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Arnold Schwarzenegger
Governor

March 22, 2006

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

CONDITIONAL APPROVAL OF CHROMIUM ISOTOPE STUDY WORKPLAN, PACIFIC GAS AND ELECTRIC COMPANY, TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA (EPA ID NO. CAT080011729)

Dear Ms. Meeks:

The Department of Toxic Substances Control (DTSC), Geological Services Unit (GSU) has completed their review of the Chromium Isotope Study Workplan, dated March 3, 2006, prepared by Pacific Gas and Electric Company (PG&E). GSU comments were provided in a technical memorandum dated March 21, 2006. A copy of the GSU memorandum is enclosed. Based on the GSU recommendations, DTSC is providing approval of the workplan with the following conditions:

1. PG&E shall revise the workplan to address the enclosed GSU comments and recommendations. The revised workplan shall be submitted to DTSC no later than April 7, 2006.
2. During April 2006, PG&E shall collect samples from the wells identified as the first analytical group in Attachment A of the enclosed GSU memorandum. The revised workplan shall provide a specific schedule for sampling these wells.
3. PG&E shall confer with DTSC before making any changes to the wells identified in the first analytical group.
4. PG&E shall be prepared to discuss the results from the first analytical group with the Consultative Workgroup (CWG) and/or the Geo/Hydro Technical Workgroup (TWG) within 30 days of completion of the chromium isotope analyses as determined by DTSC.
5. If directed by DTSC, PG&E shall implement a second phase of the Chromium Isotope Study within 45 days of receiving written notice from DTSC.

Ms. Yvonne Meeks

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6. PG&E shall submit monthly progress reports to DTSC for the duration of the Chromium Isotope Study.

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

Sincerely,



Norman Shopay, P.G.

Project Manager

Geology, Permitting and Corrective Action Branch

NTS/204A

Enclosure: GSU Memorandum, Chromium Isotope Study Workplan, RCRA Facility Investigation, PG&E Topock Compressor Station (dated March 21, 2006)

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



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



Department of Toxic Substances Control

Maureen F. Gorsen, Director
8800 Cal Center Drive
Sacramento, California 95826-3200



Arnold Schwarzenegger
Governor

MEMORANDUM

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

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

DATE: March 21, 2006

SUBJECT: Chromium Isotope Study Workplan, RCRA Facility Investigation
PG&E Topock Compressor Station, Needles, San Bernardino County
Project No. 22120/540015-48/36-HWMP

DOCUMENT REVIEWED

Technical Memorandum, Chromium Isotope Study Workplan, PG&E Topock Compressor Station, Needles, California. Prepared by CH2M Hill. Dated March 3, 2006.

INTRODUCTION

The Northern California Geological Services Unit (GSU) of the Department of Toxic Substances Control (DTSC) has reviewed the above-referenced Chromium Isotope Study Workplan (workplan). Pacific Gas and Electric Company (PG&E) has submitted the workplan as required by a January 13, 2006 DTSC letter. DTSC requested the study to assess whether chromium isotopes would provide an additional tool that can be used to distinguish the PG&E chromium releases from naturally-occurring hexavalent chromium (Cr(VI)). If the study results are positive, DTSC expects that the chromium isotope data will be used in conjunction with results of the Groundwater Background Study, and other hydrologic data, to define the extent of the chromium plume associated with the PG&E Topock Compressor Station. The study is being conducted to address the RCRA Facility Investigation (RFI) objective to delineate the chromium plume. The extent of the chromium plume must be determined to support selection of the final remedy in the Corrective Measures Study.

The workplan was provided to Consultative Workgroup (CWG) members on March 6, 2006 and was discussed by the CWG in a focused technical discussion on March 14, 2006. DTSC received comments from Hargis+Associates, Inc. (on behalf of the Fort Mojave Indian Tribe (the Tribe)) and GeoTrans, Inc. (on behalf of the Arizona

Department of Environmental Quality (ADEQ)).

This memorandum provides GSU comments and recommendations on the workplan and considers the input provided on behalf of the Tribe and ADEQ. If you have questions, please call me at 916-255-6537.

