Response to Written Comments due by September 30, 2015:

Commenter	Issue	Response
PG&E	General Comments: a. Timing of remediation of lower aquifer is limited by potential to pull chromium (VI) at the transitional area at edge of aquitard and will require upper and lower aquifers be remediated concurrently.	a. Concerns raised appear to be valid, and the Order is amended to accept the proposed edits to add requirements for remedial action implementation and analysis of background values and study of feasibility of treating to those values.
PG&E	b. Believes that depicting data either on two different maps or by using inserts is useful for showing public areas of agreement and disagreement in best professional judgment	b. Although the use of two maps is potentially a viable means to address differences in best professional judgment, the Advisory Team believes that it is potentially confusing to the public and important to have just have one map that is accurate than multiple maps that no one agrees upon.
PG&E	c. Agrees with use of term "uncertain" for the chromium in the north	c. Comment noted. Advisory Team has recommended changing the term to "disputed," because although it is not uncertain that chromium exists in the northern area, its source is disputed.
PG&E	Specific Comments: a. Requirements for remediation of lower aquifer should include requirement to remediate in accordance with current workplan and to conduct technical assessments to update the conceptual site model, define background, and evaluate cleanup timeframe.	a. The Advisory Team agrees with this recommendation, as it is consistent with the cleanup procedural requirements set forth in State Water Board Resolution 92-49, which calls for a step-wise process for cleanups, including establishing background levels and assessment of the time for the cleanup. The concerns raised regarding the existence of a transition zone and potential to cause additional contamination by pulling chromium into the lower aquifer require that a conceptual site model be updated. The Advisory Team has incorporated the recommended changes into the CAO.
PG&E	b. Technical Memorandum provides technical considerations for	Information and concepts presented in the Technical Memorandum are noted and support changing the requirements in section VI.C.1.c to allow PG&E, in addition to continuing implementation of its approved

	remediation and understanding background values.	workplan, to submit a technical report presenting an evaluation of an updated conceptual site model and background concentrations for the lower aquifer and transition zone, and submit a feasibility assessment for remediation and cleanup to background concentrations.
PG&E	c. Clarify results of the Remedial Timeframe Assessment by more accurately describing the geographic applicability of the results and level of certainty of the results.	Changes were incorporated to clarify that the estimates of cleanup time apply to the southern plume east of Serra Road. Theses timeframes were acknowledged as goals, and the rationale for the uncertainty surrounding the time estimates was added to finding 22.
PG&E	d. Requests changes to clarify that PG&E would be considered in compliance with the CAO if it complied with the requirements to operate, monitor, identify when capture is not achieved, submit a contingency plan by the deadline, and implement the plan on schedule.	The language was modified consistent with R6V-2008-0002A3, to state that the "Water Board may find PG&E out of compliance" with the Requirement, as opposed to saying that "PG&E is in violation…"
PG&E	e. Inconsistent edits were made in Ordering Requirements VI.C.1.a.i and XVIII and Attachment 1	Edits were made to require on-going remedial activities in accordance with accepted and future workplans and proposals. Specific and relevant requirements will be incorporated into the Notice of Applicability for the IRZ WDR, which is a much more appropriate location for those requirements.
PG&E	f. Recommends that the Executive Officer re-evaluate the line item requirements for the IRP Manager every 4 years.	Agreed. Change has been incorporated into the requirement.
PG&E	g. Requests that reporting dates for quarterly groundwater monitoring reports	Request granted.

	be moved to February 10, May 10, August 10 and November 10 to avoid conflicts with reporting dates in the NOA of General WDRs for In-Situ Remediation Zones.	
PG&E	h. Recommends edit to plume mapping requirements for lower aquifer, changing requirement to map to non-detect to interim maximum background levels.	Although the Advisory Team has recommended that the CAO not use non-detect as cleanup levels in the lower aquifer until additional work can be done to study what the appropriate background limits are in the lower aquifer, the Advisory Team believes that it is appropriate and necessary to continue to map the lower aquifer to non-detect concentrations so that changes can be assessed over time. Monitoring has indicated that at least some areas of the lower aquifer may be non-detect for chromium, and it is important to continue to identify and track chromium in the lower aquifer while the conceptual site modeling and feasibility assessment are conducted.
PG&E	i. Recommends additional edits allowing the presentation of saturated alluvium on maps where needed for data interpretation for consistency with previously made edits.	Additional edits were made consistent with this recommendation. The Advisory Team recognizes the importance of considering all relevant information when implementing best professional judgment to map the chromium concentrations.
Water Board Prosecution Team	General comments: a. Do not return to using best professional judgment for mapping requirements	a. The current mapping requirements to connect wells with chromium concentrations above the 3.1/3.2 background concentrations are not legally or scientifically supportable. Although the requirements evolved as a means to avoid disagreements with PG&E over the maps that were submitted, they unfortunately also create their own controversy by resulting in maps that fail to consider important hydrogeologic information and are overly simplified. This Order requires that Professional Geologists or Civil Engineers engaged in mapping the plume use best professional judgment (BPJ) that is based in

Water Board Prosecution Team	General comments: a. Do not return to using best professional judgment for mapping requirements	science. BPJ requires all available scientific information be considered. Using BPJ will result in maps that are more accurate than maps drawn by connecting wells with concentrations above the interim maximum background concentrations, which is necessary to characterize the chromium concentrations in the aquifers and assess the effectiveness of the chromium remediation. Although use of BPJ may result in some changes to the way the maps are drawn, several changes have been suggested to ensure some consistency. The Board's Advisory Team has suggested that the mapping requirements continue to include mapping of the chromium concentrations as isoconcentration contour lines. This will enable the community to continue to see how the concentrations of chromium have changed over time. In addition, maps will continue to require that the chromium concentrations at all monitoring wells are included on the map so that "hot spots" do not disappear. Previously, plume maps were required to be drawn by connecting wells with concentrations above the 3.1/3.2 interim background concentrations that were 2,600 feet apart, without regard to other relevant scientific information that may have dictated otherwise. In part, this was done because how the plume lines were drawn affected whether or not someone received replacement water or property buyout under PG&E's program. Under that program, PG&E voluntarily provided replacement water or property buyout to anyone within one mile of the plume boundary that had detectable levels of chromium in their wells. Since the California Division of Drinking Water established the drinking water standard for Cr(VI) and PG&E has terminated its replacement water and property buyout program, allowing the plume to be drawn using BPJ, as opposed to requiring lines be drawn to connect wells with chromium concentrations above background that are 2,600 feet apart of one another, will not have dramatic such effects on property interests. The Prosecution Team suggests that PG&E is already able to provide alternate interpretations of

Water Board Prosecution Team	General comments: a. Do not return to using best professional judgment for mapping requirements	chromium data, plume maps, and cleanup actions, in addition to the prescriptive mapping requirements. The prescriptive mapping requirements allow PG&E to submit technical rationale in support of or in dispute of those mapping requirements, and PG&E has submitted technical justification to support its conclusions that it should not have to draw the map to connect certain wells. That information, however, was never directly responded to by the Water Board. In order to avoid concerns of disputes each quarter over mapping requirements, this new CAO requires submittal of technical justification, evaluating specific factors. If the Water Board disagrees with one or more interpretations or conclusions in a technical justification, then the Water Board's Executive Officer or the Water Board, as appropriate, will provide final determination of the issue, after considering all relevant information. The Prosecution Team has suggested that the mapping requirements should remain until the USGS Background Study results are available. At that time, the hope is that the USGS Study will have identified what chromium is naturally occurring and what is the result of PG&E's discharge. Unlike back in November of 2013, where the Executive Officer refused to change the mapping requirements, noting that potential impact of the upcoming drinking water standard for hexavalent chromium on PG&E's requirement to supply replacement water, there are no impacts to the community or PG&E from changing the mapping requirements at this time. (See attached November 19, 2013, letter sent to PG&E and two Hinkley residents from the Water Board Executive Officer, describing reasons for not changing the prescriptive mapping requirements at that time, but informing the parties that mapping requirements are likely to change in future with anticipated adoption of a drinking water standard.) Whether the plume shape is slightly changed as a result of the mapping requirements will not impact who is eligible for replacement water nor will it affect remediation requirements or activities that are required until the Background Study is complete.

Water Board Prosecution Team	b. Northern plumes are linked to PG&E historical discharge	b. Finding 33 in the CAO has been modified by adding information describing how scientific information for the south plume directly and unequivocally links the high chromium concentrations to PG&E historical discharge. The scientific information supporting that the chromium in the northern area is conclusively linked to PG&E's historic discharge is significantly less robust and is not sufficient to require cleanup at this time. Although there is evidence to suggest that groundwater may have made it to the northern Harper Valley/Dry Lake area, PG&E has submitted scientific evidence to challenge those conclusions. California Water Code section 13304 requires a much higher level of certainty in linking contamination to a discharger for the Water Board to require cleanup and abatement of the discharge. However, the Water Board has sufficient evidence to suspect that a discharge may have occurred and can require investigation under California Water Code section 13267.
	Specific comments on CAO Findings and Orders:	
	1. Do not use the word, "interim"	1. While it is true any final adopted standard is always subject to future revision based upon new information, using the word "interim" is appropriate because it confirms the Water Board's commitment to the USGS Background Study and its intent to adopt revised background numbers based on the conclusions of that study, as all parties have indicated their willingness to accept the conclusions of the USGS Background Study.
	2. Do not use the word "uncertain" for the northern plumes	2. The word "uncertain" has been replaced by using "disputed" to describe the chromium plume in the north. PG&E has repeatedly disputed, and continues to dispute, the source of the chromium in the north and the USGS Background Study has a major focus to determine the level of naturally-occurring Cr(VI) in the north.
	3. Finding 7, separate explanation of chromium migration to lower aquifer from existing text and note non-detect levels.	3. As suggested, the lower aquifer facts have been separated into a new Finding 8. Information has been added about the concentrations of Cr(VI) in the lower aquifer and the need for additional study. There is not sufficient data to establish that the background levels of the lower aquifer are non-

		detect in all areas. In its September 30, 2015, comments on the Draft CAO, PG&E recommended that the Order be modified to require it to conduct additional studies in the lower aquifer to determine the background concentrations of Cr(VI).
Water Board Prosecution Team	4. Finding 8b, "2011" should be "2013"	4. Change made and Finding 8 has been become Finding 9.
	5. "plume" is an appropriate word for Finding 8b	5. Chromium in the north in excess of the interim maximum background concentrations is being referred to as the northern "disputed plumes" and the requirement is to map the isoconcentration contour lines for Cr(VI).
	6. Finding 8c about private supply well 16N-01	6. Change made to correctly state the reasons why Cr(VI) in well 16N-01 is not believed to be linked to PG&E's historical discharge.
	7. Delete "interim"	7. Use of the word "interim" is being retained for the reasons described in Response 1, above.
	8. Insert new Finding about background values for lower aquifer	8. A new Finding 8 was added to describe the data relied upon relating to the lower aquifer. Finding 16 is under the heading, "Regulatory History," so a discussion about background data was best under the section titled, "Chromium Contamination," which contains Findings 7-11.
	9. Divide Finding 19 into two Findings	9. Finding 19 has been renumbered to become Finding 20. Factual text describing specific requirements in CAO R6V-2008-0002A4 have been retained but text that was an interpretation of those CAO requirements has been removed. The finding has not been divided into separate findings because the additional text describes the context and reasons for those prescriptive mapping requirements.
	10. Insert new finding after Finding 33 to describe PG&E's radiation actions in lower aquifer	10. Finding 33 has been renumbered to become Finding 34. Three additional paragraphs have been added to Finding 34 to explain the need for requirements in the southern plume, northern disputed plume, and the lower aquifer.
	11. Insert new Finding to explain need for requirements in the lower aquifer	11. Finding 34 c) has been added.

Water Board Prosecution Team	12. Finding 37 c) should use the word “plume”	12. Finding 37 c) has been renumbered to 38 c). All text about northern disputed plume has been moved into the explanation for northern plume monitoring in Finding 34.
	13. Finding 37 c) needs explain the need to require monitoring in the north	13. Same as Response 12, above.
	14. Unclear on use of the word “uncertain”	14. “Uncertain” has been changed to “disputed.”
	15. Best Professional Judgment	15. Same as General Response a, above.
	16. Order IV.A.1	16. This requirement has been changed to specify for the southern plume that monitoring wells must be installed every 1,320 feet apart at a minimum. Because there may be circumstances where it would be physically impossible to install monitoring wells every 1,320 feet, this requirement now requires a technical justification explaining such constraints and plans for resolving the issue.
	17. Order IV.A.3	17. Change made and text added for clarification.
	18. Order IV.A.4	18. The chromium plume maps will be required to be drawn depicting the chromium isoconcentration contour lines. This means that the previously submitted “interpretation” map is unacceptable because it doesn’t depict chromium isoconcentration contour lines for the northern disputed plume. Drawing the isoconcentration contour lines for the southern plume and the northern disputed plumes is expected to produce maps that are substantially similar to maps that have been required previously. There will be differences, and those differences will be supported by scientific facts and the new maps can be evaluated and compared to the evaluation of remediation effectiveness.
	19. Order IV. A & B	19. This order changed to require technical justification for areas in southern plume that have monitoring wells spaced more than 1,320 feet apart and for specifically identified areas in the north that do not have sufficient resolution of the chromium isoconcentration contour lines. See also Response 16, above.
	20. Order IV.B	20. Change made to correctly state as section “IV.”
	21. Order IV.B	21. Same as General Response a, above.
	22. Order V.A.2	22. Change made.

Water Board Prosecution Team	23. Order VI.C.1.a.iii	23. Retained the word "USGS" to distinguish between the interim maximum background levels and background numbers the USGS may suggest.
	24. Order VI.c.1.b	24. Text added in Finding 7 and in this Order provision to clarify requirements for lower aquifer. This Order requires PG&E to implement its previously approved workplan Compliance with this requirement will be verified by ensuring PG&E is capturing and remediating its Cr(VI) from the lower aquifer. Orders have been added to require PG&E to submit a technical report, updated conceptual site model, and submit a feasibility study for the cleanup to background conditions.
	25. Order VII.2.a.	25. Text changed to clarify intent.
	26. Order VII.2.b&c	26. Change made.
	Specific Comments on Monitoring & Reporting Program, Attachment 8	
	1. 3rd paragraph, p1	1. Changes made.
	2. "Uncertain"	2. "Uncertain" changed to "disputed"
	3. "interim"	3. "interim" retained for reasons explained in Response 1, above.
	4. I.E., p7	4. Changes not made because those changes would be inconsistent with the Findings and Order provisions in the CAO.
	5. III.A, p9	5. "May" has been removed and text added to clarify requirements.
	6. III.B.1.a., p9	6. Brown lines depicting approximate limits of saturated alluvium are drawn using scientific knowledge and best professional judgment. The requirement to include these lines and requirement to leave these lines off maps have been deleted to allow flexibility and the option to include those lines as part of a technical justification.
	7. III.B.1.a.i., p9	7. Change has been made and more text has been added to clarify requirement.
	8. III.B.2.g, p11	8. Changes not made for the reason explained in General Response a. and Response 18, above.
	9. III.B.2.h., p11	9. This requirement no longer conflicts with Finding 19 (which has been renumbered to Finding 20). Text has been modified and added to Finding 20 to provide clarification.
Water Board Prosecution Team	10. III.B.3.d.i., p12	10. The order was changed to require re-analysis is both elements show a 25 percent or greater difference and both are less than 10 ppb but above 3.1 ppb for Cr(VI) and above 3.2 ppb for Cr(T).

IRP Manager - Project Navigator	1. Plume contouring requirements should be based on best professional judgment but the mapping should continue as it has in the past until completion of the USGS Background Study.	1. Best professional judgment is required for the chromium map contouring and this involves using scientific principles and all scientific data available. The mapping requirements contain flexibility in that information from the USGS Background Study is required to be considered in mapping the chromium concentrations.
IRP Manager - Project Navigator	2. Replacement water should include all indoor uses, including bathing.	2. Added Finding 44 in the CAO which states the basis for limiting the long-term replacement water to drinking and cooking purposes only. Because there is no health risk from showering with the water or using the water in swamp coolers, the Water Board has no authority to requirement replacement water for these purposes.
	3. Remediation goals and adaptive management should be used for cleanup times	3. Order VI. C. 1. c) iv in the CAO takes an adaptive management approach by requiring PG&E to evaluate cleanup action at least once every four years. Workplans are required if actions are not achieving expected cleanup goals.
	4. Monitor the western and northern areas and incorporate relevant interim results from USGS Background Study into CAO	4. The CAO requires monitoring to continue for the western and northern areas and results from the USGS Background Study are required factors for evaluating remediation effectiveness.
Mr. Sam Knott	PG&E should be required to provide whole house water to affected well owners who exceed drinking water standards for Cr(VI)	Finding 44 in the CAO which states the basis for limiting the long-term replacement water to drinking and cooking purposes only. It cites to an August 17, 2011, letter from the Office of Environmental Health Hazard Assessment's (OEHHA) Acting Director, responding to a letter sent by the Lahontan Water Board's Executive Officer, requesting guidance on the use of the new public health goal for hexavalent chromium (Cr VI). One of the issues raised by the Executive Officer was "whether evaporative coolers (a.k.a., swamp coolers) pose an inhalation risk by increasing the concentration of airborne Cr VI." In response, OEHAA responded that "swamp coolers do not increase the concentration of airborne Cr VI. Thus, with regards to Cr VI, swamp coolers do not constitute an inhalation risk." (August 17, 2011 Letter to Harold Singer, Executive Officer, from Acting Director of OEHHA, p. 6) Similarly, the OEHAA noted that "Since so little Cr VI is inhaled during showering, a PHG based only on ingestions is identical to that based on

