

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

MONITORING AND REPORTING
PROGRAM NO. R6V-2006-0054

WDID NO. 6B369107001

FOR

PACIFIC GAS AND ELECTRIC COMPANY
IN-SITU SOURCE AREA REMEDIATION 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 the project area (refer to Attachment 1). The groundwater flow direction is unknown but is suspected of flowing to the north at the compressor station and to the northwest beyond the project area.
- a. **Performance monitoring wells** are located within the project recirculation area or "treatment zone" and used primarily to evaluate the effectiveness of reagent injections and remediation.
 - b. **Sentry wells** comprise two rows of east-west trending monitoring wells located in the "recovery zone." The first row will be located within 150 feet downgradient of extraction wells, and spaced exactly between extraction wells to assess migration outside zone of influence. An additional sentry well will be placed on the east and west ends of the row outside the phased project area. The second row will be located within 350 feet downgradient of extraction wells and consist of the same number as in the first row of sentry wells.
 - c. **Contingency wells** comprise one row of monitoring wells located outside the project area within the "contingency zone." Contingency wells will be located between 600 and 800 feet downgradient from extraction wells to assess migration beyond the recovery zone.
 - d. **Depth-discrete monitoring wells** will be installed to evaluate chromium remediation and byproduct formation with depth in the saturated zone. These wells are screened between 125-135 feet below ground surface and located in the center of each row within the recovery zone and contingency zone.

- 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 within 0.01-foot in all wells sampled prior to the initial injection.

Post-Injection Monitoring

- A. The depth to groundwater shall be determined to within 0.01-foot in all monitoring wells identified below 14 days after the initial reagent injection, one month after initial injection, and each month until the end of the project.
- B. All monitoring wells shall be sampled at the mid-screen length 14 days after the initial reagent injection, one month after initial injection, and each month until the end of the project 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. For ethanol pilot testing, additional sentry wells may be included in the monitoring program to demonstrate there will be no degradation to water quality and the environment.

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

TABLE 1
Monitoring Wells and Sentry Wells

Constituents	Analytical Method
Total Chromium	EPA 6010
Hexavalent Chromium	EPA 7199
Volatile fatty acids (VFA)*	EPA 300.M
Total Organic Carbon	EPA 415.2
Bicarbonate Alkalinity	EPA 310.1
Nitrate/Nitrite	EPA 300
Sulfate	EPA 300
Dissolved iron	EPA 6010
Manganese	EPA 6020A
Arsenic	EPA 6020A
PH	EPA 150.1
pH, temperature, dissolved oxygen, specific conductance, ORP	Field measurements

Notes:

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

Contingency wells shall be sampled for the following constituents using the methods provided below and for any constituent in Table 1 showing exceedances of drinking water standards:

TABLE 2
Contingency Wells

Constituents	Analytical Method
Total Chromium	EPA 6010
Hexavalent Chromium	EPA 7199
Dissolved iron	EPA 6010
Manganese	EPA 6010
Arsenic	EPA 6010

C. 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 in aquifer material. 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 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

1. Sentry wells - In the event that any of the parameters are detected at or greater than trigger concentrations (refer to Table 3) at a sentry well, the Discharger must:
 - a. **Immediately** re-sample the well(s) showing exceedances.
 - b. Within **five days** of receipt of laboratory results confirming exceedances, scale back by at least half the original reagent amount or volume, or completely halt reagent injections.
 - c. Within **five days** of receipt of laboratory results confirming exceedances, notify the Water Board of results and action taken to reduce or halt reagent injections.
 - d. For exceedances confirmed in the second row of sentry wells, **within 14 days** of notification to the Water Board, the Discharger will submit a proposal to prevent further off-site migration. The proposal shall contain

a remediation and monitoring plan to restore water quality and adequately monitor groundwater downgradient of the contingency wells where violations were observed.

- e. The remediation and monitoring plan shall be placed into operation **within 90 days** of original notification to the Water Board of violations.

2. Contingency wells - In the event that any of the parameters listed in Table 3 are detected at or greater than water quality standards in contingency monitoring wells, the Discharger must:

- a. Notify the Water Board **within two working days** of receipt of laboratory results of violations being detected.
- b. **Within 14 days** of notification to the Water Board, the Discharger will submit a proposal to prevent further off-site migration. The proposal shall contain a remediation and monitoring plan to restore water quality and adequately monitor groundwater downgradient of the contingency wells where violations were observed.
- c. The remediation plan shall be placed into operation **within 90 days** of original notification to the Water Board of violations.