BACKGROUND

Currently, the extent of the chromium plume cannot be fully delineated without additional techniques for recognizing anthropogenic chromium. PG&E is conducting the Groundwater Background Study, which, in part, is expected to assist with the plume delineation. DTSC recognizes that the Groundwater Background Study will yield numeric information regarding the general concentration of chromium in the vicinity of the PG&E Topock Compressor Station. However, the Groundwater Background Study will contain uncertainty in separating the naturally-occurring chromium from the anthropogenic chromium. As the lead agency, DTSC must be satisfied with delineation of the extent of the chromium plume originating from the PG&E Topock Compressor Station. DTSC views the Chromium Isotope Study to be a valuable and viable science to evaluate the extent of the PG&E chromium plume. This study, in conjunction with the Groundwater Background Study and other hydrologic data, will likely yield multiple lines of evidence in defining the nature and extent of the anthropogenic chromium. DTSC believes the results of both the Chromium Isotope Study and Groundwater Background Study to be necessary information prior to final remedy selection.

The data generated by the Chromium Isotope Study are intended to complement other data in the vicinity of the Topock Compressor Station and are not intended to provide sole justification of the interpreted chromium plume extent. If the Chromium Isotope Study is conclusive, PG&E will have an additional tool to assist with delineation of the extent of the chromium plume originating from historical PG&E waste disposal practices.

From the DTSC perspective, the Chromium Isotope Study has two primary objectives:

- (1) to assess whether the PG&E chromium releases can be distinguished from naturally-occurring chromium; and,
- (2) if chromium isotopes can be used to distinguish anthropogenic from naturally-occurring chromium, use the chromium isotopes (in conjunction with the results of the Groundwater Background Study and other hydrologic data) to assist with delineation of the chromium plume.

A secondary objective is to use the chromium isotopes to assist with the assessment of the degree of chromium reduction that is occurring in the floodplain area.

OVERALL RECOMMENDATION

PG&E should revise the workplan to address the enclosed comments. The timeframe for workplan revision and approval should allow collection of samples in April 2006. To

facilitate the study schedule, GSU has prepared the attached recommended list of wells for the study (Attachment A). Please refer to the enclosed comments for further discussion of the rationale for this list.

COMMENTS AND RECOMMENDATIONS

1. The workplan outlines data collection activities that are intended to determine:
 - a. Whether the isotopic signature of chromium within the plume can be distinguished from the isotopic signature of chromium in background wells located at large distances from the Topock Compressor Station; and
 - b. How the chromium isotopic signature changes along groundwater flow paths within the plume.

If chromium isotopes are determined to be a useful tool for this project, PG&E proposes to collect the data to assist with plume delineation under a second phase of sampling.

The scope of work described in the workplan will not generate a data set that is capable of directly supporting delineation of the chromium plume.¹ In addition, the proposal to evaluate chromium isotopes only in plume wells and distal background wells may not provide a data set adequate to assess whether chromium isotopes are a useful tool for this project (see Comment 4).

Recommendation 1a: PG&E should revise the workplan to clearly state the following objectives: (1) assess whether chromium isotopes can be used to distinguish the PG&E chromium releases from naturally-occurring chromium; (2) if chromium isotopes can be used to distinguish anthropogenic and naturally-occurring chromium, use the chromium isotopes to assist with delineation of the chromium plume; and (3) use the chromium isotopes to assist with the assessment of the degree of chromium reduction that is occurring in the floodplain area.

Recommendation 1b: PG&E should revise the scope of work to be addressed under the workplan to ensure that the objectives identified under Recommendation 1a can be fulfilled. In order to accomplish the objectives, the revised scope of work should include (i) sampling of additional wells within the plume, (ii) wells interpreted to be at or near the plume margin, and (iii) background wells closer to the Topock Compressor Station.

2. The workplan does not provide a clear schedule for implementing the Chromium Isotope Study. During the CWG conference call on March 14, PG&E clarified the schedule for the study to be as follows:
 - a. PG&E and the USGS would collect the Phase 1 samples in April.
 - b. USGS laboratories would require approximately 45 days for Phase 1 sample analysis.

¹ Assuming that chromium isotopes are determined to be a useful tool for this purpose.