Mr. Sam Knott		ingestion plus inhalation during showering." (Id. at p. 5.) As far as dermal exposure during bathing, the July 2011 report by OEHHA setting the public health goal considered the absorption from dermal exposure to be so small (< 0.1 percent of the absorbed oral dose) that it concluded that "dermal exposure therefore does not appear to contribute significantly to the overall exposure," and was not further considered in the report. (OEHHA, "Public Health Goals For Chemicals In Drinking Water, Hexavalent Chromium (Cr VI)," July 2011, p. 8.) Therefore, because there is no health risk from showering with the water or using the water in swamp coolers, the Water Board has no authority to requirement replacement water for these purposes.
Mr. Eldert Van Dam	1. PG&E must investigate Cr(VI) to the east by my property. 2. Nitrate in PG&E's Cr(VI) plume will flow to the east and there are many other nitrate sources threatening my property.	1. Lenwood Road roughly parallels the southern plume in the north-south direction and is about 1.5 miles east of the easternmost part of the southern plume. Your dairy property is about 2 miles further east than Lenwood Road. The groundwater flow direction from the site of PG&E's historical discharge is to the north as opposed to the groundwater beneath your site which flows predominantly to the east. This means that there is a hydrogeologic split, or divide, separating and preventing the PG&E Cr(VI) plume from travelling east toward your property. The Water Board does not have any scientific evidence to suspect that PG&E's chromium plume may have flowed in a cross gradient direction more than 3.5 miles further than the lowest concentration in its southern plume. Therefore, the Water Board cannot require PG&E to investigate the area in the vicinity of your property. 2. As explained above in response 1, the hydrogeologic conditions prevent the PG&E plume from migrating cross-gradient, so there is no threat of those nitrates reaching your property. Other potential nitrate sources that may affect your property are not the subject of the PG&E CAO.
Mr. Daron Banks	1. Concerns about the Water Board's Advisory team meeting with PG&E and making major changes to the Draft CAO	The Water Board's Advisory Team has not met privately with any interested party, including the Prosecution team or PG&E. To do so could result in ex parte communications. The parties, however, are able to meet with one another. The Prosecution Team and PG&E met and developed "consensus language" to address a number of issues. This language was

		provided to the Advisory Team on July 8, 2015 for consideration, and was incorporated into the September 1, 2015, and identified as black, italicized crossed out or underlined text.
Mr. Daron Banks	2. The Board should listen to the Enforcement/ Prosecution Team	The Board members consider the input of all the parties, including the Prosecution Team, who put out the original draft of the CAO; PG&E, the IRP, and the individual community members. The Advisory Team synthesizes that information for the Board, and provides neutral legal and technical advice to the Board members.
Mr. Daron Banks	1. Plume drawing should be based on the Enforcement/Prosecution team's recommendation on connecting monitoring wells above background levels and within 2600 feet, and do not agree with allowing PG&E's consultant to draw the plume based on "Best Professional Judgment"	The Board's decisions have to be based upon substantial evidence in the record, and cannot be arbitrary and capricious. This means that there must be a valid scientific, technical or legal rational for the decision. In this circumstance, there is no sound scientific, technical or legal basis for requiring PG&E to draw the well by connecting wells with chromium concentrations above 3.1 solely because they are within 2600 feet of one another. Allowing PG&E's consultants to consider all relevant data, including the geology, hydrogeology, and geochemistry data, in drawing the plume would provide a more accurate and defensible assessment than requiring points to be arbitrarily connected. However, because it is important to the community to have a map that is consistent with how it has become accustomed to seeing the map, the Advisory Team is recommending that PG&E continue to draw lines identifying chromium concentrations contour lines, including the 3.1/3.2ppb, 10ppb and 50 ppb isoconcentration contour lines.
Mr. Daron Banks	a. Allowing PG&E to put their opinion on a contouring map is confusing and a big concern for the community.	PG&E's mapping must be based on best professional judgment and supported by technical justifications. It cannot be based solely upon opinion. Because reasonable minds might disagree as to how the data should be interpreted on the map, the Order contains a dispute resolution process in section XIX, requiring that the EO, or the board, as appropriate, will make all final determinations as to whether best professional judgment was used and is supported by technical justifications.
Mr. Daron Banks	b. Replacement Water should be for "all indoor uses."	Please see response to Sam Knott, above.
Mr. Daron Banks	a. Board should continue to enforce a	A half-mile buffer around the plume does not provide any additional benefit to the community, and several

	"minimum of a half mile buffer" around the plume to "protect public health and awareness"	community members at the May Workshop suggested that having the half-mile buffer perpetuated a stigma that all of the area within a half-mile of the 3.1/3.2 contour line is "affected," when that is not generally the case.
Mr. Daron Banks	a. Requests that Board continues to support the CAC. Issues raised by "other groups discussed in the draft" have different concerns that are not the responsibility of the Water Board, and instead are community issues.	The Board continues to support the CAC and all groups interested in the cleanup of the groundwater beneath the Hinkley community by requiring in its order the continued funding of an independent consultant to provide technical information, education and advice to community members on matters subject to regulation by the Water Board. It is not clear what "other groups discussed in the draft" are referring to.
Mr. Daron Banks	Division between the Prosecution and Advisory teams is clear and has led to unfair practices.	The division of the Board staff into advisory and prosecution teams provides more fairness and transparency in the decision-making process. The Board staff that are in the advisory and prosecution roles do not discuss the project privately with each other or the Board Members. Although this has resulted in differences of professional opinion being much more openly exposed than may otherwise occur in other types of proceedings, it has resulted in a robust, open debate of the issues.
Ms. Betty Hernandez	Do not make changes to previous mapping requirements and other requirements until USGS Background Study is done. Draft CAO must be flexible and based on scientific data.	See Response to General Comment a, above. The mapping requirements must change so the plume boundaries and other characteristics are drawn using scientific principles and using all scientific data available. Mapping in this manner means the plume shape and characteristics can be compared to maps drawn showing remediation effectiveness. Plume maps drawn without scientific basis, such as connecting wells 2,600 feet apart that contain concentrations at or above 3.1 ppb Cr(VI), cannot be compared to a mapping of remediation effectiveness since a map made by connecting dots is done so using completely different metrics than a map using scientific information and principles. The mapping requirements contain flexibility in that information from the USGS Background Study is required to be considered in mapping the chromium concentrations.

Ms. Barbara Ray and Mr. Roger Killian on behalf of CAC	1. Do not make changes to previous mapping requirements until USGS Background Study is done. 2. Replacement water must include all indoor uses such as bathing and use in swamp coolers.	1. See Response to General Comment a, above. The mapping requirements must change so the plume boundaries and other characteristics are drawn using scientific principles and using all scientific data available. Mapping in this manner means the plume shape and characteristics can be compared to a mapping of remediation effectiveness. Maps drawn without scientific basis, such as connecting wells 2,600 feet apart that contain concentrations at or above 3.1 ppb Cr(VI), cannot be compared to maps made showing an evaluation of remediation effectiveness since a map made by connecting dots is done so using completely different metrics than a map using scientific information and principles. The mapping requirements contain flexibility in that information from the USGS Background Study is required to be considered in mapping the chromium concentrations. 2. See Response to Sam Knott, above. Added Finding 44 in the CAO states the basis for limiting the long-term replacement water to drinking and cooking purposes only. That Finding states that there is a fractional or very low risk of Cr(VI) inhalation during showering and swamp coolers do not increase the Cr(VI) vapors.
Ms. Penny Harper	The present Cr(VI) plume boundaries in the north remain until the USGS Background Study is complete.	The new mapping requirements will produce chromium isoconcentration contour lines depicting disputed plumes in the north very similar in shape to the present Cr(VI) plume boundary maps that are drawn each quarter as compliance maps. The new mapping requirements contain flexibility in that information from the USGS Background Study is required to be considered in mapping the chromium concentrations.

CALIFORNIA Water Boards

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November 19, 2013

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Re: Decision on Requests by PG&E and the Members of the Hinkley Community to Change Whole House Replacement Water Program and Plume Delineation Requirements

After careful consideration of the requests submitted by the Pacific Gas and Electric Company (PG&E) and members of the public to change the requirements of the Whole House Replacement Water Program ("WHRW Program"), and after review of the comments received in response to those requests, I have decided not to make changes to the existing requirements at this time.

There are several actions by other entities within the next year that have the potential to affect the WHRW Program, including the issuance of the maximum contaminant level (MCL) for hexavalent chromium by the California Department of Public Health (DPH), also referred to as the "drinking water standard", and a review by the State Water Resources Control Board (State Board) of PG&E's petition of Cleanup and Abatement Order (CAO) 2008-0002-A4. This CAO required PG&E to conform to specific mapping protocols to delineate the boundary of its plume of hexavalent chromium in Hinkley. This means that actions outside of our control have the potential to change the existing requirements within the next nine to twelve months. With impending potential changes to the existing requirements, I have determined that modifications to the WHRW Program and the plume delineations requirements at this time would introduce additional confusion and uncertainty. If I were to make changes today, by the time that modifications to the existing requirements are implemented, those changes would undoubtedly be revised again based upon the State Board and the DPH actions.

For example, on November 4, 2013, the State Board notified the Lahontan Regional Water Quality Control Board (Water Board) that it will be taking up the petition filed by PG&E on the CAO. The petition challenges the way that PG&E is required to draw the plume and the requirement to continue to install monitoring wells to delineate the plume boundary. The State Board could modify the Water Board's Order or require the Water Board to reconsider the requirements for how the plume is delineated based upon criteria it sets forth, which could affect how the plume is drawn and, therefore, who would be eligible for the WHRW Program.

Similarly, a final decision by the DPH that sets the drinking water standard for hexavalent chromium at a level above what is in people's wells in Hinkley would limit the requirements of the WHRW Order. The current WHRW Order recognizes the legal limits on the Water Board to require replacement water, and states that PG&E is only required to provide WHRW to those wells containing hexavalent chromium at levels above the MCL levels established by DPH. Therefore, once the DPH sets the final drinking water standard, the Water Board could not require replacement water for those wells whose levels of hexavalent chromium does not exceed drinking water standard.

In leaving the current requirements in place, I recognize that there will continue to be a lot of concern in how the plume is drawn and how the WHRW Program is implemented. Because PG&E has offered WHRW systems and property buyout opportunities to some Hinkley residents, the location of the plume has had financial and social repercussions for PG&E and the community. Changing the requirements today, only to have those requirements changed shortly thereafter, will introduce a level of confusion and uncertainty that I am not comfortable with.

In my October 31, 2013 letter to Ms. Sheryl Bilbrey with PG&E, I provided a temporary recusal to notify residents that would be potentially eligible for the WHRW Program due to expansion of the 3rd quarter buffer. Since my decision is now final, I expect full compliance with the requirements of any existing order. This would mean that PG&E would have to provide interim bottled water and information regarding the WHRW Program to any newly eligible property owner within the five (5) days set forth in the existing Order.

I believe there is an opportunity for PG&E and the community of Hinkley to work together to come up with solutions that satisfy most of the needs of all of the parties, and provide that certainty for themselves, especially in light of the fact that decisions by the State Board and DPH could impose requirements that are less satisfactory to all. The Water Board has facilitated those discussions in the past and I would like to offer our assistance again. We should not wait until the DPH drinking water standard is adopted to begin our discussions about how the new standard will affect the community, PG&E and Water Board requirements.

The Water Board has recently received three complex and technically related evaluation and interpretive reports that should be discussed in an open forum [i]. The new information in these three reports answers some old questions, but raises many new ones. Everyone working together is a more effective use of expertise and resources. Cooperation between PG&E and the community can produce viable solutions that are more satisfying to everyone and more directly address concerns than decisions that are made for the parties by the Water Board. In the future, I request PG&E and the community make a good faith effort to work together and find consensus before coming to the Water Board with requests for changes. As always, we are here to provide guidance and technical assistance.

If you have any questions please contact me at pzkouyoumdjian@waterboards.ca.gov (530) 542-5412 or Doug Smith at dfsmith@waterboards.ca.gov (530) 542-5453.

Patty Z. Kouyoumdjian

PATTY Z. KOUYOUMDJIAN
EXECUTIVE OFFICER

cc: PG&E Hinkley Lyris List (and web posting)

[i] Third Quarter 2013 Groundwater Monitoring Report and Domestic Well Sampling Results, Site-wide Groundwater Monitoring Program, October 30, 2013, by CH2M Hill; Compliance with Provision 1.C. of Cleanup and Abatement Order R6V-2008-0002-A4 and Requirements of Investigation Order R6V-2013-0029, October 29, 2013, by Stantec; and Project Proposal for Occurrence of natural and anthropogenic Cr VI near a mapped plume, Hinkley, CA, September 2013, by Dr. John Izbicki with the US Geological Survey.

Pacific Gas and Electric Company

Kevin M. Sullivan
Director, Chromium Remediation

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September 30, 2015

Via Electronic Mail

California Regional Water Quality Control Board Lahontan Region
2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150
Attn: Sue Genera
Executive Assistant and Water Board Clerk
RB6enfproceed@waterboards.ca.gov

Re: Draft Cleanup and Abatement Order No. R6V-2015-DRAFT; WDID No. 6B369107001 Requiring Pacific Gas and Electric Company to Clean Up and Abate Waste Discharges of Total and Hexavalent Chromium to the Groundwaters of the Mojave Hydrologic Unit

PG&E appreciates the opportunity to submit these comments on the Draft CAO and supports a thorough and collaborative process to draft a cleanup and abatement order that facilitates our commitment to remediate groundwater in Hinkley. The release of the Draft CAO is an important step in continuing the significant progress made to date in cleaning up the chromium plume.

The Draft CAO contains several key improvements from the Proposed CAO, including recognition of the importance and value of the USGS background study, changes to the clean-up timeframes, provisions for transparent and accountable remedial system operation, clarified replacement water requirements, and provisions for a performance based and adaptable monitoring program. These changes will provide a better basis for efficient, expeditious, and scientifically and technically supported remediation under the CAO.

As our attached comments address, we have additional recommendations in areas where the advisory team made edits in the Draft CAO and which were discussed at the Public Workshop on September 16, 2015, and comments to clarify our previous comments. This cover letter highlights our recommendations and more detailed analyses along with suggested edits are in the attached comments, where needed.

1) Lower Aquifer Remediation

Some commenters at the Public Workshop asserted that based on the size and mass of the lower aquifer plume, remediation should be completed within a few years. This assertion that the remediation timeframe should be short does not reflect the challenges of remediation in this area. The hexavalent chromium plume that is currently referred to as the lower aquifer

plume resides within a complex geological environment at the edge of the blue clay where the upper aquifer and lower aquifer are in hydraulic communication. PG&E will address this portion of the plume as quickly as possible, but in this complex hydrogeologic setting, aggressive remedial activity could inadvertently increase Cr(VI) concentrations in the lower aquifer by drawing higher Cr(VI) concentrations from the upper aquifer into the lower aquifer. Successful remediation of this transitional area at the edge of the blue clay will likely require that the upper aquifer and lower aquifer chromium levels be reduced concurrently, which therefore may lead to similar timeframes for complete remediation. To reflect these considerations, and to address the concerns voiced at the Public Workshop that the Draft CAO does not provide tangible requirements for remedial operations to address the lower aquifer, we are providing recommended language edits (in the attached comments) to add requirements for remedial action implementation and additional analysis of background values and the feasibility of treating to those values.

2) Plume Mapping

PG&E appreciates the changes that were made to allow for a combination of prescriptive and performance based requirements for plume mapping, allowing the use of best professional judgment. PG&E considers the change to be appropriate, with the understanding that the change was made to be consistent with other orders in the region. PG&E agrees with the use of best professional judgment, because it allows the use of all relevant data (e.g. groundwater flow direction) and site specific considerations and avoids interpretations that are arbitrary and artificial.

In the past, we have submitted maps based on best professional judgment. Water Board staff agreed with some interpretations presented on these maps and disagreed with others, (such as PG&E's judgment that there is considerable uncertainty concerning whether the chromium in the north is from the compressor station release). Once Water Board staff determinations have been made, PG&E has drawn the plume maps according to Water Board staff direction without extensive quarterly re-evaluation and will continue to do so, i.e. the northern plume will continue to be drawn. PG&E believes that this process works for resolving differences in best professional judgment. PG&E believes that depicting the data either on two different maps, or by using inserts, is useful for showing the public areas of agreement and disagreement in best professional judgment.

3) Representation of Uncertainty of Chromium Source and Background Values

PG&E agrees with the changes in terminology that were made in the draft CAO, recognizing that the plumes in the north are "uncertain" and that the background values listed in the order are "interim". The term "uncertain" is appropriate for the chromium in groundwater in the north, given that it is not certain what the background concentration is, what the source of chromium in the north is, nor whether chromium from the compressor station flowed to the north, as detailed in previous technical documents (Stantec 2015). The term "interim"

appropriately reflects the current, discredited background values and the purpose of the ongoing USGS study to evaluate background.

PG&E is committed to addressing the groundwater impacts caused by our historical operations in Hinkley in a manner that is open and transparent, and that is protective of public health and the environment. We appreciate the dialogue with the Water Board and interested parties during the collaborative revision process that lead to the Draft CAO and look forward to the adoption of the order.

Sincerely,

Kevin Sullivan
Director, Chromium Remediation Program, PG&E

Attachments

A PG&E Comments on Draft Cleanup and Abatement Order
B Key Elements of Revised Conceptual Site Model for the Western Portion of the Lower Aquifer, Hinkley, California

References

Stantec. 2015. Comments on Proposed Cleanup and Abatement Order with Regards to Background Chromium Levels. Pacific Gas and Electric Company. Hinkley Chromium Remediation Project. March 13.

Attachment A PG&E Comments on Draft Cleanup and Abatement Order

The following comments on the Draft Cleanup and Abatement Order (CAO) are organized into two sections: one regarding the lower aquifer remediation requirements and other providing comments on various findings or requirements in Draft CAO.

1. Lower Aquifer Requirements

The hexavalent chromium [Cr(VI)] plume that is currently referred to as the lower aquifer plume resides within a complex geological environment at the edge of the blue clay where the upper aquifer and lower aquifer are in hydraulic communication. Pacific Gas and Electric Company (PG&E) will address this portion of the plume as quickly as possible, but in this complex hydrogeologic setting, aggressive remedial activity that does not consider the interaction of the lower aquifer with the upper aquifer could inadvertently increase Cr(VI) concentrations in the lower aquifer by drawing higher concentrations of Cr(VI) present in the upper aquifer downwards into the lower aquifer.

Recommendations for CAO Revisions

Based on several technical considerations that are described in detail below and in the attached Technical Memorandum (TM), PG&E recommends remedial goals for the lower aquifer be developed to acknowledge a revision to the conceptual site model (CSM) for the western limits of the lower aquifer where the blue clay aquitard transitions from being a confining layer to a thin, sandy and intermittently present clay layer (transition zone). The revised CSM should be used to determine which monitoring wells truly represent the lower aquifer versus the transition zone for use in assessing performance of the lower aquifer remedy. Finally, a technical assessment should be conducted to determine background chromium concentrations for the lower aquifer and the transition zone separately and to evaluate the timeframe of remediation to potentially very low background concentrations. PG&E suggests that if additional requirements for tangible lower aquifer remediation are desired, the requirement to remediate in accordance with the current workplans be re-inserted and a requirement to conduct technical assessments to update the CSM, define background, and evaluate the timeframe for remediation and to submit the findings be added.