The above directive must be implemented whether or not contingency well violations were similarly observed in sentry wells. The proponent shall maintain a field log noting when and how the Contingency Plan is implemented.

TABLE 3
Contingency Plan Threshold Concentrations

Parameter	Aqueous Concentration (mg/L)
Hexavalent chromium	3.61
Total chromium ¹	4.24 ⁺ *
Reagents or VFAs ²	10
Arsenic ³	0.01
Manganese ¹	0.05*
Iron (Fe ²⁺ and Fe ³⁺) ¹	0.3

Note:

¹California Secondary MCL for drinking water

²Volatile Fatty Acids; includes lactic acids, acetate, pyruvate, propionate, and butyrate. Standard based on bench-scale study results.

³Federal Primary MCL for drinking water

⁺Limit can be exceeded by up to a trend of 25 percent

*Limit may be increased upon demonstration that baseline sampling shows higher concentrations prior to reagent injection

TABLE 4
Contingency Plan Schedule

Location	Task	Schedule
Sentry wells	1. Scale back or halt reagent injections	Within 5 days of lab results confirming exceedances
	2. Notify Water Board	Within 5 days of lab results confirming exceedances
	3. For second row of wells showing exceedances, submit proposal to prevent migration outside of project boundaries and to conduct additional monitoring	Within 14 days of notification to Water Board of violation(s)
	4. Begin operating the remediation proposal	Within 90 days of notification to Water Board of violation(s)
Contingency wells	1. Notify Water Board	Within 2 days of lab results showing violations at contingency wells
	2. Submit proposal to prevent migration outside of project boundaries and to conduct additional monitoring	Within 14 days of notification to Water Board of violation(s)
	3. Begin operating the remediation proposal	Within 90 days of notification to Water Board of violation(s)

D. 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

A. Submittal of Technical Reports

1. **Ethanol Pilot Testing.** The Discharger must implement and complete an ethanol pilot test before beginning full-scale ethanol discharge.
 - a. Submit a workplan at least **60 days** before implementing an ethanol pilot test for Water Board staff review.
 - b. Submit a final report of the ethanol pilot test within **75 days** of test completion. Water Board staff must concur with any statements concerning the pilot test being successful or complete before the Discharger can implement full-scale ethanol discharge.
2. Beginning **May 15, 2007**, the Discharger must submit quarterly status reports describing project activities during the previous quarter. The reports are required to:
 - List the type, volume, and concentrations of discharges to groundwater during the prior quarter.
 - Discuss the operation of the recirculation system and estimate its area of influence.
 - Contain a site map showing all features relevant to the project.
 - Include a potentiometric map showing the calculated groundwater flow direction and gradient and provide a description of each in the text.
 - Monitoring well map listing sampling results for sentry and contingency wells.
 - Maintain tables of discharges and groundwater monitoring results during the project life.
 - Describe each and every instance of violation of the waste discharge requirements, equipment failures, and unexpected environmental impacts.
 - State whether or not adverse impacts have occurred in groundwater requiring implementation of the Contingency Plan.
 - State whether or not current monitoring wells are adequate in number, location, and depth to monitor migration of remediation by products. If not, the reports must include a workplan to conduct further groundwater monitoring.
 - Describe planned activities during the next three months of the project.

The reports 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 August 15, November 15, February 15, and May 15 of each year.**

3. **Within 60 days upon completion of the project**, submit to the Lahontan Water Board a final project report. The report must:
- Describe the type, concentration, and volume of all chemical and compounds injected into the subsurface during the project life.
 - Contain the results of sampling and laboratory analysis of samples collected during the project.
 - Include a map showing the location of project cells, injection wells, monitoring wells, extraction wells, and other relevant project details.
 - Contain 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.
 - State whether any portion of the Contingency Plan was implemented during the project and, if so, provide details.
 - Describe the findings and conclusions of in-situ remediation of hexavalent chromium and other possible by-products.
 - The final project report must include a discussion of (1) any violations of the WDR over the past 12 months, (2) the fate and transport of constituents in violation, and (3) action(s) taken to correct those violations. If no violations occurred, this shall be so stated.

