagent; fluorescein and eosin as added tracers; compounds for well rehabilitation; an expansion of the project area and stepping out of monitoring well locations; and, revised concentration limits for hexavalent and total chromium.

2. Discharger

Pacific Gas and Electric Company (PG&E) submitted a Revised Report of Waste Discharge (RWD) to conduct a Central Area In-situ Remediation Pilot Study Project (Project) at the PG&E Compressor Station, located east of the community of Hinkley in San Bernardino County. The RWD consists of transmittals dated June 15, 2007 and June 28, 2007. The RWD was deemed complete on July 27, 2007. PG&E proposes revisions to the project that were not previously considered when the initial WDRs were adopted in June 2006. For the purposes of this Order, PG&E is referred to as the "Discharger."

3. Facility

PG&E has implemented construction and operation of an in-situ remediation pilot study in the central area of the chromium plume in groundwater. The Facility is located about 3,600 feet north of the PG&E compressor station at 35863

Fairview Road in Hinkley. The compressor station began operating in 1952 and discharged untreated cooling tower water containing hexavalent chromium to unlined ponds until 1964. The effluent percolated through soils and adversely impacted groundwater quality by creating a chromium plume.

PG&E owns the land on which the compressor station and pilot study are located. The pilot study is located at and north of the intersection of Frontier and Fairview Roads. The original pilot study permitted area is 1,000 feet long and 1,800 feet wide. The Discharger is adding 600 feet to the length of the pilot study, making the revised area as being 1,600 feet long and 1,800 feet wide. For the purposes of this Order, the revised pilot study area is referred to as the "Facility."

4. Facility Location

The Facility is located east of the community of Hinkley in San Bernardino County in the Harper Valley Subarea of the Mojave Hydrologic Unit on County Assessor Parcel Numbers 0494-261-59, 0494-251-15, and 0494-251-03, as shown on Attachment "A," which is made a part of this Order. The added 600 feet of project area includes the parcel identified as APN 0494-251-03.

5. Permit History

These are revised Waste Discharge Requirements (WDRs) for an existing facility. WDRs for the Central Area in-situ remediation project were adopted in June 2006 (Board Order No. R6V-2006-0023). The WDRs in this Order revise the requirements originally set forth in Board Order No. R6V-2006-0023.

6. Enforcement History

On December 29, 1987, the Executive Officer issued Cleanup and Abatement Order (CAO) No. 6-87-160 to the Discharger, ordering the investigation, cleanup and abatement of the effects of chromium in the soil and groundwater that were discharged at the PG&E Compressor Station. The selected remediation system consisted of the extracting groundwater for irrigation of pasture crops on the East and Ranch LTUs. Natural soil properties promoted the reduction of hexavalent chromium in extracted groundwater to trivalent chromium [Cr(III)] that adhered to soil.

In June 2001, the Executive Officer issued CAO 6-01-50 ordering PG&E to eliminate the threatened nuisance condition created at the East and Ranch LTUs due to the spray irrigation of chromium-polluted groundwater to crops. In response to this order, PG&E shut down the groundwater remediation system.

7. Reason for Action

The Discharger conducted field-scale pilot testing at the Facility starting in fall 2006, under the WDRs set forth in Board Order No. R6V-2006-0023. The results are documented in the February 19, 2007 *Central Area In-Situ Phase I Pilot Study Recirculation Test Report (Test Report)* and the April 30, 2007 *First Quarter 2007 Monitoring Report*. The Test Report states that after wells were installed, background water sampling prior to reagent injection showed hexavalent and total chromium concentrations at levels above limits established in the WDRs. Upon the injection of lactate to groundwater, the pilot study successfully demonstrated biological reduction of Cr(VI) to Cr(III) occurred under anaerobic conditions. Groundwater velocities downgradient of the recirculation system were estimated using hydraulic properties calculated from a tracer test using bromide. These velocities suggested greater than expected flow conditions within the recirculation system and downgradient, indicating shortened travel time for injected reagents and potential byproducts to reach monitoring points. The Discharger believes revisions to the initial project will make for better efficiency of project implementation without violating the conditions established in the WDRs.

8. Site Geology

The soils underlying the Facility are comprised of interbedded sands, gravels, silts, and clays. The depth to bedrock is about 230 feet below the Facility. The nearest active fault is the northwest-southeast trending Lenwood fault located about 0.6 mile from the Facility.

9. Site Hydrogeology and Hydrology

The hydrogeology in the vicinity of the Facility consists of an upper unconfined aquifer and a lower confined aquifer separated by up to 25 feet of lacustrine clay that forms a regional aquitard. The upper aquifer is approximately 80 feet thick and extends from 80 feet to 160 feet below ground surface (bgs). The unconsolidated, upper aquifer is comprised of interbedded gravels, silts, and clay and is divided into two major production zones, the "A" zone, and the "B" zone. Groundwater flow in the upper aquifer is primarily to the north with an average gradient of 0.002 feet per foot.

The lower aquifer, or "C" zone, consists of semi-consolidated calcareous sediments, layers of silty sand, and minor amounts of clay. The lower aquifer extends from approximately 180 feet to 230 bgs and is bounded at its base by competent crystalline rock. The closest surface water body is the Mojave River, which is located approximately 1.2 miles southeast of the Facility.

10. Climate

The precipitation in the area of the Facility is less than five inches annually. The evaporation rate is approximately 74 inches annually. The area has hot summers and mild winters.

11. Groundwater Quality

The groundwater below the Facility contains constituents from past agricultural activities in the vicinity, chromium from the PG&E compressor station plume, and naturally occurring constituents. The most significant constituent is chromium. During baseline sampling of pilot study wells prior to reagent injection, total chromium [Cr(T)] concentrations ranged from 71.9 to 303 micrograms per liter ($\mu\text{g/L}$) and hexavalent chromium concentrations ranged from 83.6 to 334 $\mu\text{g/L}$. In addition, manganese and chloride have been detected in groundwater at concentrations up to 114 $\mu\text{g/L}$ and 172 milligrams per liter (mg/L), respectively.

The maximum contaminant level (MCL) for a municipal water source for total chromium [Cr(T)] and manganese is 50 $\mu\text{g/L}$. The Agricultural Water Quality Limit for chloride is 106 mg/L. Since the concentrations of total chromium, manganese, and chloride exceed water quality standards, groundwater at the Facility does not presently support the beneficial use of a municipal and domestic supply. There is no standard for hexavalent chromium.