To implement these recommendations, the text should be edited as follows (red text indicates edits already in the Draft CAO, comments in black are additional proposed edits):

"b) Lower Aquifer

PG&E shall clean up and abate chromium concentrations ~~greater than non-detect levels~~ in the lower aquifer that are linked to PG&E's historical discharge or remedial actions. ~~During 2014, greater than non-detect concentrations exist at: MW-23C, MW-28C, MW-31C, MW-42C, MW-92C, and MW-100C.~~

i. Continue implementing on-going groundwater extraction east of Mountain View Road to remediate chromium in lower aquifer groundwater, as proposed in PG&E's November 7, 2014 "Plan for Enhancement of Lower Aquifer Remedy" ~~and in accordance with the Water Board's conditional acceptance dated December 22, 2014..~~

ii. Submit a technical report within 180 days of this order presenting an evaluation of the updated conceptual site model and background concentrations for the lower aquifer and transition zone at the western edge of the lower aquifer.

iii. Submit a feasibility assessment for remediation and cleanup to background concentrations in the lower aquifer and the transition zone at the western edge of the lower aquifer within 90 days of Water Board approval of the conceptual site model and background report required under item ii."

Note the requirement to conduct lower aquifer remediation in accordance with the Water Board's conditional acceptance letter dated December 22, 2014 is recommended for removal from the original Proposed CAO workplan implementation requirement b.i above in an effort to streamline the number of active orders at the site. The conditional acceptance letter 1) approved the November 7, 2014 workplan and 2) required an assessment of the effectiveness of the remedy in March 2016. These requirements can be replaced with the CAO which 1) provides approval of the workplan in b.i. as written above and 2) requires annual performance reviews in Attachment 8.

Conceptual Site Model for the Lower Aquifer and Transition Zone

The attached TM provides a brief summary of technical considerations for remediation and understanding background values in what is currently referred to as the lower aquifer, which will be more fully developed with an updated CSM document. The key concepts presented in the TM are summarized here to provide context for the recommended changes to the CAO requirements. It should be acknowledged that near the margins of the blue clay that acts as an aquitard that separates the upper aquifer from the lower aquifer there is a transitional area where there is significant hydraulic communication between the two aquifers. This is particularly evident in the area of monitoring wells MW-28C, MW-92C, and MW-100C where chromium above the interim background levels has been reported. This is conceptually illustrated in cross-section on Figure 1 and in plan view on Figure 2 in the attached TM. As displayed with green well dots on Figure 2, the blue clay was either absent, logged as a sandy clay, or less than 3-feet thick at four monitoring wells (MW-28C, MW-92C, MW-98C, and MW-100C) located on the western portion of the lower aquifer. Included on Figure 2 in the attached TM is a blue shaded transitional area where the upper and lower aquifers are interpreted to be in hydraulic communication based on hydraulic testing data. The presence of the blue clay was interpreted during drilling at some wells and test borings in this area during previous investigation, but the blue clay in this area was logged to have an increasing sand content, and subsequent hydraulic testing (see below) has demonstrated that in this transitional zone the intermittent blue clay does not act as a competent aquitard in this general area.

Figure 3 in the attached memo shows hydrographs for upper aquifer/lower aquifer well pairs MW-23B/MW-23C and PZ-08/MW-92C, respectively. The blue clay acts as an aquitard at MW-23C, as demonstrated by the consistently 1-foot higher groundwater elevation at MW-23C than the upper aquifer well MW-23B, demonstrating an upward hydraulic gradient (top panel of Figure 3). On the other

hand, the hydrograph for the PZ-08/MW-92C well pair shows comparable groundwater levels at both the upper and lower aquifer wells without a significant vertical gradient like the MW-23B/23C hydrograph (bottom panel Figure 3). The hydrograph for PZ-08/MW-92C is corroborated by the observation of thin and sandy blue clay in this area and suggests that the blue clay does not act as an aquitard in this area. Figure 4 shows hydrographs for upper aquifer/lower aquifer well pairs MW-42B2/MW-42C and PZ-09/MW-100C, respectively. Like the MW-23B/MW-23C hydrograph, lower aquifer well MW-42C shows a consistently higher groundwater level (more than 1.5 feet) than upper aquifer well MW-42B2, indicating that the blue clay acts as an aquitard in this area. While an upward gradient is shown in the hydrograph for PZ-09/MW-100C (blue line above orange line), both wells respond equally to changes in upper aquifer groundwater extraction at upper aquifer extraction well EX-26, indicating that the blue clay does not act as an aquitard in this area.

Geochemical Conditions in the Transition Zone and Lower Aquifer and Implications for Background Chromium

In Finding 7 of the Draft CAO and in comments at the Public Workshop on September 16, 2015, it was observed that several monitoring wells within the lower aquifer yield non-detect concentrations. To understand whether these non-detect values represent background conditions throughout the lower aquifer and the transition zone where the upper and lower aquifer are in hydraulic communication, it is important to also consider the geochemical conditions within these portions of the aquifer. Most of the lower aquifer monitoring wells with non-detect chromium concentrations contain low dissolved oxygen and relatively low oxidation-reduction potential (ORP) which indicate conditions that could promote natural reduction of chromium and relatively lower background Cr(VI) concentrations. Near the western limits of the lower aquifer in the transition zone where monitoring wells such as MW-100C and MW-92C are present, there is generally elevated dissolved oxygen and relatively elevated ORP, which indicate conditions that could be associated with relatively more oxidation of chromium and relatively higher background Cr(VI) concentrations. Elevated dissolved oxygen and ORP conditions are also prevalent throughout the upper aquifer, and chromium is present above non-detect levels at the majority of these wells. These observations indicate that background chromium levels may vary across the aquifer that historically been designated as “lower aquifer” and that careful analysis is needed to determine the background concentrations throughout this portion of the aquifer.

Implications for Remediation

The current remedy for Cr(VI) in both the upper and lower aquifer north of Highway 58 is groundwater extraction and treatment via agricultural application. However, treating the Cr(VI) concentrations at monitoring wells MW-92C and MW-100C within the transition zone and lower aquifer monitoring wells MW-23C and MW-42C with additional lower aquifer extraction to expedite remediation in this area could result in drawing groundwater with higher concentrations Cr(VI) from the upper aquifer downwards into the lower aquifer. If this occurred, this could adversely affect the currently stable to decreasing Cr(VI) trends at these and other lower aquifer wells that have been achieved with current

lower aquifer remedial actions. Consequently, additional extraction may not expedite Cr(VI) treatment in what is currently referred to as the lower aquifer until the upper aquifer is remediated.

The hydraulic communication between the upper and lower aquifer in the transition zone at the edge of the blue clay discussed above dictates that cleanup of both the upper and lower aquifers in these areas must proceed in concert and on the same timeline. The solute transport modeling conducted as part of the Remedial Timeframe Assessment (ARCADIS 2014) was utilized to evaluate time for Cr(VI) concentrations within the upper aquifer in the vicinity of the lower aquifer transition zone to decrease to less than 3.1 parts per billion (ppb). In one of the modeling runs conducted in that study, the upper portion of the upper aquifer (model layer 1) is predicted to decrease below 3.1 ppb Cr(VI) after a period of 7 years, while the lower portion of the upper aquifer (model layer 3) is predicted decrease below 3.1 ppb Cr(VI) after a period of 20 years. Cr(VI) concentrations below 3.1 ppb were not discretely simulated with the solute transport model. Extended timeframe analyses to reach non-detect or an alternate lower Cr(VI) concentration target were therefore not assessed, but timeframes would be significantly longer than 20 years. As such, setting a cleanup goal for the lower aquifer that is sooner than the upper aquifer in this area or that is only a few years long is technically infeasible.

Further, remediating groundwater in select monitoring wells located within the transition zone such as MW-92C and MW-100C and lower aquifer monitoring wells MW-23C and MW-42C (with an effective blue clay aquitard present) to non-detect values may not be feasible with an extraction approach. Monitoring wells MW-92C and MW-100C in the transition zone are in hydraulic communication with the upper aquifer and likely to have background Cr(VI) values consistent with the upper aquifer. Because relatively elevated dissolved oxygen and ORP are observed at lower aquifer wells MW-23C and MW-42C, it may also be impossible to reduce Cr(VI) concentrations to non-detect levels with extraction at these wells where background Cr(VI) may be relatively higher than in lower aquifer locations with more strongly reducing conditions. PG&E recommends continuing to use the 3.1/3.2 ppb interim background numbers to contour Cr(VI)/Cr(T) in the lower aquifer until a new background number for the lower aquifer is determined and approved by the Water Board.

2. Additional comments

Finding 21, Page 6. PG&E previously suggested edits to this finding that were not implemented in the Draft CAO. The following edits were proposed to clarify the results of the Remedial Timeframe Assessment, to properly describe the geographic applicability of the results and the level of certainty of the results:

> *"The updated estimates range from six to 23 years to remediate 99 percent of the 50 ppb <u>southern plume east of Serra Road</u>; and 11 to 50 years to remediate 99 percent of the 10 ppb <u>southern</u> plume <u>east of Serra Road</u>. The ranges reflect remediation times for different modeled hydrologic layers of the upper aquifer (finer-grained versus coarser-grained model layers) and different assumptions of in-situ remediation modeling. These estimates inform the basis for the cleanup ~~requirement~~*

~~deadlines~~ goals in this Order. The timeframe estimates are uncertain given underlying simplifying assumptions in the modeling, uncertainty in conditions throughout the modeled aquifer, operational and construction uncertainties, and assumptions made on the timing and continuation of permitting for the project. "

Ordering Requirement V.C., Page 18. PG&E previously suggested edits to this ordering requirement that were not implemented in the Draft CAO. The comment is repeated here to re-iterate the recommendations. PG&E acknowledges the importance of timely identification of lapses in hydraulic containment and requirements to quickly submit and implement contingency plans for correction in Ordering Requirements V.D, V.E, and V.F. The timeline for submittal of a contingency plan in V.E. and the requirement to re-establish capture as soon as possible will ensure PG&E is taking all possible measures to regain capture. PG&E requests a clarification that compliance with the CAO is ensured if PG&E complies with the requirements to: operate, monitor, identify when capture is not achieved, submit contingency plans with schedules by the required deadlines, and implement the contingency plan on schedule. This will allow for the time that may be required to regain capture as corrective actions are implemented. For example, in the case where specific hydraulic metrics indicated outward gradients from February to August 2013, corrective actions were implemented and resulted in immediate improvements in metric measurements; however, it took several months for the metrics to return to inward gradients. This example can be used to define the time that may be needed to implement corrective actions, during which PG&E should not be exposed to possible violation of the CAO requirements as onsite experience has demonstrated no threat to water quality during the time period required for the metrics to show inward gradients. To implement this change to the proposed CAO, the following edits to language are suggested in requirement V.D, consistent with the current requirements in CAO No. R6V-2008-0002A3:

"~~PG&E is in violation of~~ The Water Board may find PG&E out of compliance with this Requirement if at any time any of the following conditions occurs:"

Ordering Requirements VI.C.1.a.i and XVIII on pages 20 and 30 and Attachment 1. Two opposite edits were made in the Draft CAO. In Requirement XVIII and Attachment 1, Water Board Investigative Order R6V-2013-0087 and the Water Board directive letter, dated February 25, 2014, regarding implementation of the western action plans dated September 24, 2013 and January 10, 2014 were replaced by the Draft CAO. Text added in Requirement VI.C.1.a.i on western area remediation required implementation of the western action plans in accordance with R6V-2013-0087 and the Water Board letter dated February 25, 2014. To resolve the inconsistency in these edits and to streamline the number of active orders at the site, PG&E recommends inserting the relevant requirements from R6V-2013-0087 and the Water Board letter dated February 25, 2014 into the Draft CAO.

Ordering Requirement VIII, Page 27. PG&E is committed to informing and educating the community about our programs and will continue to support the Independent Review Panel ("IRP") Manager. PG&E underscores that this aspect of the Proposed CAO is a critical component to the success of the cleanup of the chromium impacted groundwater. However, the level of effort of the IRP that is needed may

evolve over time. PG&E recommends that the Executive Officer re-evaluate the line item requirements for the IRP every four years.

This change could be implemented with the following text revisions to requirement VIII.C:

> *"The annual workplan is subject to Water Board Executive Officer approval. Every four years, the Executive Officer will review and may revise the annual requirements listed above under item B."*

Attachment 8, Section II, Page Since the issuance of the Proposed CAO, a draft Issuance of New Notice of Applicability (NOA) of General Waste Discharge Requirements for In-Situ Remediation Zones and the Northwest Freshwater Injection system was issued on July 13, 2014. The draft NOA set reporting dates for the NOA quarterly report on January 30, April 30, July 30, and October 30, the same days the quarterly groundwater monitoring reports would be required under the Draft CAO. PG&E requests that the reporting dates be staggered by moving the groundwater monitoring report deadlines to February 10, May 10, August 10, and November 10.

Attachment 8, Section III.B, Page 9. In the draft CAO, edits were made to remove the premature finding that the background concentration for the plume in what is currently referred to as the lower aquifer is non-detect. PG&E recommends the following edit to the plume mapping requirements in Attachment 8 for consistency,

> "*Using data from the monitoring wells, quarterly reports shall define the full lateral and vertical extent of chromium in groundwater, based on the monitoring information gathered pursuant to the MRP, for hexavalent and total chromium to at least the interim maximum background levels of 3.1 ppb and 3.2 ppb, respectively, in the upper aquifer~~, and to non-detect concentrations in~~ the lower aquifer, and determine the direction of groundwater flow*."

Attachment 8, Section III.B.1.a/b/c, Pages 9 and 10. In the draft CAO, appropriate edits were made in requirement III.B.1.a to allow the presentation of saturated alluvium on maps where needed for data interpretation. Edits were not made to be consistent with this change throughout the section. PG&E recommends the following edits for consistency:

> In Section III.B.1.b, delete: "~~*These maps are not to show the approximate limit of saturated alluvium in upper aquifer or flow directional arrows."*~~
>
> In Section Section III.B.1.c delete: "~~*"Include the approximate limit of saturated alluvium in upper aquifer."*~~

References

ARCADIS. 2014. Remedial Timeframe Assessment. Pacific Gas and Electric Company, Hinkley Compressor Station, Hinkley, California. June 30.

TECHNICAL MEMORANDUM CH2MHILL®

Key Elements of Revised Conceptual Site Model for the Western Portion of the Lower Aquifer, Hinkley, California

PREPARED FOR: California Regional Water Quality Control Board, Lahonton Region, and Pacific Gas and Electric Company

PREPARED BY: Isaac Wood, P.G., C.HG

DATE: September 29, 2015

Introduction

As presented in this technical memorandum (TM), the hexavalent chromium (Cr[VI]) plume that is currently referred to as the Lower Aquifer chromium plume on the western portion of the Lower Aquifer at Hinkley, California, resides within a complex geological environment at the edge of the blue clay, where the Upper and Lower Aquifers are in hydraulic communication. Pacific Gas and Electric Company (PG&E) will address this portion of the Cr(VI) plume as quickly as possible. However, in this complex hydrogeologic setting, aggressive remedial activity that does not consider the interaction of the Lower Aquifer with the Upper Aquifer could increase Cr(VI) concentrations in the Lower Aquifer rather than reduce them, by drawing higher Cr(IV) concentrations in the Upper Aquifer downward into the Lower Aquifer.

PG&E recommends that remedial goals for the Lower Aquifer are developed while acknowledging that a revision to the conceptual site model (CSM) for the western limits of the Lower Aquifer where the blue clay aquitard transitions from being a confining layer to a thin, sandy and intermittently present clay layer (hereafter called the transition zone) is needed. The key components that need to be developed in a revised CSM for the Lower Aquifer are presented in this TM. PG&E proposes to submit a technical report that evaluates these components in greater detail after the Cleanup and Abatement Order (CAO) is issued. The revised CSM presented in this forthcoming technical report should be used to determine which monitoring wells truly represent the Lower Aquifer versus the transition zone for use in assessing performance of the Lower Aquifer remedy. In addition, a technical assessment should be conducted to determine background chromium concentrations for both the Lower Aquifer and the transition zone area near the Lower Aquifer edge to evaluate the timeframe of remedial actions to reduce concentrations to potentially very low background concentrations.

Conceptual Site Model for the Lower Aquifer and Transition Zone to Upper Aquifer

Recent aquifer testing data show that near the margins of the blue clay that acts as an aquitard separating the Upper Aquifer from the Lower Aquifer, there is a transitional area where there is significant hydraulic communication between the two aquifers. This is particularly evident in the area of monitoring wells MW-28C, MW-92C, and MW-100C, where chromium above the interim background levels has been reported. This is conceptually illustrated in cross-section on Figure 1 and in plan view on Figure 2. As displayed with green well dots on Figure 2, the blue clay was either absent, logged as a sandy clay, or less than 3-feet thick at four monitoring wells (MW-28C, MW-92C, MW-98C, and MW-100C) located on the western portion of the Lower Aquifer (Stantec, 2011a-c). Included on Figure 2 is a blue-shaded transitional area where the Upper and Lower Aquifers are interpreted to be in hydraulic communication based on hydraulic testing data. The blue clay was interpreted to be present during drilling at some wells and test borings in this area during previous investigation, but the blue clay in this area was logged to have an increasing sand content (Stantec, 2011a-c), and subsequent hydraulic testing (see below) has demonstrated that in this transitional zone the intermittent blue clay does not act as a competent aquitard in this general area.

Figure 3 shows hydrographs for Upper and Lower Aquifer well pairs MW-23B/MW-23C and PZ-08/MW-92C, respectively. The blue clay acts as an aquitard at MW-23C, as demonstrated by the consistently 1-foot higher groundwater elevation at MW-23C than the Upper Aquifer well MW-23B, demonstrating an upward hydraulic gradient (top panel of Figure 3). On the other hand, the hydrograph for the PZ-08/MW-92C well pair shows comparable groundwater levels at both the Upper and Lower Aquifer wells without a significant vertical gradient like the MW-23B/23C hydrograph (bottom panel Figure 3). The hydrograph for PZ-08/MW-92C is corroborated by the observation of thin and sandy blue clay in this area and suggests that the blue clay does not act as an aquitard in this area. Figure 4 shows hydrographs for Upper and Lower Aquifer well pairs MW-42B2/MW-42C and PZ-09/MW-100C, respectively. Like the MW-23B/MW-23C hydrograph, Lower Aquifer well MW-42C shows a consistently higher groundwater level (more than 1.5 feet) than Upper Aquifer well MW-42B2, indicating that the blue clay acts as an aquitard in this area. While an upward gradient is shown in the hydrograph for PZ-09/MW-100C (blue line above orange line), both wells respond equally to changes in Upper Aquifer groundwater extraction at Upper Aquifer extraction well EX-26, again indicating that the blue clay does not act as an aquitard in this area.