The report must 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 needs to 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 Water Code 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 Water Code section 13267(b), 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

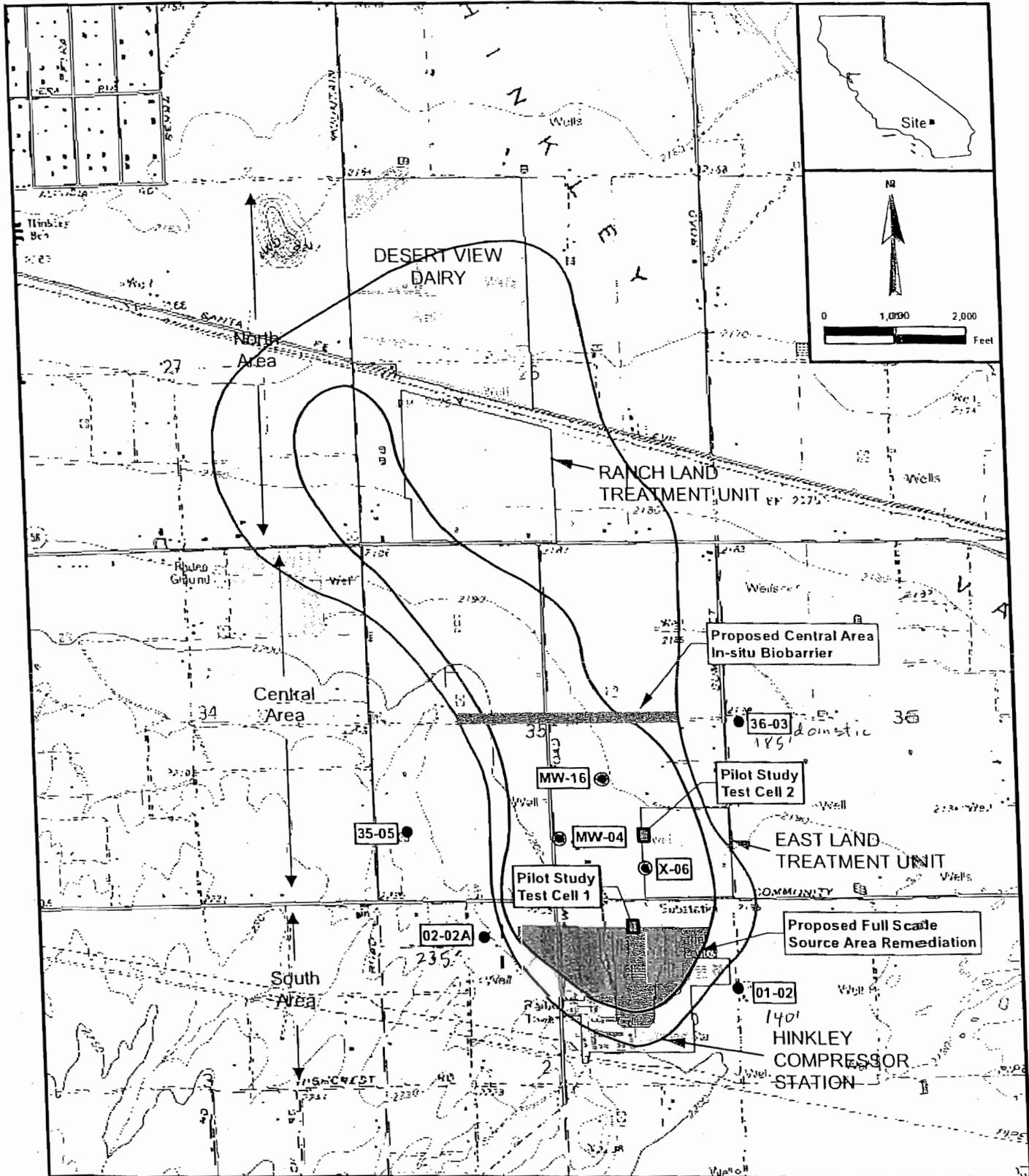
The Discharger shall, within 180 days of verifying the release, submit an Engineering Feasibility Study (Section 2550.8(k)(6) of Article 5) to preliminarily propose methods for corrective action.

III. The Water Board Executive Officer is authorized to make minor changes to these monitoring and reporting requirements following successful demonstration by the Discharger that such changes will still enable adequate protection of water quality.