12. Project Description

The purpose of the initial project is to evaluate the effectiveness of large-scale in-situ remediation under site-specific conditions for reducing hexavalent chromium in groundwater to trivalent chromium. The results would provide parameters to design a full-scale remediation system for achieving water quality standards.

Based upon the results of a pilot study conducted in fall 2006, the Discharger has proposed the following revisions to the project: (1) adding ethanol to the list of reagents; (2) adding dye tracers, fluorescein and eosin, to evaluate groundwater flow conditions; (3) including compounds (acetic acid, citric acid, hydrochloric acid, hydrogen peroxide, and sodium hydroxide) for well rehabilitation; (4) expanding the project length by 600 feet and extending out the location of monitoring and contingency wells; and (5) revising concentration limits for hexavalent and total chromium. These revised WDRs allow the project to proceed in a manner that accommodates site-specific conditions and that do not adversely impact water quality beyond the project area.

13. Waste Classification

The chromium-contaminated groundwater is classified as a liquid designated waste under section 20210 of title 27, California Code of Regulations, (CCR).

14. Waste Management Unit Classification

The aquifer soils beneath the test cells are classified as a Class II LTU in accordance with section 20614 of title 27, CCR.

15. Authorized Disposal Sites

The Facility in the central plume area, shown on Attachment "B", is the only authorized disposal sites (via injection wells).

16. Water Quality Protection Standard

A Water Quality Protection Standard (WQPS) is established in the Order for the Facility, and consists of constituents of concern (including monitoring parameters), concentration limits, monitoring points, and the point of compliance. The WQPS applies over the active life of the Facility, post-closure monitoring period, and the compliance period.

17. Land Uses

The land uses at, and surrounding, the Facility consist of residential, commercial, agricultural, and open desert land. The nearest residences and active domestic wells are located on Mountain View Road, about 700 feet west of the western boundary of the Facility.

18. Receiving Waters

The receiving waters are the groundwaters of the Harper Valley Hydrologic Area of the Mojave Hydrologic Unit. The Department of Water Resources (DWR) designation for the Harper Valley Hydrologic Area is 628.42.

19. Lahontan Basin Plan

The Water Board adopted a Water Quality Control Plan for the Lahontan Basin (Basin Plan), which became effective on March 31, 1995. This Order implements the Basin Plan.

20. Beneficial Groundwater Uses

The beneficial uses of the groundwater of the Middle Mojave River Valley Groundwater Basin as set forth in the Basin Plan are:

- a. MUN - municipal and domestic supply;
- b. AGR - agricultural supply;
- c. IND - industrial supply;
- d. FRSH - freshwater replenishment; and
- e. AQUA - aquaculture.

21. Non-Degradation

In accordance with State Water Resources Control Board (State Water Resources Control Board) Resolution No. 68-16 (*Statement of Policy with Respect to Maintaining High Quality of Waters in California*) and the Water Quality Control Plan for the Lahontan Region (Basin Plan), water degradation may be allowed if the following conditions are met: 1) any change in water quality must be consistent with maximum benefit to the people of the State; 2) will not unreasonably affect present and anticipated beneficial uses; and 3) will not result in water quality less than that prescribed in the Basin Plan; and 4) discharges must use the best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with maximum benefit to the people of the State.

Ethanol is being added to the project since it migrates faster in groundwater than does lactate, whey, and EVO and it has a shorter residence time in the aquifer. The injections of ethanol will temporarily cause some organic carbon degradation and an alcohol taste and odor to water quality in the area between the injection and extraction wells. During bioremediation, the reagent will be consumed by naturally occurring microbes, and the concentrations will become diluted in the aquifer during groundwater recirculation. The capture zone of cross-gradient extraction wells will spread ethanol across the treatment zone. Ethanol that escapes the influence of extraction wells will migrate under normal groundwater flow conditions, disperse, and be used for bioremediation. Monitoring will verify that ethanol concentrations become less with distance from the injection point. Any potential byproducts of the reduction process, such as mobilized metals, will also attenuate with distance following contact with aerobic aquifer conditions in the downgradient portion of the pilot study area. Therefore, any degradation to water quality will be temporary, should improve over time, and will be localized to the pilot study area.

The tracers, fluorescein and eosin, are being added to the project since they tend to migrate farther in groundwater than does bromide, and thus will provide better information about aquifer conditions. The injection of fluorescein and eosin at 1 mg/L will cause a coloration to groundwater. The tracers will become diluted in the aquifer during groundwater recirculation. As the tracers migrate beyond extraction wells, they are expected to reduce in concentration with distance from the injection point due to dispersion. By the time groundwater travels 800 feet to the second row of sentry monitoring wells, tracer concentrations are expected to be less than 0.1 mg/L and no color should be detected. There are no established standards for either fluorescein or eosin. The Basin Plan, however, does require compliance with narrative objectives, which includes nuisance. Coloration to groundwater from the disposal of wastes would fall under the definition of "nuisance." Since groundwater outside the pilot study boundaries is not expected to contain any color, there will be no adverse impacts to beneficial uses following the tracer test.

The use of food-grade and United States Pharmacopeia (USP) grade acids and compounds to remove biofouling from screens in monitoring and extraction wells will alter pH in groundwater and increase the concentration of TOC. Both effects, however, are expected to be localized to the vicinity of the well screen due to the strong buffering capability of the aquifer. Baseline sampling shows that bicarbonate alkalinity averaged 300 mg/L and pH is neutral to alkaline. These groundwater characteristics will confine acid and other reactions to the point of injection and will inhibit their detection at the first row of sentry wells, located 400 feet downgradient. Therefore, since groundwater pH should return to background conditions before reaching the pilot study boundaries, there will be no adverse impacts to beneficial uses following the injection of well rehabilitation compounds.

The recirculation process is designed to be the equivalent of the Best Practicable Technology, as required by the State Water Board's Resolution No. 68-16. In addition, concentrations of reagents are designed to ensure anaerobic conditions will be created throughout the treatment zone, while minimizing the potential to produce byproducts. Degradation of water quality by the revised project will be confined to a limited area within the project boundaries and will occur for only a limited time. The long-term benefit of the project will result in removal of chromium from groundwater. Therefore, the resulting water quality from this project will be consistent with the State Water Board's Resolution No. 68-16.