Geochemical Conditions in the Lower Aquifer, the Transition Zone, and Implications for Background Chromium

Several monitoring wells within the Lower Aquifer yield nondetect concentrations. However, to understand whether these nondetect values represent background chromium conditions throughout the Lower Aquifer and also the transition zone where the Upper and Lower Aquifers are in hydraulic communication, the geochemical conditions within these portions of the aquifer should also be considered. Most Lower Aquifer monitoring wells with nondetect chromium concentrations contain low dissolved oxygen and relatively low oxidation-reduction potential (ORP), which indicate conditions that could promote the natural reduction of chromium to result in relatively lower background Cr(VI) concentrations (CH2M HILL, 2015). Near the western limits of the Lower Aquifer in the transition zone where monitoring wells such as MW-100C and MW-92C are present, there is generally elevated dissolved oxygen and relatively elevated ORP, which indicate conditions that could be associated with relatively more oxidation of chromium and relatively higher background Cr(VI) concentrations. Elevated dissolved oxygen and ORP conditions are also prevalent throughout the Upper Aquifer, and Cr(VI) is present above nondetect levels at most of these wells. These observations indicate that background chromium levels may vary across the aquifer that historically been designated as “Lower Aquifer” and that careful analysis is needed to determine the background concentrations throughout this portion of the aquifer.

Implications for Remediation

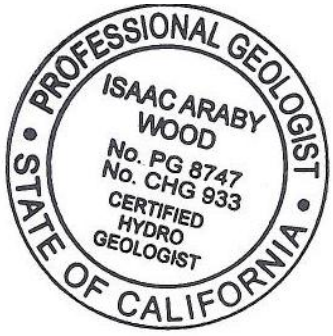
The current remedy for Cr(VI) in both the Upper and Lower Aquifers north of Highway 58 is groundwater extraction and treatment via agricultural fodder crops. However, addressing the Cr(VI) concentrations at monitoring wells MW-92C and MW-100C within the transition zone, and Lower Aquifer monitoring wells MW-23C and MW-42C, with additional Lower Aquifer extraction to expedite remediation in this area, could result in the drawing of Cr(VI) with higher concentrations from the Upper Aquifer downward into the Lower Aquifer. If this occurred, then it could adversely affect the currently stable-to-decreasing Cr(VI) trends at these and other Lower Aquifer wells that have been achieved with current Lower Aquifer remedial actions (CH2M HILL and ARCADIS, 2015). Consequently, additional extraction may not expedite Cr(VI) treatment in what is currently referred to as the Lower Aquifer until the Upper Aquifer is remediated.

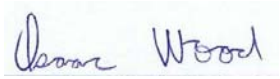
The hydraulic communication between the Upper and Lower Aquifers in the transition zone at the edge of the blue clay discussed above dictates that cleanup of both the Upper and Lower Aquifers in these areas must proceed in concert and on the same timeline. The solute transport modeling conducted as part of the *Remedial Timeframe Assessment* (ARCADIS, 2014) was utilized to evaluate time for Cr(VI) concentrations within the Upper Aquifer near the Lower Aquifer transition zone to decrease to less than 3.1 parts per billion (ppb). In one of the modeling runs conducted in that study, the upper portion of the Upper Aquifer (model

layer 1) is predicted to decrease below 3.1 ppb Cr(VI) after a period of 7 years, while the lower portion of the Upper Aquifer (model layer 3) is predicted decrease below 3.1 ppb Cr(VI) after a period of 20 years. Cr(VI) concentrations below 3.1 ppb were not discretely simulated with the solute transport model. Extended timeframe analyses to reach nondetect or an alternate lower Cr(VI) concentration target were, therefore, not assessed, but timeframes would be significantly longer than 20 years. As such, setting a cleanup goal for the Lower Aquifer that is sooner than the Upper Aquifer in this area or that is only a few years long is technically infeasible.

Further, remediating groundwater in monitoring wells located within the transition zone such as MW-92C and MW-100C and Lower Aquifer monitoring wells such as MW-23C and MW-42C (with an effective blue clay aquitard present), which are located near the transition area where hydraulic communication with the Upper Aquifer is present, to nondetect values may be infeasible with an extraction approach. Monitoring wells MW-92C and MW-100C in the transition zone are in hydraulic communication with the Upper Aquifer and likely to have background Cr(VI) values consistent with the Upper Aquifer. Because relatively elevated dissolved oxygen and ORP are also observed at Lower Aquifer wells MW-23C and MW-42C, reducing Cr(VI) concentrations to nondetect levels at these wells where background Cr(VI) may be relatively higher than in Lower Aquifer locations with more strongly reducing conditions may be impossible. PG&E recommends continuing to use the 3.1/3.2 ppb interim background numbers to contour Cr(VI)/Cr(T) in the Lower Aquifer until a new background number for the Lower Aquifer is developed and approved by the Water Board.

This TM was prepared on behalf of PG&E by the following California Registered Professional:





Isaac Wood, P.G., C.HG

CH2M HILL, Inc.
155 Grand Avenue, Suite 800
Oakland, California 94612

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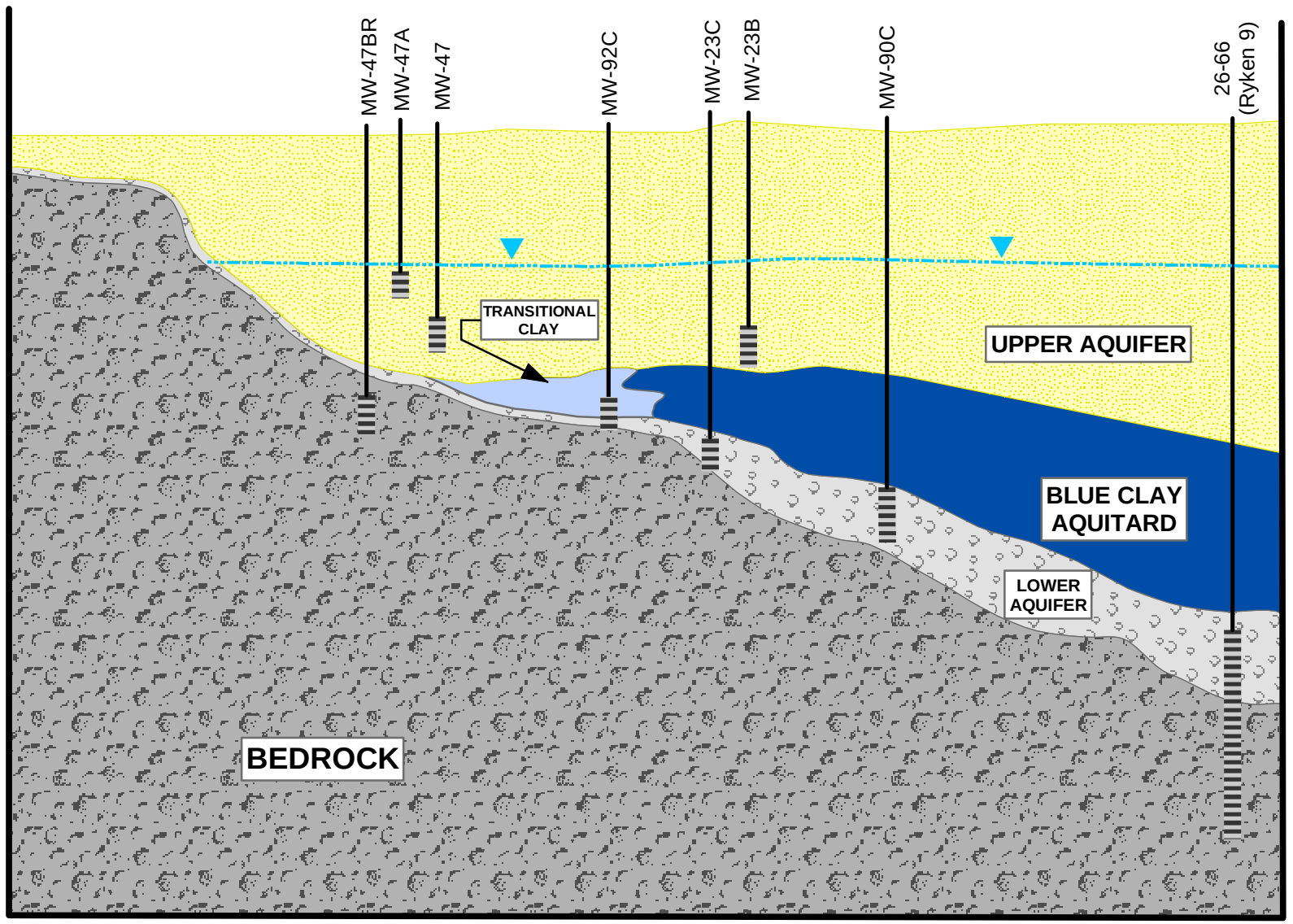
Figures

Z:\PG&E\MXD_Files\November 2010\Figure 2 (Site Stratigraphy (2010-11-22).mxd



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FOR:
Pacific Gas & Electric
Groundwater Remediation Project
Hinkley, California

GENERALIZED SITE STRATIGRAPHY

FIGURE: 1

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
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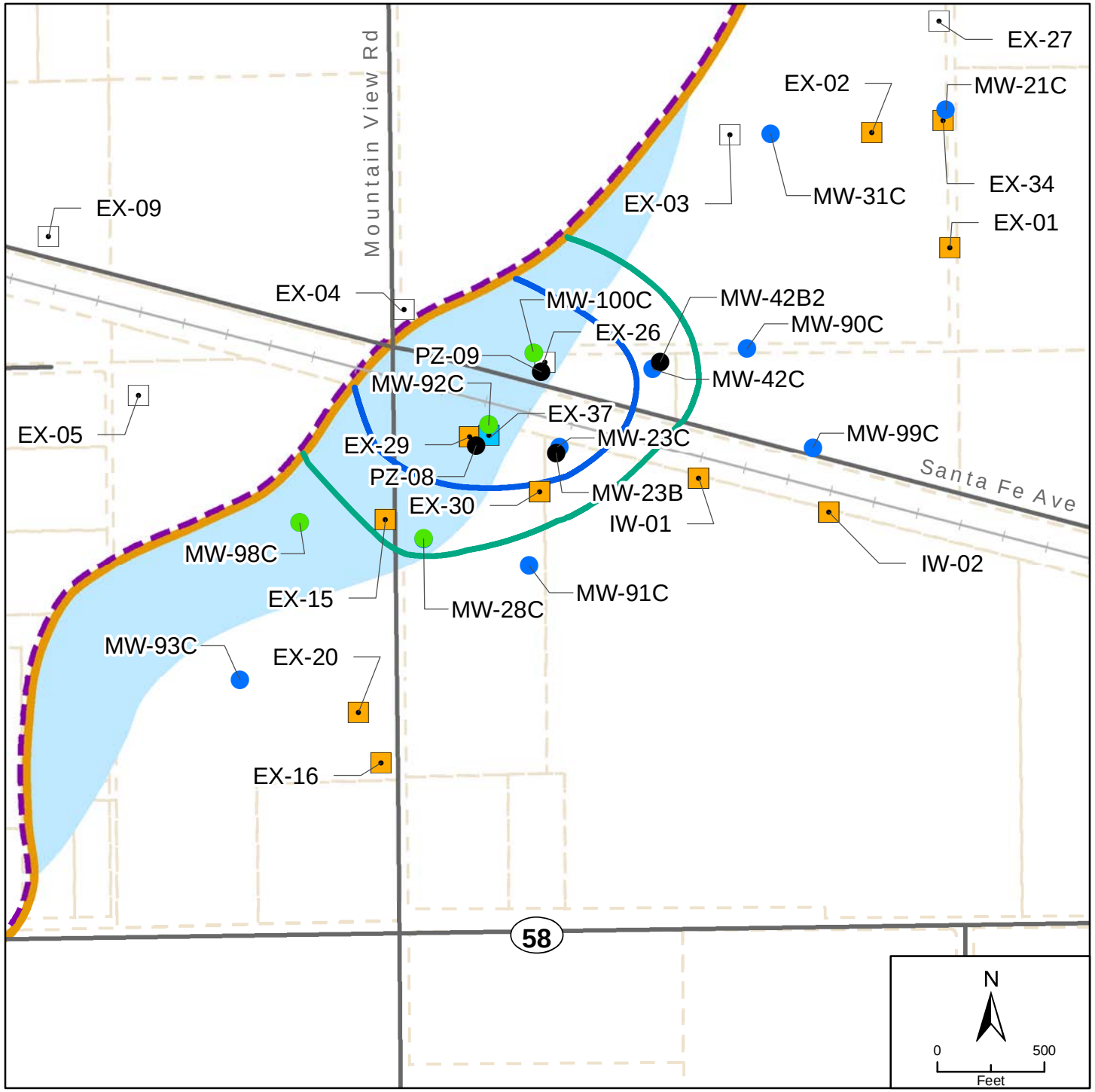
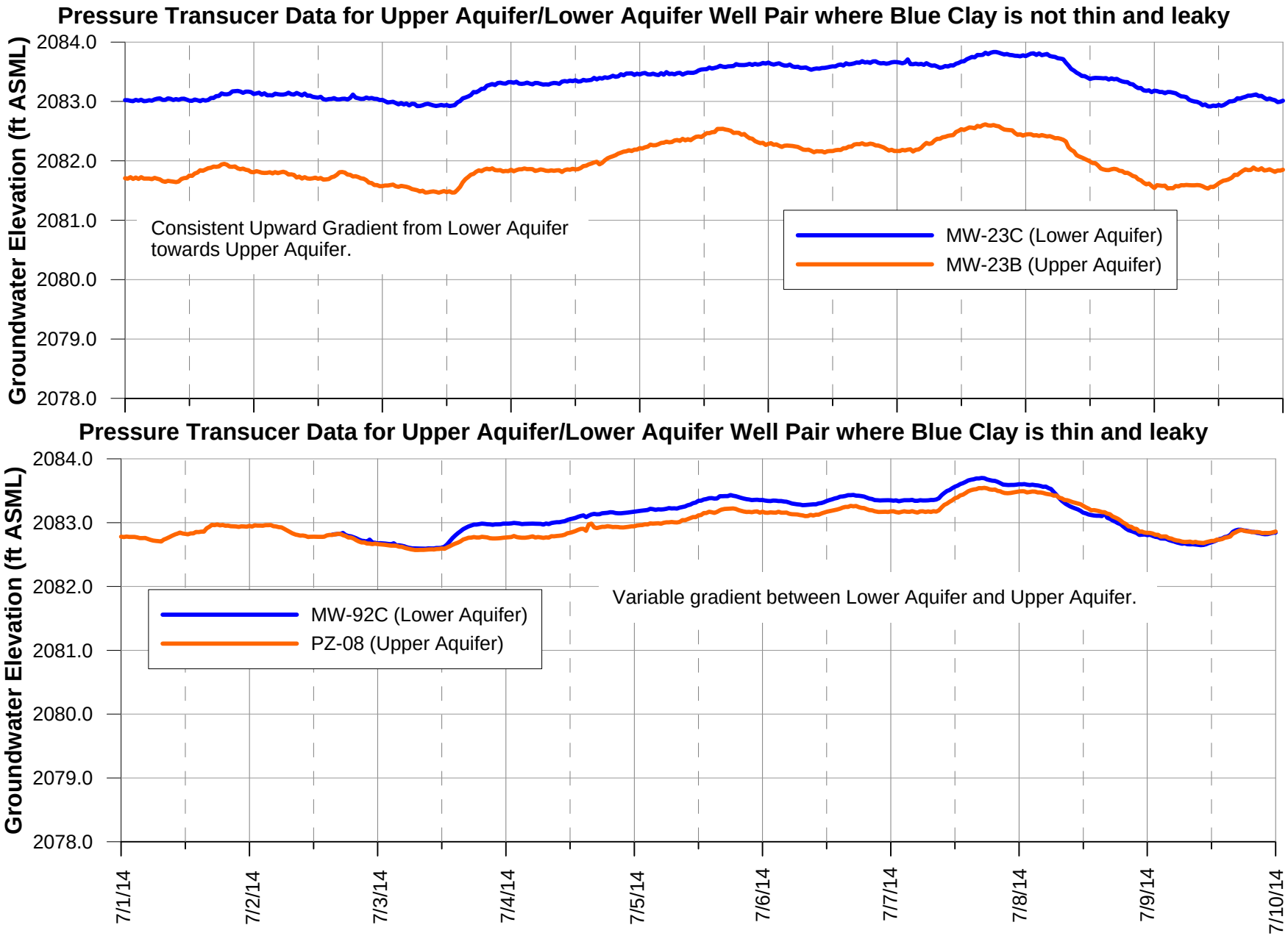


LEGEND:

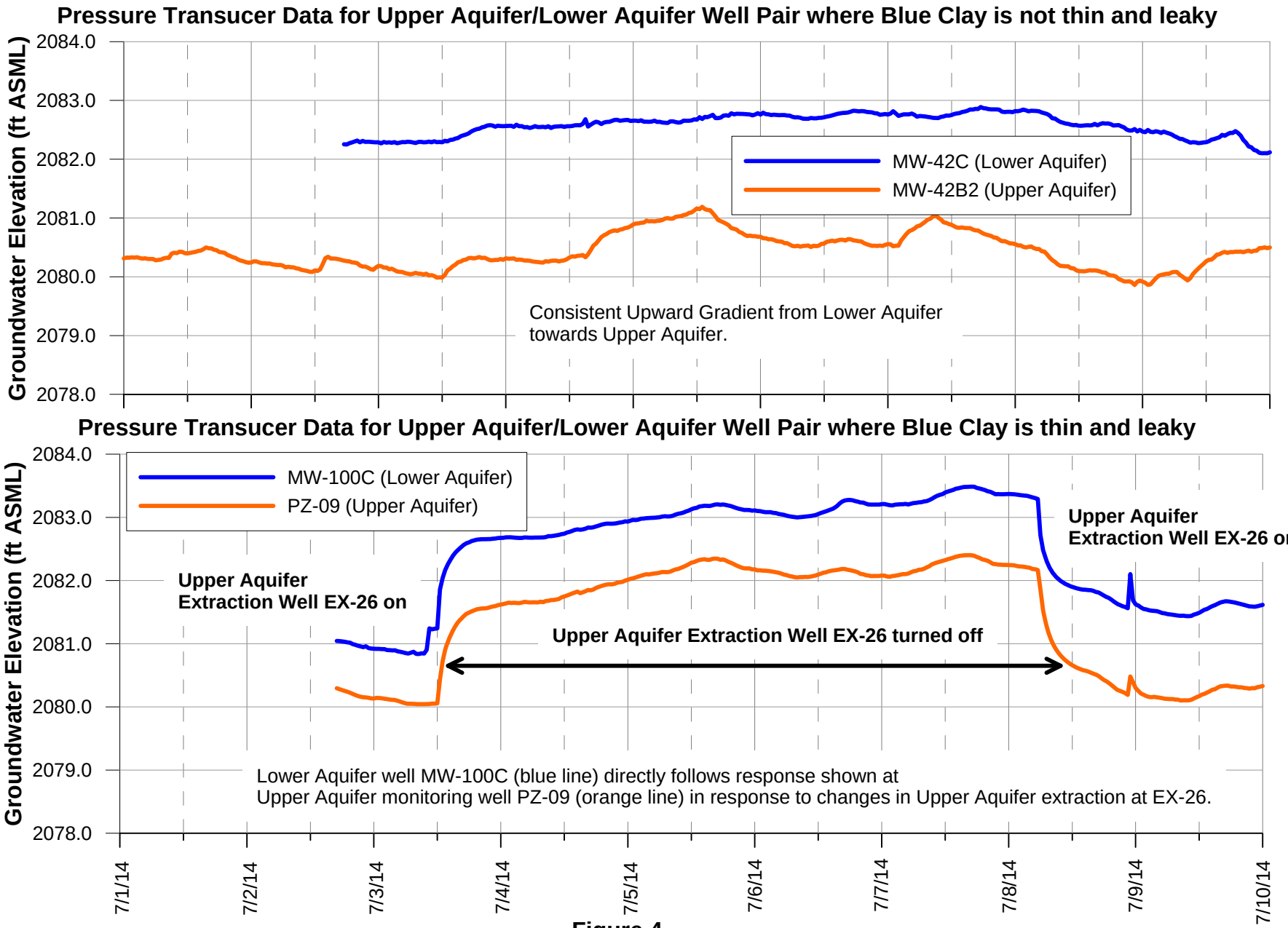
- Upper Aquifer Monitoring Well
- Lower Aquifer Monitoring Well
- Blue Clay either absent or less than 3-feet thick in boring log.
- Groundwater extraction well
- Upper Aquifer Extraction Well
- Upper and Lower Aquifer Extraction Well
- Approximate limits of blue clay layer forming Lower Aquifer from boring logs. The blue clay layer is absent, thin and leaky in portions of its western extent.
- Approximate transition zone area where the Upper Aquifer and Lower Aquifer are in hydraulic communication. Reducing chromium concentrations in this area will be dependent on reducing Upper and Lower Aquifer concentrations in concert.
- Approximate outline of Cr(VI) or Cr(T) in Lower Aquifer exceeding values of 3.1 and 3.2 µg/L, respectively, Second Quarter 2015
- Approximate 10-µg/L outline of Cr(VI) or Cr(T) concentrations in Lower Aquifer, Second Quarter 2015

FIGURE 2
APPROXIMATE TRANSITION ZONE AREA FOR BLUE CLAY AQUITARD FORMING LOWER AQUIFER
PACIFIC GAS AND ELECTRIC COMPANY
HINKLEY COMPRESSOR STATION
HINKLEY, CALIFORNIA



Notes
1) ft. ASML: Feet Above Mean Sea-Level

Figure 3
Pressure Transducer Data for
Upper Aquifer/Lower Aquifer Well Pairs at MW-23C and MW-92C
Pacific Gas & Electric Co. Hinkley Compressor Station



Notes
1) ft. ASML: Feet Above Mean Sea-Level

Figure 4
Pressure Transducer Data for
Upper Aquifer/Lower Aquifer Well Pairs at MW-42C and MW-100C
Pacific Gas & Electric Co. Hinkley Compressor Station

CH2MHILL

MEMORANDUM

TO: Patty Kouyoumdjian
Executive Officer

FROM: Lauri Kemper, PE
Assistant Executive Officer

DATE: September 30, 2015

SUBJECT: Prosecution Team's Comments on September 1, 2015 Draft Cleanup and Abatement Order (CAO) for Chromium Contamination from the PG&E Hinkley Compressor Station, San Bernardino County

The Lahontan Water Board's Prosecution Team appreciates the opportunity to provide our comments on the Advisory Team's September 1, 2015 Draft CAO, for the PG&E Hinkley Compressor Station. The Table of Comments, Attachment 1, is in addition to consensus language coordinated with PG&E and requested by and provided to the Advisory Team on July 8, 2015.

A Unique Case

The PG&E Hinkley Compressor Station Chromium Remediation Project is unique for many reasons and, therefore, requires a site-specific response and approach in terms of requirements specified in Water Board Orders.

- The area of groundwater contaminated is over seven miles in length and two and a half miles in width. The Lahontan Region has no other groundwater contamination case of this size and with as many domestic wells threatened or affected (excluding sites controlled by the Department of Defense).
- The number of affected or threatened domestic wells and persons: At one time, nearly three hundred private domestic wells were being tested by PG&E. Many individuals still reside in close proximity of the contamination and rely on the groundwater for all domestic uses.
- The contaminant, hexavalent chromium, exists in nature, making the establishment of background concentrations more challenging. For a purely man-made substance, such as MTBE, background concentration can be easily set at below non-detectable concentrations. No simple investigation or a conflict resolution process can determine what percentage of the detected hexavalent

chromium is attributable to PG&E's historic discharges of hexavalent chromium, which is why a five year, five million dollar study is now underway.

- The geology is complex in this area and varies across the contaminated zones. This complex geology and pumping by other parties over such a large area of contamination make predicting fate and transport of the chromium and remediation by-products challenging. Over the years of Water Board oversight of the remediation, unpredictable and unforeseen changes in groundwater quality have occurred frequently.
- Wide-spread public interest because of a movie.
- Involvement of the U.S. Geological Survey to conduct a chromium background study to evaluate the occurrence of natural and anthropogenic Cr(VI) in groundwater.

The Prosecution Team Does Not Support Returning to Using "Best Professional Judgment"

At a site with as complex geology as this one, and with so many outside parties pumping the groundwater, the use of best professional judgment has resulted in several different results. Professional licensed geologists can, and do, arrive at different answers using the same information and data available to them. Reasonable, professional minds can differ. At this site, the Water Board has received technical reports with different interpretations from different PG&E consultants. Because of the uncertainty about conditions existing underground, this is not too surprising. It is a good reason to prescribe methodology for contamination plume mapping so that **consistent** and **comparable** maps can be produced every time someone is preparing one. Having consistent, comparable maps and reports aids the community and all interested parties by providing ease of understanding how conditions changed, for better or for worse.

PG&E incorporated "best professional judgment" in its submissions to the Water Board from the 1987 Cleanup and Abatement Order (No. 6-87-160) through October 30, 2011 when a new investigative order took effect (No. R6V-2011-0079). Between 2006 and 2011, Water Board staff often disagreed with the "best professional judgment" by PG&E and its many consultants. The submissions under the "best professional judgment" standard were inadequate and often unsupported. The situation reached a peak at the March 9, 2011 Water Board meeting in Barstow in which nearly 200 public members complained about, among other things, alleged PG&E's biased plume mapping, withholding chromium data collected from domestic wells, delays in installing monitoring wells to define the plume boundaries, and interpretation of the plume's extent. The public insisted that the Water Board take action and be more transparent in responding to PG&E requests.

Based upon the inconsistent mapping resulting from "best professional judgment" of the PG&E consultants, the Water Board issued the September 29, 2011 Investigative Order R6V-2011-0079 specifying criteria for map drawing, map content, and technical report content. The Order required the use of all data including domestic well data when no monitoring wells were in place in a particular area. This action was taken to provide

consistency between the different consultants and to provide **comparable** mapping of the contamination over time.

Recall that the Water Board agreed to a settlement of $3.6 million with PG&E in March 2012 when the Water Board did not agree with PG&E's professional judgment contained in reports for CAO R6V-2008-0002. More than a dozen reports and correspondence PG&E submitted from 2009 to 2011 regarding monitoring well MW-62A couched the rising amount of hexavalent chromium as first an anomaly and later as not being an appropriate sentry well, not evidence of plume migration in its best professional judgment. The Board agreed with the settlement documents that, in fact, the plume had not been contained and issued the administrative civil liability.

The 2011 investigative order mapping and reporting criteria were continued in Cleanup and Abatement Order R6V-2008-0002-A4 that you issued on behalf of the Board on January 15, 2013. The Board's orders in 2011 and 2013 contained this evolved mapping system for its comparable, consistent, and easy to understand properties. To return to the unsatisfying "best professional judgment" standard would undermine past Board orders and backtrack on the progress made in working with PG&E and community towards better transparency of information.

Since the 2011 investigative order, PG&E has been free to provide alternate interpretations of chromium data, plume maps, and clean up actions, in addition to those required by the Water Board. PG&E first started doing this by drawing separate chromium plume maps in quarterly groundwater monitoring reports. In late 2014, after discussions with Water Board staff on the importance of consistency and clarity, and to avoid confusing one map with the other, PG&E changed its mapping submittal by providing its interpretation as insets on the chromium plume maps drawn in compliance with Water Board orders. This system has worked well, has received few public complaints, and should be continued. Continuing this mapping system provides PG&E with known parameters of what to submit in its maps and reports that provide the Board, its staff, and the community with an understandable, comparable, and is flexible enough for PG&E to submit insets representing any data set, factors, interpretation, or emphasis it prefers. If the Board Members and the Advisory Team desire, they can easily continue this alternative mapping with the use of inset maps in the new Cleanup and Abatement Order.

This unique case incorporates a process among the interested parties to continually improve how information is shared, contingent upon how PG&E reports its data. This is <u>not</u> a routine voluntary cleanup matter, and we have all learned from the many years and numerous Board orders. The Prosecution Team respectfully requests that the Board and the Advisory Team continue the mapping and reporting system it instituted in the 2011 investigative order and 2013 CAO, at least until the Background Study results are available, and not return to the ambiguous "best professional judgment" standard that has proven itself inadequate in this matter.

The Northern Plumes in the Hinkley Valley and Harper Dry Lake Valley are Linked to Compressor Station Discharge

PG&E has claimed that the northern two plumes on current maps are not related to historical chromium releases at the Hinkley compressor station. Yet, as seen in the figure as Attachment 2, the three maps show the progression of the chromium plume over time. Chromium in groundwater was mapped as one large plume connected to the compressor station in first quarter 2012, just 3½ years ago. In 2013, the plume was drawn divided as two separate plumes due to remedial actions. In 2014, the northern plume is shown as divided again but that may just be due to lack of monitoring data in the east side of the Hinkley Gap.

The division of contaminant plumes in groundwater is normal during remedial action implementation. This plume behavior is consistent with the plume examples for Deer Park and Patchogue, New York; Port Hueneme, California; and the Rhineland Refinery in Germany, shown in Figures 2 and 3 of the July 2015 Groundwater article "Exceptionally Long MTBE Plumes of the Past Have Greatly Diminished" (Attachment 3). Whether the contaminant is hydrocarbons or metals, such as hexavalent chromium, their dissolved behavior in groundwater is the same in that they migrate wherever groundwater flows.

The northern plume is considered as real in the U.S. Geological Survey's (USGS) proposal for chromium background study. The 2014 study proposal includes a map on Figure 2 (Attachment 4) showing the chromium plume boundary lines in groundwater in the North Hinkley Valley and Harper Dry Lake Valley. The explanation for the map states "Plume extent in upper aquifer (2013); Cr(VI) >3.1 micrograms per liter, dashed where not contiguous with compressor station." This latter part indicates the USGS currently considers the dashed plume in the north to be related to the compressor station. The current background study will be establishing just how wide and long the northern plume boundary lines extend.

The Prosecution Team contends that enough time (56 years) has passed to allow hexavalent chromium discharged to the groundwater from the Compressor Station to have reached all locations currently being mapped as chromium contamination plumes. With remedial actions occurring just in the past 23 of those years, a majority of the chromium plume in groundwater migrated to the north unabated. Although not much is known yet about natural levels of hexavalent chromium in the northern valleys, it is more probable than not some portion of any hexavalent chromium found there can be attributed to PG&E's historical discharges. With over 65 years of professional technical experience, the Prosecution Team concludes that based on all the evidence it is likely that northern plumes in the north Hinkley Valley and Harper Dry Lake Valley consist of chromium from the compressor station.

The Water Board has the authority to revise the CAO and update it when new information becomes available. The Prosecution Team recommends using the January 7, 2014 Project Navigator letter describing what information from the USGS

the Board may consider for action as a set of operating rules for right now (See Attachment 5). The process described in this letter was supported by the parties involved in the Technical Working Group in Hinkley, including PG&E. The Water Board may consider changing its mapping requirements following results of the USGS background study, but until such time, we recommend maintaining the current requirements.

Draft CAO Comments

The attached Table of Comments (Attachment 1) provides the Prosecution Team's specific comments and concerns with a word, sentence, or paragraph in the Draft CAO. Often times, we provide alternate language for your consideration. We are most concerned with chromium plume mapping requirements, and cleanup of the lower aquifer. We are open to discussing further with you and PG&E ways to resolve our concerns so that accountability and consistency in regulation can continue at this site.

Attachments:
1. Prosecution Team Comment Table on Draft CAO
2. Chromium Plume Maps 2012, 2013, 2014
3. July-August 2015, Groundwater, "Exceptionally Long MTBE Plumes of the Past Have Greatly Diminished" pages 515-524
4. Figure 2, Study area location, 2014 USGS Chromium Background Study Proposal
5. Project Navigator January 7, 2014 letter regarding "Actionable Information"

Attachment 1

Prosecution Team's Comments on September 1, 2015 Draft Cleanup and Abatement Order R6V-2015-DRAFT

Submitted to the Advisory Team on September 30, 2015

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
1	Finding (F). 6 / P. 2 (and throughout)	…"interim" maximum background levels…	The use of the term "interim" in reference to the currently adopted background values throughout the Draft CAO is incorrect and confusing. The background values of 3.1/3.2 Cr(VI)/Cr(T), adopted by the Water Board in CAO R6V-2008-002A1 were not termed "interim" values. They are in effect and will remain so until changed by future Water Board action, which is not guaranteed. In finding 16, the criticisms and limitations of the currently adopted background values are acknowledged. However, the current background values remain the best available data for their intended use. The Prosecution Team notes that any regulatory value is subject to change based on new information; for example, public health goals and drinking water standards all can be revised based on new data. But such values are not termed "interim" when they are adopted; rather it is simply recognized that they are subject to review and revision. This is the most straightforward and least confusing approach, and should be applied here as well. We recommend removing the word 'interim' where added by the Advisory Team throughout the CAO.
2	F. 7 / P. 2 (and throughout)	…"uncertain plumes"…	In finding 16, the criticisms and limitations of the currently adopted background values are acknowledged, particularly as they apply to the northern area. The Prosecution Team and PG&E in our consensus language used the term "uncertain" regarding background values in finding 16 in the context of the limitations of the 2007 background study, only, the Advisory Team has applied it as a descriptor for the northern area plumes, over-reaching in its interpretation of the term. The Prosecution Team does not agree that the term should be globally applied to the northern plumes for the following reasons: In first quarter 2014, concentrations of up to 275 ppb Cr(VI) were detected in monitoring well MW-193S3 in the northern area; other MWs in the

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
			northern area throughout 2014 showed concentrations up to 17.9 ppb. While we acknowledge questions regarding the accuracy of the currently adopted background values of 3.1/3.2 Cr(VI)/Cr(T) for the northern area, it is very unlikely that a new background study will establish that background values in the area are in the 100s of parts per billion, given the lack of evidence of geologic units known to contain high amounts of chromium minerals (see May 21, 2015 Prosecution Team response A.2, including section i). Evidence previously presented (see May 21, 2015 responses to Advisory Team, Prosecution Team response A.2) to support this conclusion includes presence of groundwater flow through the Hinkley gap from the Mojave River, groundwater flow direction, groundwater velocity and time since waste discharge, and highly elevated levels of chromium in monitoring wells in the contaminant flow path. Also, the issuance of CAO R6V-2008-0002-A4 and other past board orders support the use of "plume" to describe PG&E's chromium release affecting groundwater quality in the north Hinkley Valley and Harper Dry Lake Valley. The Prosecution Team contends the weight of evidence, including general hydrological principles, supports the conclusion that elevated concentrations of chromium detected in the northern area monitoring wells are reasonably attributed, in part, to PG&E's waste discharges from the compressor station. These areas are correctly referred to as chromium plumes that are known and not uncertain. The use of the term "uncertain" is not properly applied to the northern plumes and should be removed.
3	F. 7 / P. 2	Insertion of sentences at end of finding explaining the process for chromium migration to the Lower Aquifer	Finding 7 starts out discussing the contents of PG&E's 2014 3rd Quarter Groundwater Monitoring Report. The Advisory Teams inserted sentences at the end of the finding, based on a different PG&E document, describing the details of chromium migration from the upper aquifer to the lower aquifer. The Prosecution Team believes these two subjects should be in separate findings. In addition, the final inserted sentence

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
			appears to be redundant of the third to last sentence. Suggest deleting the final sentence but retaining the part "east of Mountain View Road and near Santa Fe Road" to add to the end of the third to last sentence. The Prosecution Team also thinks it is important to note in this new finding that chromium concentrations in the Lower Aquifer were originally at non-detect concentrations in 2006 before starting to increase due to migration from the upper aquifer. Suggested language can be: Since 2001, PG&E has stated in reports and in technical meetings that it has no plans to conduct a background study in the Lower Aquifer. Thus, it is reasonable for the Water Board to rely on upgradient monitoring wells to set the cleanup goal in the Lower Aquifer. Only after the discharger attempts remediation using best available technology and is unable to achieve cleanup goals, can alternate cleanup goals be proposed (Resolution No. 92-49). In the matter of chromium contamination in the Lower Aquifer in Hinkley, PG&E is still in the process of implementing groundwater extraction to reach background levels and cannot yet propose alternate cleanup goals.
4	F. 8b / P. 3	Insertion of the year "2011" in the first sentence. .	PG&E began mapping chromium as two discontinuous plumes separated from the southern plume in 3rd Quarter 2013, not 2011. . Please make this correction.
5	F. 8b / P. 3	Strike-out of word "plume" in this finding	For discussion on the word "plume" being appropriate for this finding, please see Comment 2.
6	F. 8c / P. 3	Last sentence insertion: "because 16N-01 is not located in downgradient groundwater flow direction."	The reason chromium in well 16N-01 is not believed to be from PG&E's compressor station is because it is too far north of the compressor station to be reasonably attributed to PGE; well 16N-01 is 2.6 miles <u>farther</u> than the calculated fate and transport distance (7.3 mi) of the chromium plume in the footnote of Finding 9. We suggest adding the following text to the end of the sentence: "…because 16N-01 <u>is 2.6 miles farther than the 7.3 mile calculated distance of</u>