- c. PG&E and the USGS would evaluate the Phase 1 data.
- d. In June, PG&E would make a presentation to the Geo/Hydro Technical Workgroup (TWG) with Phase 1 findings and would provide recommendations for a second phase of the study (if any).
- e. Contingent activity: PG&E and the USGS would collect the Phase 2 samples in late July.
- f. Contingent activity: USGS laboratories would require approximately 45 days for Phase 2 sample analysis.
- g. Contingent activity: PG&E and USGS would evaluate Phase 1 and 2 data.
- h. Contingent activity: In October, PG&E would make a presentation to the TWG with findings.
- i. In November 2006, PG&E and the USGS would issue a joint technical memorandum with the study results.

Given the overall project schedule, the proposed November 2006 completion for the Chromium Isotope Study would be adequate to support plume delineation.¹ However, based on various discussions regarding the study, GSU has concerns that unforeseen factors may delay the study so that it is not completed within a timeframe needed to support plume delineation.¹ Examples of these factors include: (1) additional arrangements for sampling Groundwater Background Study wells after April 2006; (2) time to come to agreement on the wells to be included in the second phase of the study; (3) delays in funding the USGS; and (4) longer time to perform the isotope analyses (e.g., laboratory setup time, other work with priority over the PG&E samples).

Recommendation 2a: PG&E should collect all samples that may be needed for the Chromium Isotope Study during one field mobilization in April 2006. If a single field mobilization is not possible (see Comment 3), PG&E would collect the samples in separate field mobilizations in April 2006 and potentially July 2006.

Recommendation 2b: The revised workplan should identify all foreseeable wells that may be sampled by the Chromium Isotope Study (e.g., within plume, at or near plume margin, near site background, distal background). The workplan should divide the samples into two analytical groups. The first analytical group should include samples from wells within the plume, near the plume margin, at background locations near the site, and at background locations distal from the site. The second analytical group should include other wells that may further characterize chromium isotope signatures within the plume, near the plume margin, and at background locations.

Recommendation 2c: The decision for which well samples will be analyzed in the second analytical group should be made after review and evaluation of the findings from the first analytical group. To ensure that the study continues to move forward, GSU suggests that DTSC should make this decision shortly after the June TWG meeting which will discuss the Chromium Isotope Study.

Recommendation 2d: The revised workplan should provide a more detailed schedule for the study.

3. Stakeholder input has influenced the wells that are recommended for the first analytical group identified in Attachment A. The most notable input is summarized below:
 - a. From various discussions, GSU understands that USGS staffing and funding constraints will restrict the size of the first analytical group to 25 samples plus the quality assurance/quality control samples. For this reason, Attachment A recommends only 25 wells for the first analytical group.
 - b. ADEQ comments on the workplan advocate that additional data gaps be filled prior to selection of wells for the Chromium Isotope Study in Arizona. After careful consideration of this comment, GSU is recommending that the Arizona wells be included in the second analytical group. GSU anticipates that the appropriateness of sampling these wells could be evaluated with consideration of the results of the Arizona Topock Groundwater Study.
4. The background information provided in Sections 2.2 through 2.5 of the workplan indicates that interpretation of the chromium isotope data will be challenging. The analysis requires understanding of the processes causing isotopic fractionation and how these processes are operating along the groundwater flow path. It is not clear how the chromium isotope signature of the proposed distal background wells supports the objective of determining whether chromium isotopes can assist with delineating the plume at the Topock Compressor Station. The geologic materials and residence times for groundwater collected from the proposed background wells are not necessarily representative of the hydrologic conditions and processes affecting the chromium isotope signature in groundwater in the vicinity of the Topock Compressor Station. The hydrologic conditions and processes are poorly understood for some proposed background wells.

The USGS has chromium isotope data collected elsewhere in the Mojave Desert that indicates that a wider range of chromium isotope values can be expected for a data set collected over a larger area. The wider range is interpreted to be caused by varied geologic and redox conditions. The implication of these findings for the Chromium Isotope Study is that a more precise range of chromium isotope signatures would be obtained if the background samples are collected closer to the Topock Compressor Station.

Furthermore, the workplan does not discuss the methods that will be used to compare the chromium isotope signatures of groundwater samples from the background wells and the plume wells.

Recommendation 4a: PG&E should provide the technical justification for the use of distal scale background wells in the Chromium Isotope Study, considering that the overall purpose of the study is to support delineation of the chromium plume at the Topock Compressor Station.

Recommendation 4b: PG&E should revise the list of wells proposed in the workplan to include background wells that are closer to the Topock Compressor Station, additional wells that represent the alluvial fan setting, and additional wells on the California side of the Colorado River.