22. Constituents of Concern

The Constituents of Concern (COCs) consist of total chromium Cr(T), hexavalent chromium Cr(VI), and Total Organic Carbon (TOC). Potential constituents of concern include bromide, chloride, fluorescein and eosin tracers, reagents to be analyzed as ethanol and volatile fatty acids (lactic acid, acetate, pyruvate, propionate, and butyrate), and naturally-occurring reducible metals, such as arsenic, manganese, and iron.

23. Water Quality Data Evaluation

Since the project involves the injection of unregulated, food-grade reagents and acids (acetic and citric) to groundwater to stimulate bioremediation, a statistical method of monitoring data for detection of a release of waste from the Facility is not needed. If USP grade compounds (hydrogen peroxide, sodium peroxide, and hydrochloric acid) are injected to groundwater, a statistical method of monitoring data for detection of a release will be applied for this project.

24. Detection Monitoring

For the same reason listed above in Finding No. 23, a detection monitoring program for determining whether there has been a release to groundwater will only be applied if USP grade compounds are injected to groundwater.

25. Corrective Action

A Corrective Action Program (CAP) to remediate released wastes from the Facility may be required pursuant to sections 20385 and 20430, title 27, CCR, if results of an Evaluation Monitoring Program (EMP) warrant a CAP.

26. California Environmental Quality Act

The Lahontan Water Board is the lead agency for this project under the California Environmental Quality Act (Public Resources Code section 21000 et seq.).

An Initial Study describing the project was prepared by CH2M Hill on behalf of the Lahontan Water Board and PG&E. It was circulated under State Clearinghouse No. 2006041005 to satisfy CEQA with the Water Board as Lead Agency. The Initial Study indicates the intent of the Lahontan Water Board to consider a Subsequent Mitigated Negative Declaration.

In a public meeting on November 28, 2007, the Lahontan Water Board adopted a resolution certifying the environmental document stating that the effects on the environment from the Project are not significant as mitigated, adopting a Subsequent Mitigated Negative Declaration and a Mitigation Monitoring and Reporting Plan to satisfy CEQA, and authorizing Lahontan Water Board staff to send a Notice of Determination to the State Clearinghouse.

The discharge described in these WDRs is consistent with the Negative Declaration and no new significant impacts are expected from the discharge allowed by these WDRs.

27. Notification of Interested Parties

The Lahontan Water Board has notified the Discharger and all known interested parties of its intent to adopt revised WDRs for the project.

28. Consideration of Interested Parties

The Lahontan Water Board, in a public meeting, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED that the Discharger shall comply with the following:

I. DISCHARGE SPECIFICATIONS

A. Discharge Limitations

1. Board Order No. R6V-2007-0032 allows the injection to groundwater at the Facility of potassium bromide, lactate, whey, EVO, and groundwater containing chromium extracted on site.

These revised WDRs additionally allow for the discharge of fluorescein, eosin, compounds for well rehabilitation, and ethanol.

2. The maximum amount of potassium bromide to be injected to groundwater at the Facility shall be 10 pounds.
3. The maximum volume of lactate to be discharged to groundwater at the Facility shall be 225,000 gallons of 60% solution.
4. The maximum volume of whey to be discharged to groundwater at the Facility shall be 800,000 pounds of powder and 2,000,000 gallons in liquid solution.
5. The maximum volume of EVO to be discharged to groundwater at the Facility shall be 55,000 gallons of 100% vegetable oil (soy based).
6. The maximum amount of fluorescein and eosin dyes to be injected to groundwater at the Facility shall be 3 pounds each.
7. The maximum combined volume of citric acid, acetic acid, hydrochloric acid, hydrogen peroxide, and sodium hydroxide to be discharged to groundwater at the Facility shall be 360,000 gallons of 1 to 7 percent solution.
8. The maximum volume of the alcohol to be discharged to groundwater at the Facility shall be 400,000 gallons of 95% solution. The volume will be blended into groundwater recirculated within the injection zone.

B. Receiving Water Limitation

The discharge of waste shall not cause a violation of any applicable water quality standards outside the pilot study boundaries, with the exception of chromium, manganese, and chloride, for receiving water. The pilot study boundaries are described in Finding Nos. 3 and 4 and shown in Attachment "B." The discharge must not cause the presence of the following substances or conditions in groundwaters of the Middle Mojave River Valley Groundwater Basin.

The groundwater quality outside the pilot study boundaries, as a result of the discharge, shall not exceed the total chromium [Cr(T)] and hexavalent chromium [Cr(VI)] concentration limits based upon the maximum background concentration described in quarterly monitoring reports outside the pilot study boundaries. The groundwater quality outside the pilot study boundaries, as a result of the discharge, shall also not exceed the manganese and chloride concentration limits based upon 125 percent

of the maximum background concentration described in quarterly monitoring reports.

1. Chemical Constituents - Groundwaters shall not contain concentrations of chemical constituents (with the exception of chromium) in excess of the maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL) based upon drinking water standards specified in the following provisions of Title 22 of the CCR (with the exception of TDS and nitrate): Table 64431-A of Section 64431 (Inorganic Chemicals), Table 64431-B of Section 64431 (Fluoride), Table 6444-A of Section 64444 (Organic Chemicals), Table 64449-A of Section 64449 (SMCLs - Consumer Acceptance Limits), and Table 64449-B of Section 64449 (SMCLs - Ranges). This incorporation-by-reference is prospective including future changes to the incorporated provisions as the changes take effect. Groundwaters shall not contain concentrations of chemical constituents that adversely affect the water for beneficial uses.
2. Agricultural Water Quality Limit - Groundwaters shall not contain concentrations of chemical constituents that cause a nuisance or that adversely affect beneficial uses.
3. Taste and Odors - Groundwaters shall not contain taste or odor-producing substances other than from chromium in concentrations that cause nuisance or that adversely affect beneficial uses. For groundwaters designated as Municipal or Domestic Supply, at a minimum, concentrations shall not exceed adopted SMCLs specified in Table 64449-A of Section 64449 (SMCLs - Ranges), and Table 64449-B of Section 64449 (SMCLs - Ranges) of Title 22 of the CCR, including future changes as the changes take effect.
4. Color - Groundwaters shall not contain color-producing substances from tracers in concentrations that cause nuisance or that adversely affect beneficial uses.
5. Any presence of toxic substances in concentrations that individually, collectively, or cumulatively cause detrimental physiological response in humans, plants, animals, or aquatic life is prohibited.
6. The migration of hexavalent chromium and total chromium outside the pilot study boundaries in concentrations exceeding the maximum background concentration, as referenced in the next section, is prohibited.