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
			the chromium plume (the chromium in this well at this time does not appear to be attributed to PG&E's historic discharges from the compressor station)."
7	F. 16 / P. 5	Last sentence insertion: "and will be referred to interim maximum background concentrations."	As explained in Comment #1, the Prosecution Team recommends that the last sentence be deleted.
8	F. 16 / P. 5		The Prosecution Team recommends the insertion of a new finding after Finding 16, describing the setting of background values in the Lower Aquifer: Since 2002 when the detection limit for Cr(VI) was lowered to 0.2 ppb, monitoring wells MW-11C and MW-14C, located in the upgradient gradient flow direction, and MW-21C, located in the cross gradient flow direction, have always shown non-detect levels during monitoring event. And prior to chromium concentrations increasing in MW-23C starting in 2006, background levels in this well were consistently at non-detect concentrations or 0.2 ppb Cr(VI).
9	F. 19/ P. 5 & 6	Insertion of explanation of how PG&E used the chromium plume boundaries to offer replacement water or property buyout	The inserted sentences no longer describes CAO R6V-2008-002A4 but instead describes PG&E use of chromium plume boundary lines to provide replacement water or offer property buyout. Thus, the Prosecution Team recommends that this finding be divided into two separate findings. The second finding should begin with the second inserted sentence, "With the drinking water maximum contaminant level set at 10 ppb for Cr(VI)…"
10	F. 33/ P. 9		The Prosecution Team recommends the insertion of a new finding after Finding 33 describing PG&E's current remedial actions being implemented in the Lower Aquifer: The Water Board approved PG&E's Lower Aquifer workplan, dated November 7, 2014, for adding a new extraction well to enhance chromium cleanup effectiveness in the Lower Aquifer. The new extraction well, EX-37, came online in March 2015. With a total of three extraction wells now working to remove chromium

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
			in the Lower Aquifer, clean up to background levels detected in MW-11C and MW-14C is now achievable in a shorter timeframe. The current concentration at MW-92C (27 ppb Cr6) is about 45 percent less than the historical maximum concentration (41.8 ppb Cr6) from August 2011. Based upon the rate of chromium reduction over the past 3 years with two extraction wells, cleanup to background using three extraction wells should be achieved in 3 to 4 years.
11	F. 33/ P. 9		The Prosecution Team recommends the insertion of a new finding after the recommended new finding in Comment #10 to explain the need and justification for setting cleanup levels and cleanup times in the Lower Aquifer: "Since chromium contamination to the Lower Aquifer has only existed since approximately 2006, and has always been below 50 ppb, it is reasonable to set short timeframes to achieve complete cleanup in this area. Groundwater in the lower aquifer should be able to be restored within five years based on extrapolating information seen from PG&E's remediation status reports for the lower aquifer over the last few years and remediation progress seen in the upper aquifer."
12	F. 37c/ P. 11	Deletion of word "plume."	As explained in Comment #2, the Prosecution Team believes that "plume" is the correct term to describe where contamination exists, is consistent with prior board orders, and should be left in due to the detection of chromium in groundwater in monitoring wells.
13	F. 37c/ P. 11	Deletion of explanatory sentences regarding why monitoring is needed	The finding was to support monitoring frequency and explain how the frequency would be modified. The Advisory Team's deletion of the explanatory sentences now makes the intent and readability of this finding unclear. The Prosecution Team recommends either retain the deleted sentences or re-write sentences to provide support for monitoring in northern area. Suggested language is provided below. "The extent of chromium plume boundaries in groundwater is not fully defined in the northern valleys. Dissolved chromium migrates unimpeded with natural groundwater flow to the

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
			north. A groundwater monitoring program is necessary to track this movement and to protect public health at domestic wells. The "Groundwater Monitoring and Reporting Program, CAO No. R6V-2015-PROP", in Attachment 8, provides a sufficient monitoring and reporting program in the northern areas to achieve these goals. Additionally, the program includes a process for sampling frequency modifications based upon statistical trends indicating changes over time."
14	F. 37c/ P. 11	. Insertion of the word "uncertain."	The insertion of the word "uncertain" suggests that the northern plume existence is uncertain rather than just the extent of its boundary lines.
15	Order IV.A. & B./ P. 15 & 16 and throughout	Insertion of "best professional judgment"	As stated in the cover memo to these comments, PG&E was allowed to use "best professional judgment" from 1987 to 2011. The Water Board did not agree with the professional judgment being applied as it resulted in under-representing the locations of chromium contamination, leading to the Water Board expounding plume mapping requirements in September 2011. The evolved system has been successful since 2013 and incorporates PG&E's preferences in a map inset, allowing them to display the information as they see best in their professional judgment. Should the Board desire to alter the mapping and reporting system, the Prosecution Team recommends revisiting the matter after the Board obtains the USGS background study results. We suggest adding a finding based on the above information and on the two different maps previously submitted by PG&E during 2010. For example: "Having consistent, comparable maps and reports over the course of time aids in providing transparent information to the community and all interested parties. The mapping and reporting system developed and established in Orders No. R6V-2011-0079 and R6V-2008-0002-A4 provides consistency and comparability of plume maps, along with the flexibility for PG&E to provide inserts using their preferred data sets, factors, and display."

Attachment 1

Prosecution Team's Comments on September 1, 2015 Draft Cleanup and Abatement Order R6V-2015-DRAFT

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
16	Order IV. A.1/ P. 15	Insertion of sentence defining "sufficient resolution"	For the reasons cited in Comments #15 and 18, the Prosecution Teams recommends that in the sentence in A.1, the word "either" be removed in the first line and it end at "…where monitoring wells are no more than 1,320 feet apart." We recommend deleting the last part of the sentence stating, "a California licensed Professional Geologist…"
17	Order IV.A.3/ P. 16	Deletion of the words "undefined plume" and replacement with "may exhibit insufficient resolution."	As explained in Comment #2, the Prosecution Team believes that "plume" is the correct term, is consistent with prior board orders, and should be left in. The words "may exhibit insufficient resolution" are too vague and unclear to the average person. Consider replacing these words with language consistent in the last eight CAOs, such as "…and these areas require better chromium boundary definition (or investigation)."
18	Order. IV.A.4/ P.16	Insertion of "best professional judgment" requirements.	For the past few years, PG&E quarterly groundwater monitoring reports have included alternate figures or insets in figures stating that "best professional judgment" is used to draw its version of chromium plume maps. These alternate drawings, however, show plume lines significantly less in size and area than plume lines drawn using criteria set in board orders, including the most recent CAO R6V-2008-0002-A4. For instance, Figure 5-6 in the First Quarter 2014 Groundwater Monitoring Report, which is PG&E interpretation of "best professional judgment," the northern plumes in the north Hinkley Valley and Harper Dry Lake Valley are absent despite monitoring well data showing chromium concentrations in groundwater up to 275 ppb. Also missing are the western finger, western "bunny" ear and eastern bunny nose (both south of Thompson Road) in the southern plume, despite chromium concentrations in groundwater up to 8 ppb. None of these plume lines should be missing since they are in the downgradient flow path of the chromium release at the compressor station, and within the calculated fate and transport of the chromium plume referenced in the footnote on bottom of page 3 of the Draft CAO. Water Board staff provided more detailed explanations for the chromium plume extending from the Hinkley Valley to the Harper Dry Lake Valley in our May 21, 2015 responses to the Advisory Team.

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
			Since PG&E's "best professional judgment" differs from the Water Board staff's best professional judgment, we recommend maintaining the current requirements (those provided by the Prosecution Team) in the proposed CAO, consistent with R6V-2011-0079 and R6V-2008-0002-A4 and the Project Navigator The Prosecution Team recommends removing section IV.A.4. and replacing it with plume mapping criteria consistent with prior board orders R6V-2011-0079 and CAO R6V-2008-0002-A4, Order I.C. in the "Groundwater Monitoring and Reporting Program in Attachment 8. We suggest including a statement such as: "Incorporating the original mapping and reporting criteria will also alleviate resource intensive review of each submission by Board professionals and install consistency and comparability among the maps and reports for ease of understanding and information transparency." The suggested findings in Comments #15 and 16, above, would support this change in the Order portion of the CAO.
19	Order IV. A. & B./ P. 15 & 16	Deletion of the words "undefined plume" and replacement with words "may exhibit insufficient resolution."	As explained in Comment #2, the Prosecution Team believes that "plume" is the correct term, is consistent with prior board orders, and should be left in.
20	Order. IV. B/ P.16	Citation of section VI.A.3 in the first sentence.	The Prosecution Team believes that "VI" is the incorrect section cited. "IV" is the correct section since it refers to "insufficient resolution" of chromium concentrations.
21	Order IV. B./ P.16 & 17	Insertion of "best professional judgment," incomplete sentences.	For the reasons cited in Comments #13 and 17, the Prosecution Team recommends removing all references to using "best professional judgment" and "technical justification." Doing so will require that the word "either" be removed from the first sentence on page 16. Since this then makes the requirement for submitting a workplan necessary, the sentence beginning "If submitting the workplan…" should be returned to the original

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
			CAO text. The last sentence in this section stating "As access is gained over time…" conflicts with the Order requirement to submit a workplan within 30 days of the date of this Order. Instead, the last sentence needs to stand as a separate order, such as Order IV.B.1. or keep the original Order IV.B. that starts "PG&E shall submit a workplan to install monitoring wells…" Since it is recommended that "best professional judgment" should be removed from the last sentence in this section, the Prosecution Team recommends revising it to read, "As access is gained over time, PG&E shall submit a workplan to the Water Board within 30 days to better define the chromium plume boundaries when monitoring well distances exceed 1,320 feet apart."
22	Order V. A.2/ P. 18	Insertion of sentence describing hydraulic containment	The Prosecution Team agrees with the inserted sentence and recommends adding the underline part: "…from specific monitoring well pairs and triplets within the <u>most recent</u> mandated capture zone <u>accepted by the Water Board</u>.
23	Order. VI.C.1.a. iii / P. 21	Insertion of term "<u>USGS</u>" referring to background values in this consensus language order.	The insertion of the term "USGS" is incorrect. The reference to "background values" in this consensus language order was intended to mean those values that are in effect when the USGS preliminary report is released in 2017. The USGS preliminary results report referenced in this Order will likely not contain a proposal for new background values for the western area, but more likely may have an assessment if the chromium area is attributable to the compressor station or not. If so, then PG&E will assess the feasibility to clean up to the background values in effect in 2017. It is important to understand that the USGS will not set new background values. Rather, the USGS, in its final background study report, will propose background values for the Water Board to consider adopting.
24	Order VI.C.1.b / P. 21 & 22	Deletion of lower aquifer cleanup requirements,	Given the Advisory Team's changes, the Prosecution Team is not clear on how compliance with this requirement can be measured and

Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
		including cleanup level and timeframe.	enforced. As the Lower Aquifer continues to be used today for domestic and agricultural supply, restoring it to background quality is necessary. Therefore, to ensure that cleanup of chromium occurs in the Lower Aquifer in a timely manner, we recommend leaving requirements as proposed by the Prosecution Team since they are reasonable and feasible. Alternately, the CAO can require cleanup be completed within five years.
25	Order VII. 2. a / P. 25	Advisory Team revision: "Within 45 days of <u>this Order being issued</u> . . ."	This revision now contradicts finding 43. Please clarify if the intent is to require a replacement water plan within 45 days of the order being issued, or within 45 days of identification of a private supply well having increasing trends of chromium indicating likely future exceedances of chromium MCL (original language). The original language is in line with the Water Board authority to require replacement water as outlined in the *Olin Order* (see finding 41, last sentence). The Prosecution Team recommends retaining this language from the consensus CAO draft.
26	Order VII. 2. b and c./ P. 26	"replacement drinking water" . . .	Include "<u>and cooking</u>" to all references to replacement water.

Attachment 1

Prosecution Team's Comments on September 1, 2015 Draft Cleanup and Abatement Order R6V-2015-DRAFT

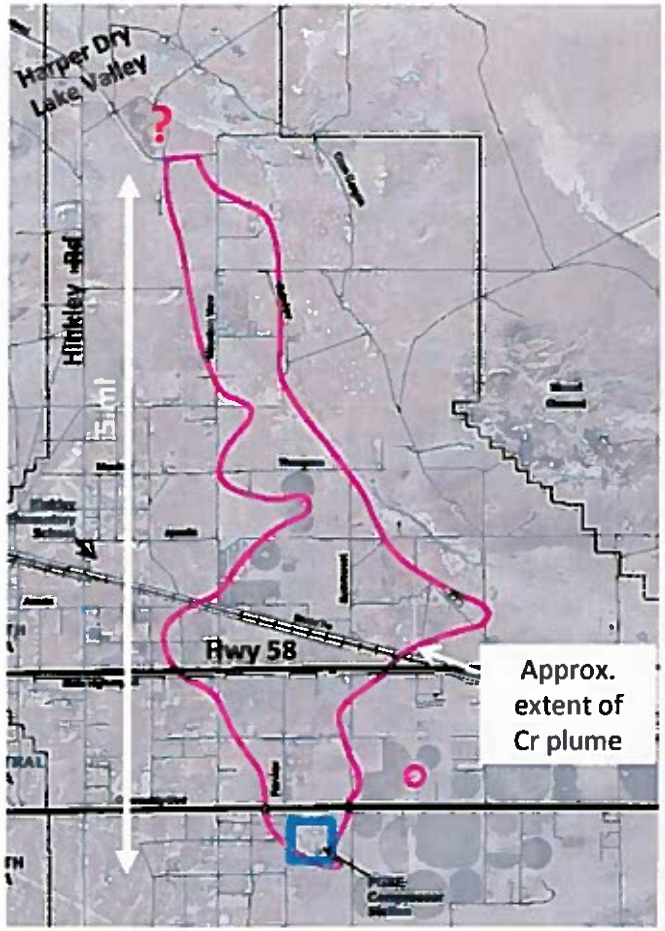
Groundwater Monitoring and Reporting Program, Attachment 8			
Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
1	Third paragraph / P.1 (MRP Program)	"As cleanup progresses…in order to best effectuate those goals."	Suggest removing "in order" which is superfluous. It is not clear what goals are being referred in the phrase, "to best effectuate those goals," since there are no reference to goals in either of the preceding paragraphs. Suggest replacing the phrase with "…to best accommodate changing conditions."
2	D. / P. 4 (and throughout)	…"uncertain plumes"…	The Prosecution Team's objections to the use of "uncertain" in this section and throughout the MRP are the same as described in Comment #1 in the Draft CAO findings. We strongly recommend that "uncertain" be removed in all locations that reference the northern plumes since the word's use is not being properly applied and should be removed.
3	D.1. / P. 5 (and throughout)	…"interim" maximum background levels…	The Prosecution Team's objections to the use of "interim" in this section and throughout the MRP are the same as described in Comment #2 in the Draft CAO findings. We strongly recommend that "interim" be removed in all locations that reference the currently adopted background values since the word's use is incorrect and confusing.
4	I.E./ P. 7 (Monitoring)	In the first sentence, deletion of "plume" and insertion of "where the plume is uncertain" in reference to the northern area	As described in Comment #2 in the Draft CAO, the word "plume" is appropriate for describing the northern plumes. Therefore, the Prosecution Teams recommends leaving the original text as is in the first paragraph under section E with regards to "northern plume area" and "plume area monitoring well…"
5	III.A./ P.9 (MRP Reports)	Insertion of the ending of the sentence, "…to provide sufficient resolution…"	As explained in Comments #2 and #17 in the Draft CAO, the Prosecution Team believes that "plume" is the correct term, is consistent with prior board orders, and should be left in. The words "may exhibit insufficient resolution" are too vague and unclear to be understandable to the average person. Consider replacing these words with language consistent in last eight CAOs, such as "…to provide better chromium boundary definition..."
6	III.B.1.a./ P.9	Deletion of the	The brown lines added to chromium plume maps

Groundwater Monitoring and Reporting Program, Attachment 8			
Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
	(Map Types)	sentence in the original proposed CAO: "These maps are not to show the approximate limit of saturated alluvium in upper aquifer or flow direction arrows."	to show the approximate limit of saturated alluvium in the upper aquifer are confusing. The intent of the brown line is to suggest that there exists insufficient saturated alluvium for the migration of the chromium plume. However, the same maps show domestic wells in the same areas as the brown line, contradicting that there exists insufficient water supply. The brown line and flow direction arrows are more appropriate for inclusion on poteniometric maps reflecting groundwater characteristics such as elevation data, flow direction, and gradient. Thus, the Prosecution Teams recommends adding these requirements to <u>potentiometric maps only</u> in III.B.1.b, instead of chromium plume maps.
7	III.B.1.a.i./ P.9 (Map Types)	Insertion of the ending of the sentence, "…however, data from domestic wells shall not be used to draw the plume boundary lines."	The added part of the sentence is appropriate where adequate monitoring wells exist to provide chromium data in groundwater. However, in some areas of the north, PG&E has not been able to acquire access to private properties or sensitive species habitat for installing monitoring wells. In those instances, Water Board staff and PG&E agreed to use data from domestic wells. The Prosecution Teams suggest adding to the end of the inserted sentence "<u>except in the northern area where no monitoring well is located within one-half mile of domestic wells.</u>"
8	III.B.2.g./ P.11 (Map Content)	Deletion of criteria for discharger to use for drawing plume boundary lines on maps and insertion of language for discharger to use "best professional judgment."	The Prosecution Team's objections to the removal of criteria for plume mapping and insertion of "best professional judgment" are the same as described in Comments #13, #17, and #21 in the Draft CAO. The Prosecution Team recommends reinstating the original text containing plume mapping criteria to be consistent with prior board orders, such as CAO R6V-2008-0002-A4, Order I.C. in the "Groundwater Monitoring and Reporting Program in Attachment 8.
9	III.B.2.h./ P.11 (Map Content)	Insertion of section that begins, "Identify all areas within one-mile outside of the plume boundary where…"	This added requirement contradicts Finding 19, top of page 6 in the Draft CAO: The Advisory Team uses specific language that "prescriptive plume definition and mapping requirements are no longer needed, as the plume map is not being used to determine who gets replacement

Groundwater Monitoring and Reporting Program, Attachment 8			
Comment #	CAO section/page	Advisory Team Language	Prosecution Team Comment
			water." But, as indicated in this section, plume mapping is required for the discharger to comply with this requirement. Therefore, the Prosecution Team recommends removing Finding 19 in the Draft CAO.
10	III.B.3.d.i./ P.12 (Report Content)	Insertion of the criteria of "4 ppb for Cr(VI)/Cr(T)" for water sample results showing a relative percentage difference of 25% or greater to trigger re-analyzing.	Justification for using 4 ppb as the criteria was not provided in this section or in a finding. Given that the maximum chromium background levels are 3.1 ppb Cr(VI) and 3.2 ppb Cr(T), the Prosecution Teams recommends that these numbers be used as the criteria for triggering re-analyzing of water samples.