Ordered by: Harold J. Singer Dated: Nov 9, 2006
HAROLD J. SINGER
EXECUTIVE OFFICER

Attachment: Figure of Well Locations

(LSD:PG&E Source Area WDRM&R 1006 prop)



LEGEND

-  PG & E Property
-  Main Roads
-  Nearest Active Private Wells
-  Existing Contingency Monitoring Well
-  Draft Approximate outline 10 µg/L Total Chromium (including Hexavalent Chromium) concentration, Upper Aquifer, February 2006
-  Draft Approximate outline 50 µg/L Total Chromium (including Hexavalent Chromium) concentration, Upper Aquifer, February 2006

**FIGURE 1
SITE LOCATION MAP
PHASED FULL-SCALE IN-SITU
SOURCE REMEDIATION**
PACIFIC GAS AND ELECTRIC COMPANY
COMPRESSOR STATION
HINKLEY, CALIFORNIA



Legend

- Former Oil Water Separator
 - Former Unlined Evaporation Ponds
 - Former Trench
 - Phase 1 Buildout
 - Phase 2 Buildout
 - Existing Performance Monitoring Well
 - Existing Monitoring Well
 - Groundwater Extraction Well
 - Remediation Well
 - New Performance Monitoring Well
- February 2006 Chromium Plume
- - - - 10 ppb Cr(T)
 - 50 ppb Cr(T)