C. Water Quality Protection Standard

1. Monitoring Parameters

The monitoring parameters within the treatment zone wells are: total chromium Cr(T), hexavalent chromium Cr(VI), ethanol, TOC, and, if hydrochloric acid or tracers are used, chloride, bromide, fluorescein, and eosin. The monitoring parameters for sentry wells located 400 feet and 800 feet downgradient of injection wells are: Cr(T), Cr(VI), ethanol, TOC, volatile fatty acids (VFAs), mobilized metals (arsenic, iron, and manganese), and, if hydrochloric acid or tracers are used, chloride, bromide, fluorescein, and eosin. At contingency wells located 1,600 feet downgradient from injection wells, monitoring parameters are: Cr(T), Cr(VI), mobilized metals, and, if detected in sentry wells, TOC, bromide, chloride, ethanol, fluorescein, eosin, and VFA.

2. Monitoring Points

The monitoring points at the Facility are monitoring wells in the treatment zone, sentry wells, and contingency wells located in each pilot test cell, as shown on Attachment "B."

3. Point of Compliance

The point of compliance as defined in section 20164, title 27, CCR for the project are the contingency wells located on the boundary of the pilot study, approximately 1,600 feet downgradient of the injection wells. The discharge of Cr(T), Cr(VI), VFA, bromide, chloride, ethanol, fluorescein, eosin, and byproducts, such as arsenic, iron, and manganese, at the contingency wells cannot exceed the concentration limits established in the Section I.C.4 at the point of compliance or it will be construed as a violation of these requirements.

4. Concentration Limits

The concentration limits for the monitoring parameters located at the monitoring points for the Facility are the following:

CONCENTRATION AND REPORTING LIMITS

Monitoring Parameter	Matrix	Concentration Limit (mg/L)	Reporting Limit (mg/L)	Recommended Analytical Method
Hexavalent Chromium Cr(VI)	Liquid	*	0.001	EPA 7199
Total Chromium Cr(T)	Liquid	*	0.005	EPA 6010
VFA ¹	Liquid	10	1.0	EPA 300.M
Arsenic ²	Liquid	0.01	0.01	EPA 6010
Bromide ³	Liquid	2.3	0.1	EPA 300
Chloride ⁴	Liquid	**	1.0	EPA 300
Eosin	Liquid	100 ⁶	0.008	none
Ethanol ⁴	Liquid	760	10	EPA 1400
Fluorescein	Liquid	100 ⁶	0.002	none
Iron (Fe2+ and Fe3+) ⁵	Liquid	0.3	0.05	EPA 6010
Manganese	Liquid	**	0.01	EPA 6010

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

³Federal Suggested No-Adverse-Response Level (SNARL)

⁴Taste and Odor Threshold

⁵California Secondary MCL

⁶Color Detection

NA=not applicable

* Concentration limit to be set based upon the maximum background concentration detected in groundwater, as demonstrated in quarterly monitoring report

** Concentration limit to be set at 125 percent of the maximum background concentration measured in groundwater prior to initial injection of reagents

D. General Requirements and Prohibitions

1. Surface flow or visible discharge of waste to land surface, surface waters, or surface water drainage courses is prohibited.
2. The discharge must not cause pollution as defined in section 13050 of the Water Code, or a threatened pollution.
3. Neither the treatment nor the discharge shall cause a nuisance as defined in section 13050 of the Water Code.
4. The discharge of waste except to the authorized disposal site is prohibited.

5. The discharge of waste, as defined in the Water Code, that causes a violation of any narrative water quality objective (WQO) contained in the Basin Plan, including the Nondegradation Objective, is prohibited.
6. The integrity of the LTU must be maintained throughout the life of Project, and shall not be diminished as a result of any maintenance operation.
7. The discharge of waste that causes a violation of any numeric WQO contained in the Basin Plan is prohibited.
8. Where any numeric or narrative WQO contained in the Basin Plan is already being violated, the discharge of waste that causes further degradation or pollution is prohibited.
9. The Discharger shall remove and relocate or otherwise mitigate any wastes that are discharged not in accordance with these WDRs.
10. Hazardous waste as defined under article 1, chapter 11, division 4.5 (§66261.3 et seq.) of title 22, CCR must not be disposed and/or treated at the Facility, outside the scope of these discharge requirements.
11. The discharge to the ground of any chemicals stored in tanks at the Facility is prohibited.
12. Discharge of solid waste to the Facility is prohibited.

II. PROVISIONS

A. **IT IS HEREBY ORDERED** that Board Order No. R6V-2006-0023 is rescinded.

B. Standard Provisions

The Discharger must comply with the "Standard Provisions for Waste Discharge Requirements," dated September 1, 1994, in Attachment "C," which is made a part of this Order.

C. Monitoring and Reporting

Pursuant to Water Code section 13267(b), the Discharger must comply with Monitoring and Reporting Program No. R6V-2007-0032 as specified by the Executive Officer. The Monitoring and Reporting Program may be modified by the Executive Officer.

D. Claim of Copyright or Other Protection

Any and all reports and other documents submitted to the Lahontan Water Board pursuant to this request will need to be copied for some or all of the following reasons: 1) normal internal use of the document, including staff copies, record copies, copies for Board members and agenda packets, 2) any further proceedings of the Lahontan Water Board and the State Water Board, 3) any court proceeding that may involve the document, and 4) any copies requested by members of the public pursuant to the Public Records Act or other legal proceeding.

If the Discharger or its contractor claims any copyright or other protection, the submittal must include a notice, and the notice will accompany all documents copied for the reasons stated above. If copyright protection for a submitted document is claimed, failure to expressly grant permission for the copying stated above will render the document unusable for the Lahontan Water Board's purposes, and will result in the document being returned to the Discharger as if the task had not been completed.