5. The workplan does not discuss the minimum chromium concentration that can be used for chromium isotope analysis. Some proposed wells have very low or non-detect chromium concentrations.

- Chromium concentrations in the "Taylor" well have ranged from <0.2 to 1 micrograms per liter ($\mu\text{g/L}$) between May and December 2005.
- Chromium concentrations in the "CA Agricultural Station" well have ranged from 1 to 2.8 $\mu\text{g/L}$ between May and December 2005.
- Chromium concentrations in well MW-39-50 were non-detect in January and February 2006.

Recommendation 5a: The revised workplan should discuss the factors controlling the minimum chromium concentration that can be analyzed for chromium isotopes.

Recommendation 5b: PG&E should consider the minimum chromium concentration range issue when revising the list of wells to be evaluated by the study.

6. The proposed list of wells for the study contains redundant wells (i.e., GSWC-3/4, New ADOT/EPNG-2), and too many wells located in Arizona relative the number of California wells. The revised list of wells should eliminate redundancies and should increase the number of California background wells.

7. GSU concurs with the ADEQ recommendation to collect samples from all lithologic units. Attachment A addresses this recommendation by including wells from the upper, middle, and lower depth intervals of the Alluvial Aquifer and by including the single bedrock well (MW-23) that has had intermittent chromium detections.

8. The workplan should be revised to include a section describing the data interpretation task. The section should discuss the following items:

- The scope of USGS input in the data interpretation process.
- The decision process for determining whether the second sample group will be analyzed.
- The geochemical parameters that will be used to recognize hydrologic factors that may be affecting decreasing chromium concentrations.
- A summary of existing stable isotope data for oxygen and hydrogen that identifies the types of water in the site vicinity (e.g., source water, impacted groundwater, unimpacted groundwater, surface water).
- The extent to which the data set will allow insight into the processes causing chromium isotope fractionation (e.g., reduction, adsorption).

- The geologic data for the selected wells that will allow PG&E to evaluate the processes causing isotopic fractionation.
 - Procedures for comparing chromium isotope signatures within the plume versus the background wells.
 - Based on a comment from the Tribe: how the data evaluation will address the potential effect of combining data points from long-screen water supply wells with data from short-screened monitoring wells.
9. The revised workplan should address ADEQ Comments 4 and 5.
- “4. The discussion on the chemistry of chromium does not adequately address the effect of the precipitation of Cr(III) on chromium concentrations, instead emphasizing sorptive reactions. At near-neutral pH, Cr(III) concentrations are generally believed to be controlled by precipitation reactions rather than sorption. The impact of Cr(III) precipitation on the isotopic composition should be discussed more fully, although it is likely to be minor.”
- “5. On page 5, duplicate samples are discussed. These duplicate samples should be analyzed for wells over the range of concentrations (i.e., low, medium, and high) to provide information on how repeatability may vary with concentration.”
10. Page 2.5, Section 2.5. This section should also discuss the chromium isotope data for the PG&E Hinckley facility.
11. Page 5, first full paragraph. The workplan indicates that the USGS laboratory will analyze samples speciated for hexavalent and total chromium using U.S. EPA Method 218.6. This method is usually used for hexavalent chromium analyses. Please clarify that the method will also be used to measure total chromium.
12. Page 5, third full paragraph. For the wells that are not sampled as part of the Groundwater Background Study, indicate the additional analytical parameters that will be analyzed in conjunction with the chromium isotope sampling event. Each well included in the Chromium Isotope Study should be sampled for general chemistry parameters and stable isotopes of oxygen and hydrogen within 45 days of collecting the sample for chromium isotope analysis.
13. Table 1. Wells with groundwater stable isotopic signature similar to the cooling tower water (e.g., the oxygen and hydrogen) may provide the chromium isotope signature of the source water. This signature can be observed along a northeast-trending groundwater flow path that extends from wells near the historical discharges to Bat Cave Wash (e.g., MW-10, MW-11) to well cluster MW-39 in the floodplain area. Wells along this groundwater flow path may allow assessment of chromium isotope fractionation within the plume. Some wells along this flow path are already included in the study (e.g., MW-10, MW-38S, MW-24B, MW-20-130, MW-20-70, MW-39-80, MW-39-50). PG&E should consider adding wells the following wells to the study:

MW-11: This well may provide an additional assessment of the initial chromium isotope signature of the source water.