Attachment 2

PG&E Chromium Plume Maps Over Time



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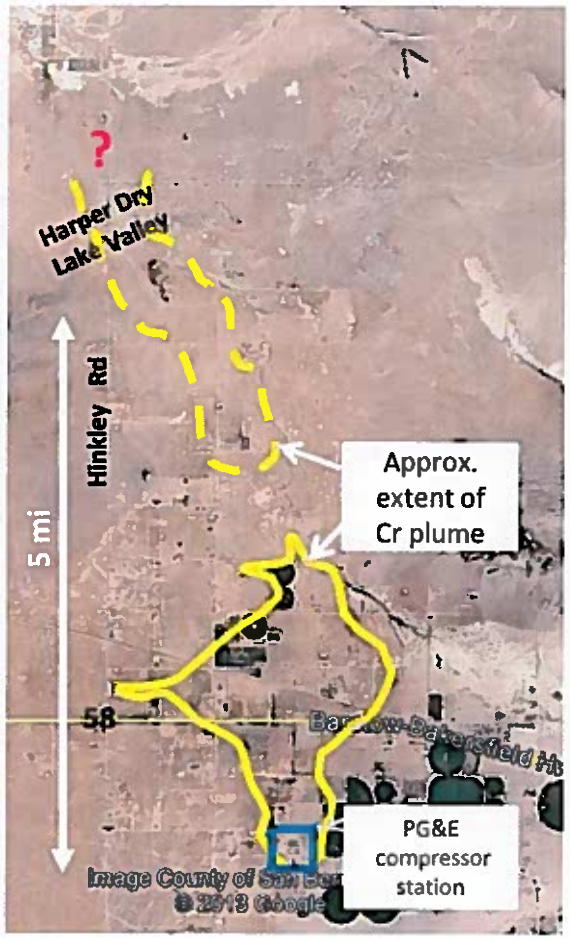

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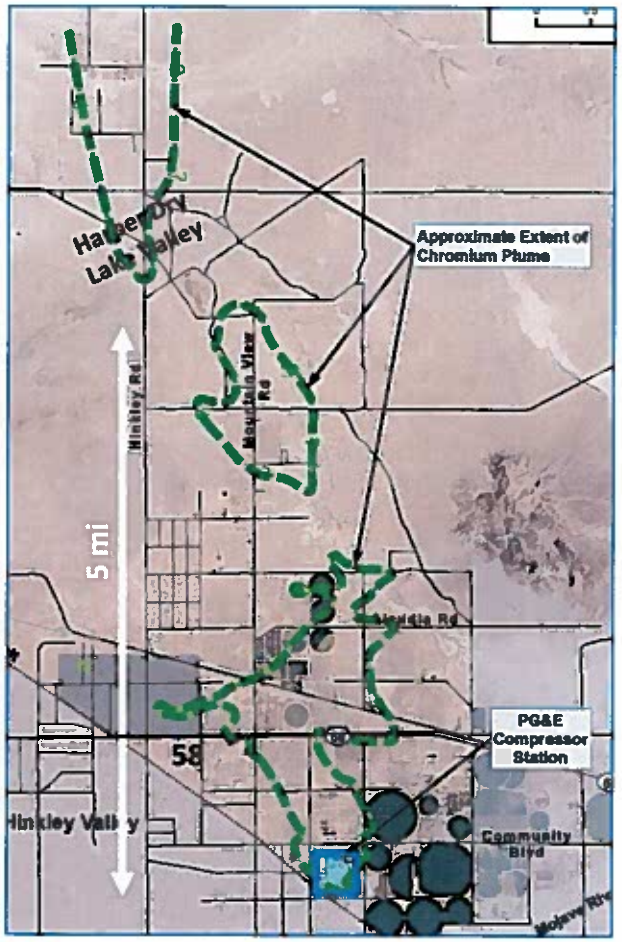

2nd Quarter 2014

Groundwater

Issue Paper/

Exceptionally Long MTBE Plumes of the Past Have Greatly Diminished

by James M. McDade[1], John A. Connor[2], Shawn M. Paquette[2], and Julia M. Small[2]

Abstract

Studies published in the late 1990s and early 2000s identified the presence of exceptionally long methyl tert-butyl ether (MTBE) plumes (more than 600 m or 2000 feet) in groundwater and have been cited in technical literature as characteristic of MTBE plumes. However, the scientific literature is incomplete in regard to the subsequent behavior and fate of these MTBE plumes over the past decade. To address this gap, this issue paper compiles recent groundwater monitoring records for nine exceptional plumes that were identified in prior studies. These nine sites exhibited maximum historical MTBE groundwater plume lengths ranging from 820 m (2700 feet) to 3200 m (10,500 feet) in length, exceeding the lengths of 99% of MTBE plumes, as characterized in multiple surveys at underground storage tank sites across the United States. Groundwater monitoring data compiled in our review demonstrate that these MTBE plumes have decreased in length over the past decade, with five of the nine plumes exhibiting decreases of 75% or more compared to their historical maximum lengths. MTBE concentrations within these plumes have decreased by 93% to 100%, with two of the nine sites showing significant decreases (98% and 99%) such that the regulatory authority has subsequently designated the site as requiring no further action.

Introduction

Methyl tert-butyl ether (MTBE) was used in the United States primarily as an octane enhancer and fuel oxygenate from the late 1970s to 2004, with use continuing until 2006 in some states. When compared to other components of gasoline (i.e., alkanes and aromatics), MTBE has a: (1) higher water solubility; (2) lower sorption coefficient (i.e., lower retardation); and (3) lower Henry's constant (i.e., less volatilization from water). Initial studies in the 1990s posited that MTBE was generally recalcitrant to natural biodegradation (Yeh and Novak 1991; Suflita and Mormile 1993; Hubbard et al. 1994; Mormile et al. 1994; Neilson 1994). As a result of its physical and chemical characteristics, some scientists predicted that releases of MTBE to groundwater would result in MTBE-affected groundwater plumes that were much longer than plumes of the traditional gasoline components, benzene, toluene, ethylbenzene, and xylenes (BTEX) (Fogg et al. 1998; Odencrantz 1998; Weaver et al. 1999; Haas and Trego 2001). The discovery of MTBE plumes that were more than 600 m long (2000 ft) located on Long Island, New York (five sites) and Southern California (one site) (Weaver et al. 1996, 1999; Salanitro et al. 2000; Haas and Trego 2001; Thuma et al. 2001) appeared to support these expectations.

More recent papers continue to cite these exceptional plumes as representative of the dimensions and persistence of typical MTBE plumes over time (Kane et al. 2001; Douthit 2003; Linnemann 2003; Arey and Gschwend 2005; Myrttinen et al. 2009). However, the fate of these nine exceptional plumes over time has never been investigated, and there has been no update in the literature regarding the current plume status. Prior to initiating this investigation, we hypothesized that these exceptional MTBE plumes could have reduced significantly in size

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and concentration over the ensuing decade, consistent with findings of more recent investigations showing that MTBE and its microbial breakdown product, tert-butyl alcohol (TBA), stabilize and diminish at rates comparable to benzene plumes (Stevens et al. 2006; Tarr and Galonski 2007; Kamath et al. 2012; McHugh et al. 2014). The goal of this issue paper has been to provide an update to the current MTBE plume status (i.e., dimensions, plume length, and maximum concentrations) and advance the understanding of the behavior of MTBE plumes based on over a decade of water quality data.

For the purpose of this evaluation, MTBE plumes of 600 m (2000 ft) or more in length have been characterized as "exceptional" with respect to the common lengths of BTEX and/or MTBE plumes reported in a number of studies (Happel et al. 1998; Mace and Choi 1998; Reid et al. 1999; Reisinger et al. 2000; Shorr and Rifai 2002; Rifai et al. 2003; Wilson 2003; Shih et al. 2004; Kamath et al. 2012, Connor et al. 2014). Based on these prior studies, the 90th percentile MTBE plume length is approximately 120 m (400 ft) and the 99th percentile length is approximately 430 m (1400 ft). Consequently, MTBE plumes greater than 600 m (2000 ft) in length represent much less than 1% of plumes.

In total, nine sites have been identified for the purpose of this investigation, including seven underground storage tank (UST) sites, one refinery facility, and one bulk terminal facility (Table 1). Of the nine sites, six were identified in the literature listed above for the Long Island, New York and Southern California sites. We recognize that these nine sites do not represent a comprehensive list of all exceptionally long MTBE plumes; however, these sites are often cited as evidence of MTBE plume dimensions, and this issue paper aims to provide an update to the current conditions of these exceptional plumes.

Methodology

Each of the nine sites evaluated in this study had been delineated in three dimensions (length, width, and depth), thereby confirming that diving or detached plumes had not escaped the monitoring well network (API 2006). The monitoring records at these sites provide from 5 to 19 years of groundwater data, with the total number of monitoring wells at each site ranging from 79 to 445 (includes multilevel sampling wells). At each of the nine sites, the analytical groundwater sampling program included analysis of BTEX and MTBE, with TBA and other fuel oxygenates (i.e., ethanol, tert-amyl methyl ether [TAME], etc.) analyzed at six of the nine sites. Monitoring data were obtained through literature searches, Freedom of Information Act (FOIA) requests from regulatory agency files, and/or contact with regulatory project managers. For each site, we reviewed the available information to extract the following key facts: (1) historical and recent plume lengths and dimensions, (2) groundwater concentrations over time, (3) hydrogeologic and geochemical parameters, (4) the number and volume of gasoline releases, (5) the number

Table 1
Summary Information of Nine Exceptional MTBE Plumes

No.	MTBE Plume Location	Type of Facility	Volume of Release (L)	Groundwater Seepage Velocity (m/year)	Maximum Past MTBE Plume Length (m)	Most Recent MTBE Plume Length (m)	Years Between Observed Maximum and Most Recent Plume Length (Dates)	Percent Reduction in Plume Length over Time
1	Deer Park, New York	Service station	75,700	150	3200	2780	9 (2001 to 2010)	13%
2	East Patchogue, New York	Service station	50,300–55,300	175	1270	530	4 (2003 to 2007)	58%
3	Hampton Bays, New York	Service station	17,000	50–75	820	150	8 (2003 to 2011)	81%
4	Lindenhurst, New York	Service station	Not reported	200	1370	75	11 (1999 to 2010)	94%
5	Riverhead, New York	Service station	Not reported	125	1190	0	8 (1997 to 2005)	>99.9%
6	Uniondale, New York	Service station	28,000	150–180	1860	1740	6 (2003 to 2009)	7%
7	Port Hueneme, California	Service station	40,900	35–110	1460	560	10 (2002 to 2012)	61%
8	San Diego, California	Terminal/pipeline	1,136,000	Shallow: 170	2260	310	9 (2003 to 2012)	86%
9	Rhineland, Germany	Refinery	Not reported	Shallow: 1100	1220	290	3 (2006 to 2009)	76%

and location of additional sources, and (6) remediation activities for both the source zone and the downgradient plume areas. The Supporting Information provided with this paper includes a list of site-specific references that were used to determine plume lengths, concentrations vs. time, hydrogeology, remediation activities, etc. The Supporting Information also includes more detailed site-specific information documenting conditions for the nine sites in this study.

Groundwater plume lengths were defined based upon the applicable regulatory criteria at each location. Therefore, MTBE plumes for sites in New York and California were contoured to the state-specific regulatory criteria for MTBE in groundwater of 10 µg/L and 5 µg/L, respectively (CADHS 1998; NYSDEC 2008). Regulatory criteria were not specified for the Rhineland, Germany site; consequently, plume dimensions were estimated based upon a 10 µg/L concentration limit for MTBE. Plume lengths were defined as the cumulative length of affected groundwater exceeding this concentration limit (i.e., from the furthest upgradient exceedance point to the furthest downgradient exceedance point). This measurement is distinct from the commonly used "extent of the plume" (i.e., the distance of the plume from the source). In addition, the plume lengths presented in this paper include the source zone of light nonaqueous liquid (LNAPL), if present.

The cumulative plume length also accounts for detached plumes with several "pockets" of affected groundwater above the regulatory limits. Detached plumes of this nature were observed at six of the nine sites, but in no case had the detached plumes migrated beyond the extent of the monitoring well network. The percent reductions in MTBE concentrations over time were calculated by comparing the historical maximum concentration to the most recent maximum concentration observed at the site from the total monitoring well population.

Description and History of Nine Exceptional MTBE Plumes

Summary information regarding the site location, release volume, groundwater velocity, and historical and recent MTBE plume lengths are provided in Table 1 (see Tables S1 through S4 for additional details on site conditions, including aquifer geologic characteristics).

Site Remediation Activities

At each of the nine sites, some form of remediation activity has been conducted with the goal of reducing the source mass and/or addressing the downgradient portion of the plume (see Table S3 for remediation activities). In this issue paper, we do not attempt to separate the effects of natural attenuation processes vs. active remediation with regard to their effects on the plume dimensions and concentrations. Rather, we have evaluated each plume to determine the degree to which the plume has persisted or diminished under the combined effect of these processes.

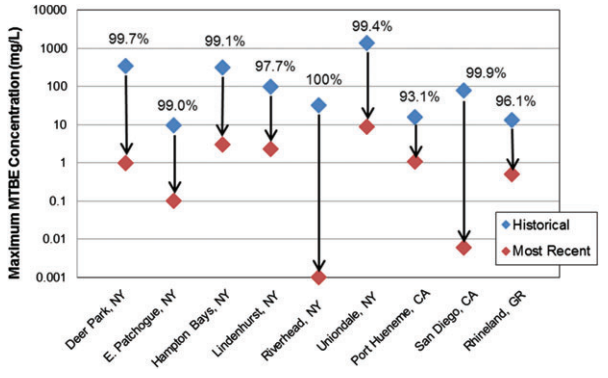

Figure 1. Percent reduction in MTBE maximum concentrations over time.

Results

Reduction in MTBE Plume Concentrations over Time

For all nine sites, the maximum site MTBE concentrations over time decreased by over 90%, with six of the nine sites exceeding 99% reduction (see Figure 1), representing a two order of magnitude decrease in the maximum MTBE concentration (see Table S4 for detailed concentration data). The minimum percent reduction in the maximum MTBE concentration over time was 93.1% (Port Hueneme, California site), which represents an approximate one order of magnitude decrease in the maximum MTBE concentration. Plume concentrations have been evaluated by comparing the historical maximum MTBE concentration among all monitoring wells to the most recent MTBE maximum concentration among all monitoring wells at each site. This method provides a lower-end estimate of the concentration change over time, and is not affected by the possible displacement of the plume center of mass.

Reduction in MTBE Plume Lengths and Source Zone Concentrations over Time

As shown in Table 1 and Figure 2(a) through 2(g), five of the nine MTBE plumes have reduced in length by over 75% from their past reported maximum lengths, and seven of nine plumes have reduced by over 50%. The median length reduction for the nine MTBE plumes is 76%. Two plumes evidence reductions in length of less than 15% (Deer Park and Uniondale, New York), however, as shown on isopleth contours created for the plumes on Figure 3(a) and 3(b), significant mass reductions were nevertheless observed at these sites.

Evaluation of Associated BTEX and TBA Plumes

In general, the observed historical maximum BTEX plumes at these sites were shorter than the historical maximum MTBE plumes; however, BTEX plumes greater than 275 m (900 ft) in length were observed at seven of the nine sites (see Table 2). BTEX plume lengths at the eight sites with data have generally decreased over time, similar to the MTBE plumes.

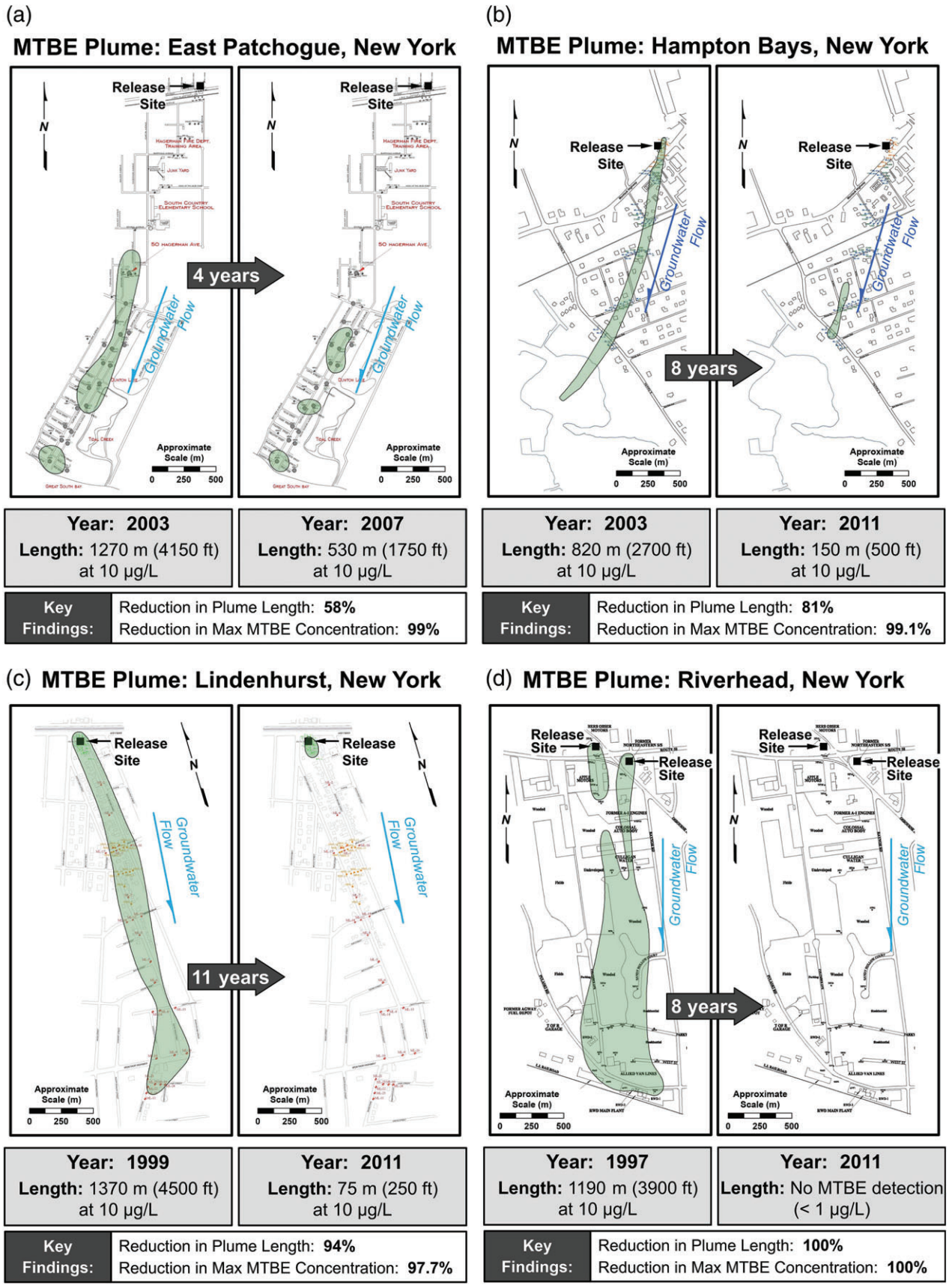

Figure 2. Comparison of maximum plume length vs. most recent plume length (a through g).