III. TIME SCHEDULE

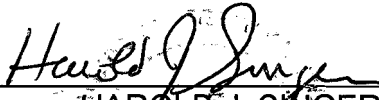
A. Submittal of Technical Reports

1. Beginning **January 30, 2008**, the Discharger must include the following information in a quarterly status report describing pilot study activities, required in Board Order No. R6V-2007-0032: the type, volume, and concentrations of discharges to groundwater; describe instances of violation of the waste discharge requirements, equipment failures, and unexpected environmental impacts; and whether or not adverse impacts have occurred in groundwater requiring implementation of the Contingency Plan. Lastly, the report must describe planned activities during the next three months of the pilot study. The report must 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 April 30, July 30, October 30, and January 30 of each year.**

B. Expiration

These waste discharge requirements do not expire.

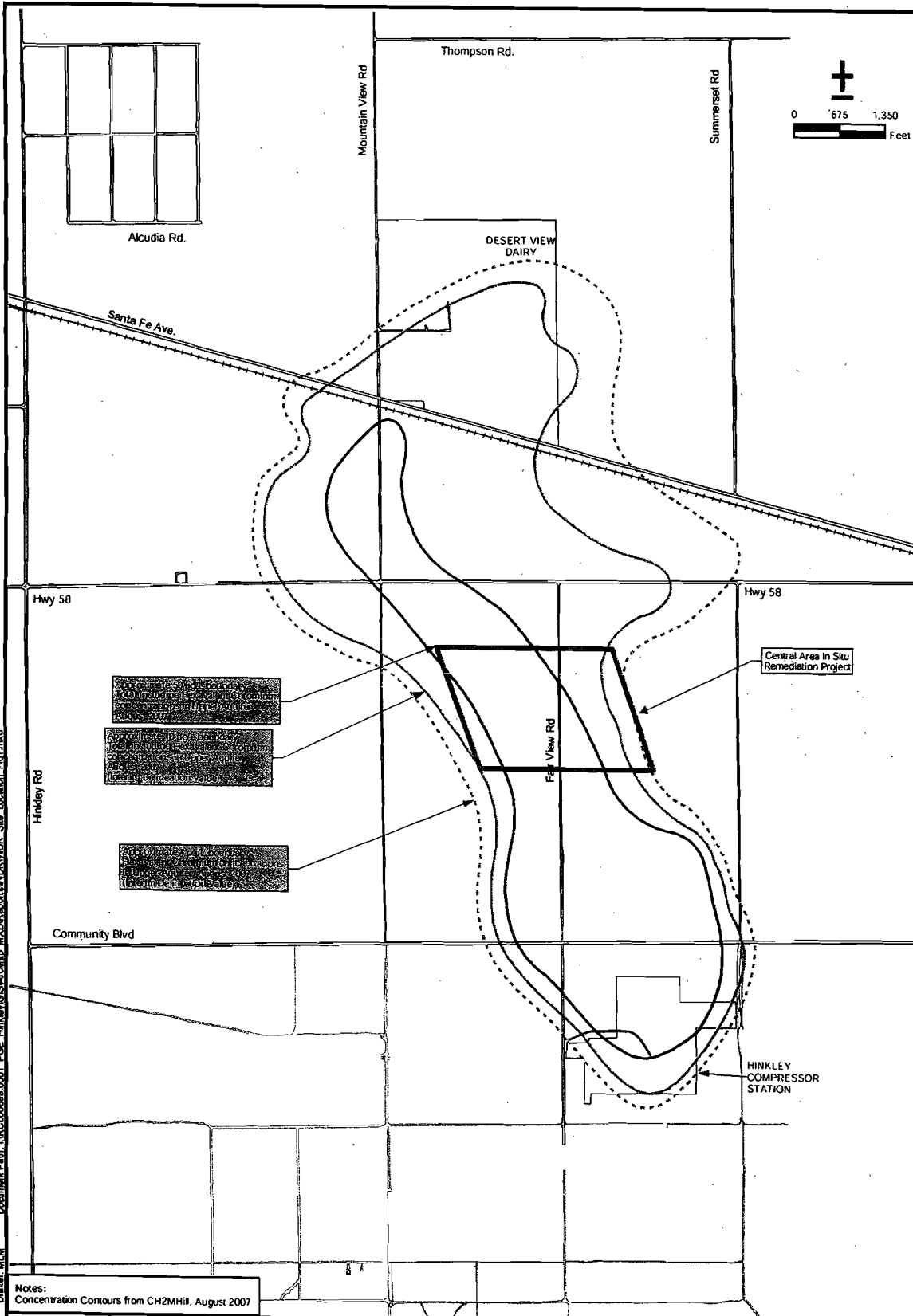
I, Harold J. Singer, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Lahontan Region, on November 28, 2007.



HAROLD J. SINGER
EXECUTIVE OFFICER

- Attachments: A. Location Map
B. Map of Pilot Study Area
C. Standard Provisions for Waste Discharge Requirements

ATTACHMENT A



Document Path: \\ARC0000088.0001_PGE_Hinkley\GIS\ArcMap_MXD\reports\DRIVER\DR Site_Location_Fig1.mxd
 Drafter: MLM
 Date: 05/07/2007

Notes:
 Concentration Contours from CH2MHill, August 2007

Program Manager
 Lisa Cope

Project Manager
 Eric Putnam

Task Manager
 Hollis Phillips

Technical Review
 Frank Lenzo

ARCADIS

155 Montgomery Street, Suite 1500
 San Francisco, California 94104
 Tel: 415 374 2744
 Fax: 415 374 2745
 www.arcadis-us.com

Site Plan

Revised Central Area In Situ
 Remediation Project

Pacific Gas and Electric Company: Hinkley Compressor Station
 Hinkley, California

ATTACHMENT

A

ATTACHMENT B

ATTACHMENT C

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

STANDARD PROVISIONS
FOR WASTE DISCHARGE REQUIREMENTS

1. Inspection and Entry

The Discharger shall permit Regional Board staff:

- a. to enter upon premises in which an effluent source is located or in which any required records are kept;
- b. to copy any records relating to the discharge or relating to compliance with the Waste Discharge Requirements (WDRs);
- c. to inspect monitoring equipment or records; and
- d. to sample any discharge.