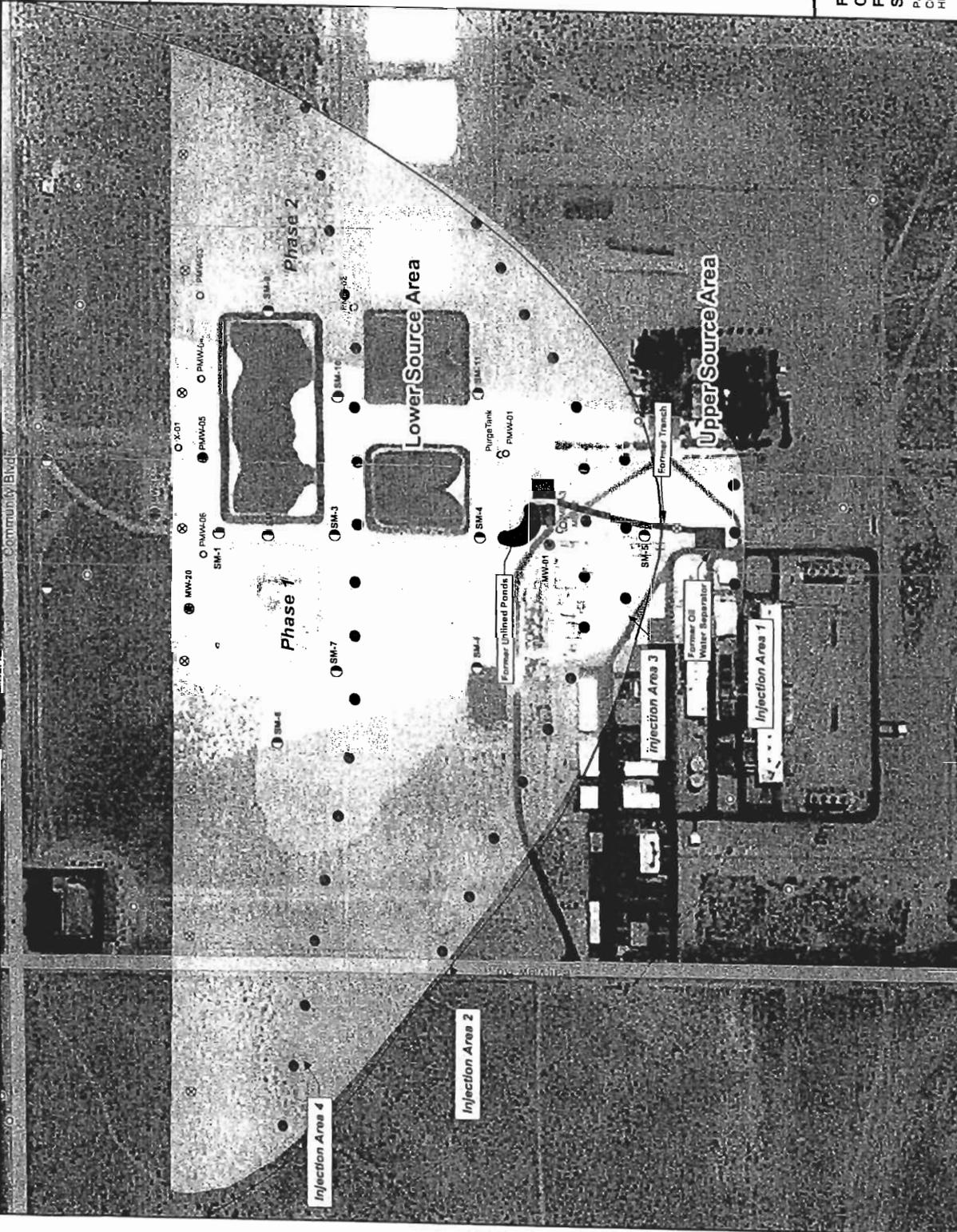


FIGURE 2
CONCEPTUAL PHASED
FULL-SCALE IN-SITU
SOURCE REMEDIATION APPROA
 PACIFIC GAS AND ELECTRIC COMPANY
 COMPRESSOR STATION
 HINKLEY, CALIFORNIA

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**Pacific Gas and
Electric Company**

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October 3, 2006

Mr. Chuck Curtis, P.E.
California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

Subject: *Comments on Tentative Waste Discharge Requirements for the In-Situ Source Area Remediation Project*

Dear Mr. Curtis:

Pacific Gas and Electric Company (PG&E) appreciates the opportunity to review and comment on the tentative Waste Discharge Requirements (WDRs) to implement a full-scale in-situ remediation project in the source area of the chromium plume at the Hinkley Compressor Station. PG&E concurs with the planned action to adopt WDRs for the Source Area at the Board Meeting in November. We have the following comments and clarifications on the tentative WDRs:

Board Order

Pages 2, 3, and 7: Selected paragraphs may need to be renumbered (paragraph numbers 4, 6, and 25 are missing; "Enforcement History" and "Reason for Action" on pages 2 and 3, respectively, are both numbered paragraph 1).

Page 4, Paragraph 11: In accordance with the August 4, 2006 response letter from PG&E to the Lahontan Regional Water Quality Control Board (LRWQCB) letter titled *Incomplete Report of Waste Discharge for the In-Situ Source Remediation Project, Hinkley Compressor Station, San Bernardino County - WDID No. 6B369107001* (attached for your reference), the project will be built and operated in up to two phases instead of three phases. Please replace Figure 2 with the revised Figure 2 from the August 4, 2006, PG&E response letter. For your convenience, a copy of the August 4 revised Figure 2 is attached.

Page 8, Section I.A: The paragraph numbering for the discharge limits is missing some items or needs to be renumbered (items 1, 2, 4 are missing).

Page 9, Section I.B: The "project boundaries" in this section are not explicitly defined, considering application of the subsequent discharge limitations. The draft groundwater limits for total chromium (Cr[T]) and hexavalent chromium (Cr[VI]) are based on the maximum concentrations detected at the Source Area in 2006 - in this case well PMW-03. Because of the nature of source areas, it is possible, if not likely, to see significant variability of concentrations in monitoring wells - especially during the initiation of recirculation or injection systems. For this reason, PG&E believes it is not appropriate to

allow temporary variations of measured Cr(T) and Cr(VI) in monitoring wells to affect the operation of the remedy, regardless of the observed chromium concentrations. There is no conceivable way in which the in situ applications could increase chromium concentrations in groundwater.

However, if the LRWQCB decides to require that variations in chromium concentrations be used as criteria that will affect the remedy implementation, we propose that at a minimum, the Cr(T) and Cr(VI) limits should not be set until all wells are installed and sampled during a baseline event. We request that limit for Cr(T) and Cr(VI) should be based upon the maximum concentration detected in groundwater prior to initial injection of reagents and showing increasing trend of 25 percent or greater. We propose that the Cr(T) and Cr(VI) limits should not be set until all wells are installed and sampled during a baseline event.

Page 11, Section I.C.4: Similar to the Central Area WDRs (dated June 14, 2006), the concentration limit for manganese should 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". We propose that the manganese limits should not be set until all wells are installed and sampled during a baseline event.

Page 11, Section D: This section's numbering is incorrect.