MW-39-60: Chromium was not detected in well MW-39-50 during the January 2006 sampling event. PG&E should consider substituting well MW-39-60 for well MW-39-50.

14. PG&E should also consider adding the following wells located within the plume:

MW-26: Allow assessment of chromium isotope signature in eastern portion of plume before it enters the floodplain area.

MW-38D: Allow assessment of chromium isotope signature in lower portion of Alluvial Aquifer at a location within Bat Cave Wash (i.e., near the source).

15. Table 1. Please clarify why a partial reduction signature is expected for well MW-12, which is completed in alluvial fan materials.

Peer reviewed by: Alfredo Zanoria, C.E.G., C.H.G.

Attachment A. Recommended Well List for Chromium Isotope Study

Well No. (1)	Analytical Group (2)	State	Monitored Zone (3)	Recent Cr(VI) Concentration (ppb)	Alluvial Fan	Floodplain	Bat Cave Wash	Source Water Signature	Potential Cr Reduction Signature
Within Plume									
MW-10	1	CA	Upper AA	4570	x		x	x	
MW-19	1	CA	Upper AA	1240	x				
MW-20-70	1	CA	Upper AA	4640	x			x	x
MW-24B	1	CA	Lower AA	5240	x			x	
MW-25	1	CA	Upper AA	1450	x				
MW-34-100	1	CA	Lower AA	752		x			x
MW-37D	1	CA	Lower AA	1680	x		x		
MW-38S	1	CA	Upper AA	776	x		x	x	
MW-39-60	1	CA	Middle AA	20.4		x		x	x
MW-11	2	CA	Upper AA	649	x		x	x	
MW-12	2	CA	Upper AA	626	x				
MW-20-130	2	CA	Middle AA	~10,000	x			x	
MW-26	2	CA	Lower AA	3220	x				x
MW-36-90	2	CA	Lower AA	72		x			x
MW-38D	2	CA	Lower AA	227	x				
MW-39-60	2	CA	Lower AA	1750		x		x	x
At or Near Plume Margin									
MW-13	1	CA	Upper AA	21.5	x		x		
MW-14	1	CA	Upper AA	31.7	x				
MW-33-210	1	CA	Lower AA	6.9		x			
MW-33-90	1	CA	Middle AA	16.5		x			x
MW-35-135	1	CA	Lower AA	25.7		x			
MW-35-60	1	CA	Upper AA	33.3		x			x
MW-37S	1	CA	Middle AA	7.6	x		x		
MW-40S	1	CA	Upper AA	5.1	x				
MW-40D	2	CA	Lower AA	83.5	x				
MW-41M	2	CA	Middle AA	8.9	x		x		
MW-41S	2	CA	Upper AA	5.1	x		x		
Other Wells									
CA Ag Sta (3)	1	CA	AA	1	x				
CW-1M	1	CA	Middle AA	18.1	x				
CW-2M	1	CA	Middle AA	13.9	x				
Lily Hill	1	CA	AA	10.2	x				
MW-16	1	CA	Upper AA	4.1, 7.65	x				
MW-17	1	CA	Upper AA	13.6	x				
MW-18	1	CA	Upper AA	35	x				
OW-3M	1	CA	Middle AA	10.6	x				
OW-3S	1	CA	Upper AA	19.3	x				
EPNG-2	2	AZ	AA	9	x				
GSRV-2	2	AZ	AA	24.7	x				
GSWC-1	2	AZ	AA	12.5	x				
Langmaack	2	AZ	AA	21	x				
MW-15	2	CA	Upper AA	7.6	x				
MW-23	2	CA	Bedrock	8.8	x				
Needles MW-11	2	CA	AA	2.4		x			
PMM-Supply	2	CA	AA	0.5	x				
Topock-2	2	AZ	AA	7.4	x				

Notes:

¹ Recommended wells are subject to USGS input as to feasibility of analyzing sample from each well for chromium isotopes. Ability to measure chromium isotope signature is a function of the chromium concentration and the total dissolved solids content. Low chromium concentrations for CA Ag Sta and PMM-Supply are of particular concern.

² Decision for analyzing samples from Group 2 wells should be made after review of data from Group 1 wells and should be made on a well by well basis.

³ AA is Alluvial Aquifer.