2. Reporting Requirements

- a. Pursuant to California Water Code 13267(b), the Discharger shall immediately notify the Regional Board by telephone whenever an adverse condition occurred as a result of this discharge; written confirmation shall follow within two weeks. An adverse condition includes, but is not limited to, spills of petroleum products or toxic chemicals, or damage to control facilities that could affect compliance.
- b. Pursuant to California Water Code Section 13260 (c), any proposed material change in the character of the waste, manner or method of treatment or disposal, increase of discharge, or location of discharge, shall be reported to the Regional Board at least 120 days in advance of implementation of any such proposal. This shall include, but not be limited to, all significant soil disturbances.
- c. The Owners/Discharger of property subject to WDRs shall be considered to have a continuing responsibility for ensuring compliance with applicable WDRs in the operations or use of the owned property. Pursuant to California Water Code Section 13260(c), any change in the ownership and/or operation of property subject to the WDRs shall be reported to the Regional Board. Notification of applicable WDRs shall be furnished in writing to the new owners and/or operators and a copy of such notification shall be sent to the Regional Board.
- d. If a Discharger becomes aware that any information submitted to the Regional Board is incorrect, the Discharger shall immediately notify the Regional Board, in writing, and correct that information.

- e. Reports required by the WDRs, and other information requested by the Regional Board, must be signed by a duly authorized representative of the Discharger. Under Section 13268 of the California Water Code, any person failing or refusing to furnish technical or monitoring reports, or falsifying any information provided therein, is guilty of a misdemeanor and may be liable civilly in an amount of up to one thousand dollars (\$1,000) for each day of violation.
- f. If the Discharger becomes aware that their WDRs (or permit) are no longer needed (because the project will not be built or the discharge will cease) the Discharger shall notify the Regional Board in writing and request that their WDRs (or permit) be rescinded.

3. Right to Revise WDRs

The Regional Board reserves the privilege of changing all or any portion of the WDRs upon legal notice to and after opportunity to be heard is given to all concerned parties.

4. Duty to Comply

Failure to comply with the WDRs may constitute a violation of the California Water Code and is grounds for enforcement action or for permit termination, revocation and re-issuance, or modification.

5. Duty to Mitigate

The Discharger shall take all reasonable steps to minimize or prevent any discharge in violation of the WDRs which has a reasonable likelihood of adversely affecting human health or the environment.

6. Proper Operation and Maintenance

The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the Discharger to achieve compliance with the WDRs. Proper operation and maintenance includes adequate laboratory control, where appropriate, and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by the Discharger, when necessary to achieve compliance with the conditions of the WDRs.

7. Waste Discharge Requirement Actions

The WDRs may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Discharger for waste discharge requirement modification, revocation and re-issuance, termination, or a notification of planned changes or anticipated noncompliance, does not stay any of the WDRs conditions.

8. Property Rights

The WDRs do not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

9. Enforcement

The California Water Code provides for civil liability and criminal penalties for violations or threatened violations of the WDRs including imposition of civil liability or referral to the Attorney General.

10. Availability

A copy of the WDRs shall be kept and maintained by the Discharger and be available at all times to operating personnel.

11. Severability

Provisions of the WDRs are severable. If any provision of the requirements is found invalid, the remainder of the requirements shall not be affected.

12. Public Access

General public access shall be effectively excluded from treatment and disposal facilities.

13. Transfers

Providing there is no material change in the operation of the facility, this Order may be transferred to a new owner or operation. The owner/operator must request the transfer in writing and receive written approval from the Regional Board's Executive Officer.

14. Definitions

- a. "Surface waters" as used in this Order, include, but are not limited to, live streams, either perennial or ephemeral, which flow in natural or artificial water courses and natural lakes and artificial impoundments of waters. "Surface waters" does not include artificial water courses or impoundments used exclusively for wastewater disposal.
- b. "Ground waters" as used in this Order, include, but are not limited to, all subsurface waters being above atmospheric pressure and the capillary fringe of these waters.

15. Storm Protection

All facilities used for collection, transport, treatment, storage, or disposal of waste shall be adequately protected against overflow, washout, inundation, structural damage or a significant reduction in efficiency resulting from a storm or flood having a recurrence interval of once in 100 years.

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION**

**REVISED MONITORING AND REPORTING
PROGRAM NO. R6V-2007-0032**

WDID NO. 6B369107001

FOR

**PACIFIC GAS AND ELECTRIC COMPANY
REVISED CENTRAL AREA IN-SITU
REMEDATION 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. Within 200 feet of the project's southern boundary are two rows of monitoring wells used to assess the in-situ remediation process. North of the monitoring wells are two rows of sentry wells. The sentry monitoring wells are being revised from locations of 180 and 400 feet in the downgradient groundwater flow direction from injection wells, to 400 and 800 feet. Contingency wells locations are also being revised to approximately 1,600 feet downgradient from injections wells, instead of 1,000 feet. The revised location of contingency wells is on the pilot study northern boundary. In addition, six pairs of nested wells are being included in the project to evaluate the vertical effect of remediation and potential mounding of injections cross gradient to groundwater flow. The revised well locations and nested well locations are shown in Table 1.

Table 1. Well Terms and Location

Wells	Location from Southern Boundary
Injection and Extraction	<100 ft (Treatment area) (CA-MW-100 & 200 series)
Monitoring Wells	<200 ft (CA-MW-100 & 200 series)
Sentry	400 & 800 ft (CA-MW-300 & 400 series)
Contingency	1,600 ft (CA-MW-500 series)
Nested (shallow and middle zone in upper aquifer)	1) At each end of injection well line (CA-MW-106 & 107 & CA-MW-101 & 108). 2) Near each end of 1 st row of sentry wells (CA-MW-301 & 302 and CA-MW-310 & 311). 3) Along center line of groundwater flow through 1 st and 2 nd rows of sentry wells (CA-MW-305 & 306 and CA-MW-405 & 406)

- 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 2. 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 the tracers (potassium bromide, fluorescein, and eosine) injected in Cell 3. Record the volume of distilled water injected for dilution of initial injected concentration, if used. Calculate the diluted concentration of tracers following distilled water injection.
- B. During tracer testing, maintain a log recording the date, time, monitoring or extraction well location, and measured bromide tracer concentration from field probes or note color observation for fluorescein and eosine.
- C. Collect groundwater samples from monitoring wells for laboratory confirmation of potassium bromide, fluorescein, eosine, and other constituents listed in Table 2. The reporting limit for each constituent shall be in accordance to limits listed in Table 2.
- D. Following injection of tracers, concentrations will be monitored in the first and second row of downgradient monitoring wells, i.e., the CA-MW-100 and 200 series. If tracers are detected, additional downgradient and cross-gradient monitoring wells must be sampled in the subsequent sampling event until the non-detect boundary line is defined. Where detected, tracers must continue to be monitored in subsequent sampling events, until the concentrations decline below 100 micrograms per liter for two consecutive sampling events.