Page 11, Section D.5 (the 6th item): This comment regarding the integrity of the Land Treatment Unit (LTU) is not applicable to the Source Area WDRs, and should be deleted.

Page 13, Section III.A.1: The proposed requirement implies that the first phase of the system is in place and operating, and that the sampling will be completed in time to submit a quarterly report by February 15, 2007. We propose that the reporting schedule be based on approximately 60 days after actual project startup. However, if a specific schedule date for the first quarterly status report is required, please use May 15, 2007.

Page 13, Section III.A.2: References to the full-scale in-situ remediation project as a "pilot test" should be changed to "project".

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Page 2, Table 1: Consistent with the Central Area WDRs, nitrate and nitrite can be analyzed together using EPA Method 300.

Page 3, Section C: The contingency plan should incorporate the detailed information provided in PG&E's August 4, 2006, response letter (e.g., data validation, confirmation sampling if limits exceeded).

In addition, we would like to eliminate Cr(T) and Cr(VI) as water quality standards for contingency monitoring wells that would require notification to the LRWQCB. Fluctuating Cr(T) and Cr(VI) concentrations are found in the source area monitoring wells, and temporary increases are expected and should not cause the shutdown of the in-situ remediation system.

Page 4, Table 3: This table should match the table that is presented on Page 11, Section I.C.4 of the Board Order. We propose that the Cr(T) and Cr(VI) limits should not be set until all wells are installed

and sampled during a baseline event and that concentrations show increasing trend of 25 percent or greater.

Page 4, Table 4: The Contingency Plan schedule should incorporate the detailed information provided in PG&E's August 4, 2006, response letter (e.g., data validation, confirmation sampling if limits exceeded). The pertinent excerpt that discusses the Contingency Plan is provided below:

In addition to monitoring the contingency wells (i.e., X-02, MW-15, and if necessary, X-06, MW-04, and MW-16), the following actions will be performed if there are detections of secondary by-products above the WDR threshold levels in the downgradient-most contingency wells:

1. As part of routine operations, laboratory data will be reviewed and subjected to data validation.
2. The LRWQCB will be notified within three working days of completion of data validation.
3. The wells in which the threshold levels are exceeded will be resampled to confirm the exceedances. These data will also be reviewed, validated, and reported to the LRWQCB.
4. If the exceedances are confirmed, the reagent injections will be scaled back or halted within five working days of confirmation of the exceedances (i.e., within five working days of completion of the validation of the resampled results).
5. A proposal will be submitted to the LRWQCB to modify the IRZ operations, address migration outside of the IRZ system boundaries, and conduct additional monitoring. The proposal will be submitted within ten working days of confirmation of the exceedances.

Possible responses to address migration include operation of a groundwater extraction system upgradient of the water supply wells to provide capture of secondary by-products, provision of an alternative water supply to impacted domestic water users, and/or groundwater oxygenation (such as by recirculation wells circulating oxygenated water). Changes in the status or ownership of the wells could also affect the applicable response action. The response action will be appropriate for the types and proximity of downgradient receptors.

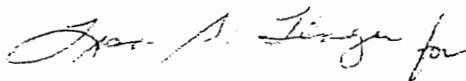
Page 5, Section II.1: The proposed requirement implies that the first phase of the system is in place and operating, and that the sampling will be completed in time to submit a quarterly report by February 15, 2007. We propose that the reporting schedule be based on 60 days after actual project startup. However, if a specific schedule date for the first quarterly status report is required, please use May 15, 2007.

Page 6, Section II.A.1: The proposed text requires that the Water Board be notified of a release of extracted groundwater containing chromium to ground surface. This general description should be made more specific by the additional qualifier of total chromium concentrations above 50 micrograms/liter.

October 3, 2006

Thank you for allowing PG&E the opportunity to comment on the tentative WDRs. If you have any questions, or need additional information, please do not hesitate to call me.

Sincerely,

A handwritten signature in cursive script, appearing to read "Eric P. Johnson for".

Eric P. Johnson
Hinkley Remediation Project Manager

Enclosure (PG&E's August 4, 2006 response letter)

cc: Cindi Mitton, Acting Supervisor, RWQCB Lahontan Region, Victorville
Lisa Dernbach, RWQCB Lahontan Region, South Lake Tahoe
Joe Koutsky, RWQCB Lahontan Region, South Lake Tahoe