Post-Injection Groundwater Monitoring

- A. Monitoring wells shall be sampled at the mid-screen length after the initial reagent injection for the constituents in Table 2 below. Water analysis for chloride is only required if hydrochloric acid is injected into wells for screen rehabilitation. Water analysis for bromide, fluorescein, and eosine is only required if injected for tracer testing.

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

TABLE 2. Monitoring Parameters

Constituents	Analytical Method	Reporting Limit (mg/L)
Total Chromium	EPA 6010	0.005
Hexavalent Chromium	EPA 7199	0.001
Bromide*, Chloride**	EPA 300	0.1
Methane	RSK 175	0.002
Eosine*	spectrofluorophotometer	0.008
Fluorescein*	spectrofluorophotometer	0.002
Ethanol	EPA 1400	10
Total Organic Carbon	EPA 415.1	1.0
Volatile fatty acids (VFA)***	EPA 300.M	1.0
Calcium, Sodium, Magnesium	EPA 200.7	1.0
Bicarbonate Alkalinity	EPA 310.1	10
Phosphorus (as phosphate)	EPA 300	0.1
Ammonia	EPA 350.2	10
Nitrate/Nitrite	EPA 300	0.02
Sulfate	EPA 300	1.0
Sulfide	EPA 376.1	1.0
Dissolved iron	EPA 6010	0.05
Manganese	EPA 6010	0.01
Arsenic	EPA 6010	0.01
pH	EPA 150.1	1-14
pH, Bromide, temperature, dissolved oxygen, specific conductance, ORP	Field measurements	

Notes:

*To be analyzed only if tracers are discharged at site

**To be analyzed only if hydrochloric acid is discharged at site

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

- B. The depth to groundwater shall be determined to at least 0.01-foot increments according to the monitoring frequency identified in Table 3 until the end of the pilot study.
- C. Monitoring wells, installed downgradient of the treatment zone, shall be used to assess tracer migration and in-situ bioremediation efficiency. Sentry wells and contingency wells shall be used to verify hexavalent chromium transformation in groundwater. Sentry and contingency wells shall also be used to confirm bioremediation effectiveness, tracer diffusion, potential mobilized metals, and other constituents.

Table 3 shows the monitoring frequency to be implemented at the monitoring wells, sentry wells, and contingency wells, based upon an estimate groundwater velocity in the treatment zone of up to 4 feet per day.

Table 3. Monitoring Frequency

Monitoring Location	Begin Sampling
1 st & 2 nd rows monitoring wells	30 days after initial tracer or reagent injections and then monthly for three more months. Quarterly sampling thereafter.
1 st row sentry wells (400 ft)	60 days (2 months) after initial injections and then monthly for two more months. Quarterly sampling thereafter.
2 nd row sentry wells (800 ft)	120 days (4 months) after initial injections and then quarterly sampling thereafter.
Contingency wells (1,600 ft)	10 months after initial injections and then quarterly thereafter.

Since the velocity of groundwater beyond the influence of the recirculation system may reduce to 1.6-2 feet per day, the monitoring frequency can only be modified after accumulating at least two years worth of data at each sampling location.

D. Contingency Plan

The injection of lactate, whey, EVO, and ethanol 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 from aquifer sediments. For instance, like hexavalent chromium, iron, manganese, and arsenic may also reduce and become mobilized in groundwater. In addition, reducing conditions may generate gases, such as methane and hydrogen sulfide. Water samples will be collected from the sentry and contingency wells during routine sampling discussed before in Item B. If any of the reagents, mobilized metals, or tracers are found at elevated concentrations above background conditions 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 4) 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, if any of the parameters are detected above trigger concentrations in the second row of sentry wells, located 800 ft from the recirculation system, the Discharger will notify the Water Board within 5 days. The Discharger will then consult with the Water Board staff concerning the

results. If the Discharger cannot indicate the unlikely scenario for constituent migration beyond the pilot test boundaries, the Discharger must implement the Contingency Plan (refer to Table 5). In the latter case, injections must be scaled back or halted within 5 days of consulting with Water Board staff. Within 14 days of consulting with Water Board staff, the Discharger must begin the process of implementing air sparging or another equally effective remediation method for the constituent exceeding the water quality standard. The chosen remediation method must be in operation within 120 days of consultation with Water Board staff. The chosen remediation method must restore the aquifer between sentry and contingency wells to pre-pilot study conditions and restore water quality to levels listed in waste discharge requirements, preventing migration outside the pilot study boundaries.

If any of the parameters listed in Table 4 are not detected in both rows of sentry wells, the Discharger is not required to test for that parameter in contingency wells. In the event that any of the parameters listed in Table 4 are detected at water quality standards in contingency monitoring wells on the pilot study boundaries, the applicant will notify the Water Board within two working days of receipt of laboratory results of violations being detected. Within 14 days of notification, the Discharger will submit a proposal to the Water Board to contain such migration outside the pilot study boundaries. The proposal shall include 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 4.
Contingency Plan Threshold Concentrations

Parameter	Trigger Concentrations (mg/L)
Hexavalent & Total Chromium	*
Arsenic ²	0.01
Chloride [†]	*
Eosine [†]	0.1 ⁶
Ethanol ⁴	760
Fluorescein [†]	0.1 ⁶
Iron (Fe ²⁺ and Fe ³⁺) ⁵	0.3
Manganese	**

Note:

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

²Federal Primary MCL for drinking water

³Federal Suggested No-Adverse-Response Level (SNARL)

⁴Taste and Odor Threshold

⁵California Secondary MCL for drinking water

⁶Color Detection

†to be analyzed if hydrochloric acid or applicable tracer is used

*Concentration limit to be set based upon the maximum background concentration detected in groundwater, as demonstrated in quarterly monitoring reports

**Concentration limit to be set at 125 percent of the maximum background concentration measured in groundwater prior to initial injection of reagents

**TABLE 5.
Contingency Plan Schedule**

Task	Schedule
Notify Water Board staff	Within 5 days of lab results for sentry wells
Scale back or halt reagent, tracer, or well rehabilitation compounds injections	Within 5 days of consulting with Water Board staff who believe that off-site migration above water quality standards is possible
Begin process ¹ of Implementing air sparging or other equally effective remediation method	Within 14 days of consulting with Water Board staff for second row sentry wells
Activate air sparging or alternate remediation method in groundwater	Within 120 days of consulting with Water Board staff for second row sentry wells
Notify Water Board staff	Within 2 days of lab results showing exceedence of water quality standards at contingency wells
Submit proposal to prevent migration outside of pilot study boundaries and to conduct monitoring beyond contingency wells.	Within 14 days of notification to Water Board for contingency wells

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

E. 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.

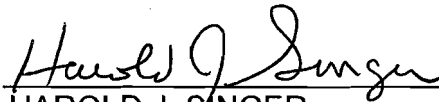
Monitor for gases in general atmosphere and in monitoring wells and extraction wells prior to collecting water elevation data and groundwater samples. If air monitoring indicates that a gas is present, additional air sampling shall be conducted to determine risk to field personnel. If a risk is indicated, 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.

II. REPORTING REQUIREMENTS

Quarterly status reports and the project completion report shall be submitted to the Water Board in accordance to the schedule listed in Board Order No. R6V-2007-0032.

Ordered by:



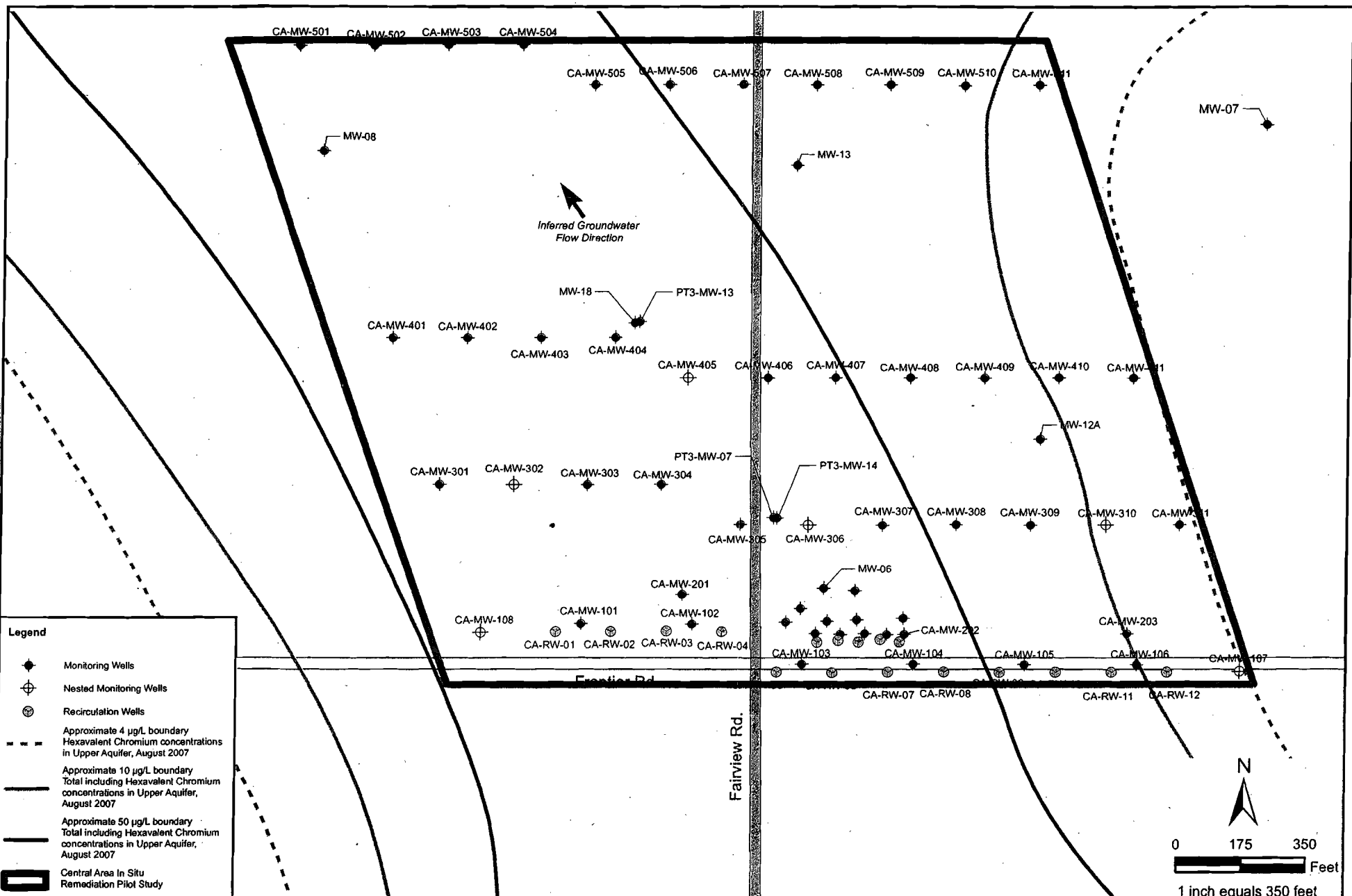
Dated:

HAROLD J. SINGER
EXECUTIVE OFFICER

Attachment: Figure of Well Locations

ATTACHMENT

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Legend

- ◆ Monitoring Wells
- ⊕ Nested Monitoring Wells
- ⊗ Recirculation Wells
- - - - - Approximate 4 µg/L boundary Hexavalent Chromium concentrations in Upper Aquifer, August 2007
- Approximate 10 µg/L boundary Total including Hexavalent Chromium concentrations in Upper Aquifer, August 2007
- Approximate 50 µg/L boundary Total including Hexavalent Chromium concentrations in Upper Aquifer, August 2007
- ▭ Central Area In Situ Remediation Pilot Study

N

0 175 350

Feet

1 inch equals 350 feet

Program Manager
Lisa Cope

Project Manager
Eric Putnam

Task Manager
Hollis Phillips

Technical Review
Frank Lenzo

155 Montgomery Street, Suite 1500
San Francisco, California 94104
Tel: 415 374 2744
Fax: 415 374 2745
www.arcadis-us.com

Well Layout
Revised Central Area In Situ
Remediation Project

Pacific Gas and Electric Company: Hinkley Compressor Station
Hinkley, California

ATTACHMENT

B