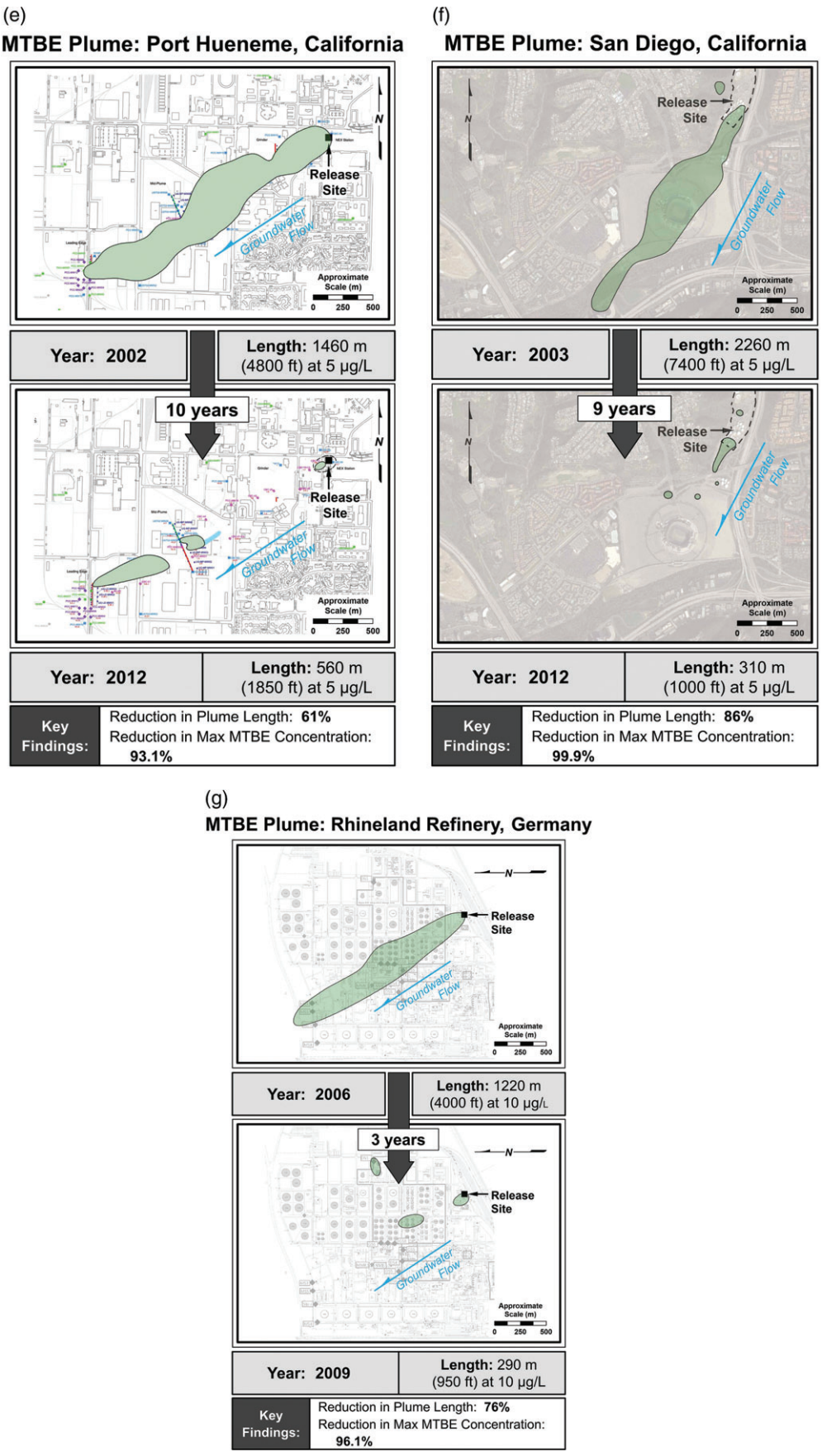

Figure 2. Continued

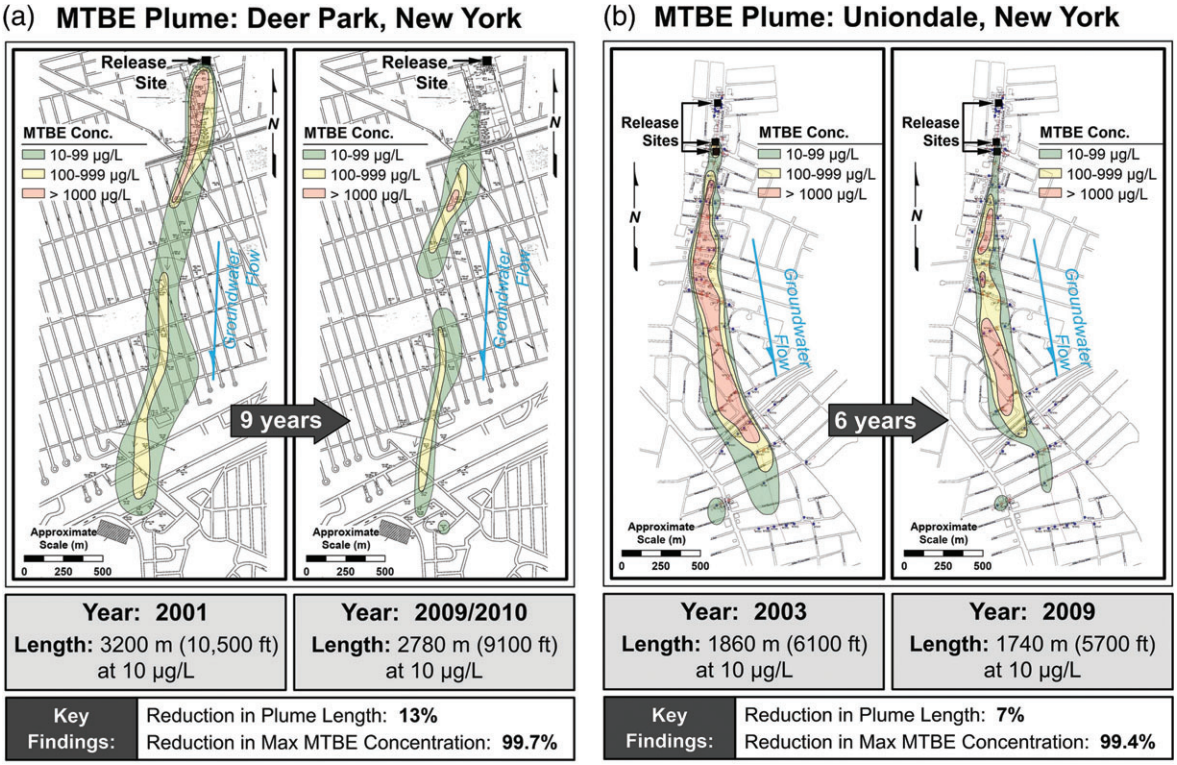

Figure 3. Comparison of maximum plume length vs. most recent plume length with MTBE iso-contours (a and b).

At the three sites where TBA monitoring was routinely conducted (Hampton Bays, New York; Port Hueneme, California; and San Diego, California), the observed maximum TBA plume lengths were approximately the same length or shorter than the MTBE plumes (see Figure 4(a) through 4(c)). As shown in Table 2, TBA groundwater plume lengths ranged from 820 to 1740 m (2700 to 5700 feet) corresponding to 77% to 100% of the maximum length of the corresponding MTBE plume. In general, the plume lengths for the MTBE and TBA plumes at the Hampton Bays, New York site, were of the same length historically, with both plumes decreasing in length at approximately the same rate (see site-specific references in Supporting Information). This is likely due to the fact that the plumes have the same end point with discharge of the plumes into Tiana Bay initially, and subsequently, the downgradient groundwater extraction system located hydraulically upgradient of Tiana Bay (see Figure 4(a)). Maximum TBA plume lengths for the Port Hueneme and San Diego, California sites, were shorter than the corresponding MTBE plume lengths (see Table 3). TBA plumes at the Port Hueneme and San Diego, California sites are likely shorter in length than the corresponding MTBE plumes because of remediation systems located downgradient of the source (i.e., biobarriers and groundwater extraction, respectively) that have effectively limited the length of both MTBE and TBA plumes. More recent reports for both sites indicate that plume lengths and mass flux of TBA are decreasing (see site-specific reference in Supporting Information). For the San Diego, California site, it was estimated that the mass of dissolved TBA had been reduced 94% from 2005 to 2012 (56 to 5.9 kg; see site-specific references in Supporting Information).

Common Factors Contributing to Exceptional MTBE Plumes

Compared to the general population of MTBE plume sites, these nine exceptional MTBE plume sites share the following characteristics:

1 Larger volume gasoline releases: As shown in Table 1, the reported release volumes for the nine sites investigated in this study range from 17,000 to 1,136,000 L (4500 to 300,000 gallons). Excluding the release of 1,136,000 L (300,000 gallons), which was associated with historical releases from aboveground storage tanks and pipelines on a bulk terminal facility, the median release volume is approximately 41,000 L (10,800 gallons). According to a USEPA study, the average reported gasoline release from USTs in the United States is 2300 to 2650 L (600 to 700 gallons) (USEPA 1987). Consequently, the reported release volumes for exceptional MTBE plume sites with UST releases are over 6 to 29 times greater than the average UST release in the United States.
2 Higher groundwater velocity: At all nine sites, the underlying affected aquifer consisted of either sand or gravel, with eight of the nine sites consisting of highly permeable coarse sand/ gravel deposits. Groundwater seepage velocities uniformly exceeded 60 m/year (200 ft/year), and seven of nine sites exhibited seepage

Table 2
Maximum Reported MTBE, BTEX, and TBA Plume Lengths

No.	MTBE Plume Location	Maximum MTBE Plume Length (m)	Maximum BTEX Plume Length (m)	Maximum TBA Plume Length (m)
1	Deer Park, New York	3200	370	IDE
2	East Patchogue, New York[1]	1270	1590	[2]
3	Hampton Bays, New York[1]	820	610	820
4	Lindenhurst, New York	1370	490	IDE
5	Riverhead, New York[1]	1190	270	[2]
6	Uniondale, New York	1860	400	[2]
7	Port Hueneme, California	1460	50	1430
8	San Diego, California	2260	810	1740
9	Rhineland, Germany	1220	Not reported	IDE

IDE = insufficient data to estimate plume length.
[1]Maximum MTBE length terminated at a discharge point (i.e., surface water body or water supply well).
[2]Constituent not reported.

velocities above 120 m/year (400 ft/year) (Table 1). These velocities fall within the upper quartile of seepage velocities as determined in prior surveys of remediation sites in the United States (Newell et al. 1990).

3 Multiple releases or release sites: At four of the nine sites, multiple releases are reported to have occurred at the same site (Deer Park, Riverhead, and Uniondale, New York, and San Diego, California), or multiple plumes from two or more separate sites have merged to create one commingled plume (Riverhead and Uniondale, New York).

4 Groundwater redox condition: The results for the nine sites suggest that the groundwater reduction/oxidation conditions affect the change in plume length over time. Three of the eight sites for which geochemical data were reported (Deer Park, New York; Port Hueneme, California; and San Diego, California) exhibited anoxic groundwater conditions (i.e., dissolved oxygen <1 mg/L). Among these three sites, only the Deer Park site exhibited a decrease in the plume length (13%) over time that was significantly less than that observed at higher-oxygen sites. In addition, all three sites show concentration reductions comparable to the other six sites. These data suggest that anoxic conditions alone are not a reliable predictor of plume behavior, considering the effects of both remediation and natural attenuation.

Conclusions

The updated information for these nine exceptional MTBE plumes indicates that there has been a substantial reduction in concentrations and, in most cases, of plume length over the past decade. Monitoring data show that this plume reduction was not a result of the plume detaching or otherwise moving beyond the monitoring well network. Rather, the plumes were observed to diminish as a function of source or downgradient remediation and natural attenuation factors. As such, our review does not address the full population of exceptional MTBE plumes. Nevertheless, this update to the prior studies should prove useful to other researchers interested in the long-term behavior of MTBE, benzene, and TBA associated with petroleum releases.

Overall Reduction of Exceptional MTBE Plumes

Seven of the nine plumes have decreased in length by over 50% since the time of their past maximum observed lengths, with five of the nine plumes, exhibiting an MTBE plume length reduction of 75% or greater. Additionally, all nine sites exhibited at least a one order of magnitude (i.e., 90%) reduction in the maximum MTBE concentration observed at the site over time, with six of the nine sites exhibiting a reduction in maximum MTBE plume concentrations of two orders of magnitude (more than 99%).

Two sites, Deer Park and Uniondale, New York, exhibited a smaller reduction in MTBE plume length than the other seven sites (13% and 7%, respectively). Limited plume reduction for the Uniondale, New York site may be the result of a comingled MTBE plume with at least four potential sources and multiple releases over time. In addition, at the Deer Park, New York site, sulfate reducing and methanogenic conditions in the groundwater aquifer might be contributing to the limited MTBE plume reduction over time, as attenuation rates might be slower under these reduction-oxidation conditions compared to sites that are more aerobic. Nevertheless, significant reductions in MTBE concentrations and mass were observed at both of these sites, with 99.7% and 99.4% reductions in maximum MTBE concentrations over time, respectively.

Effects of Remediation vs. Natural Attenuation

Insufficient information is available for most of these nine sites to assess the relative effects of remediation vs. natural attenuation on the MTBE plumes. However, at the three sites where TBA concentrations were measured in groundwater, the data show that biodegradation of MTBE to TBA is an important factor in MTBE plume attenuation.

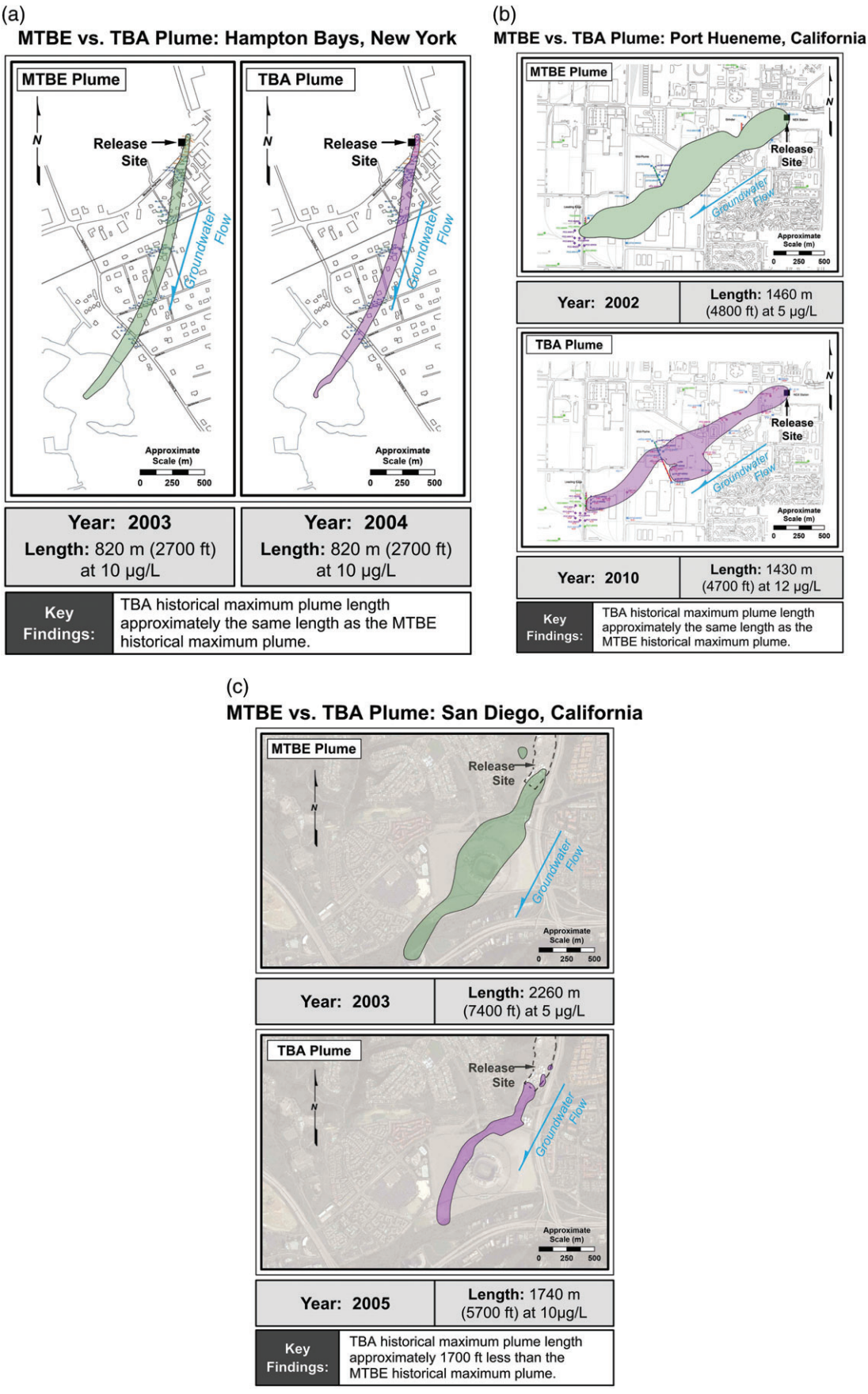

Figure 4. Comparison of maximum MTBE plume length vs. maximum TBA plume length (a through c).

Table 3
Summary of MTBE and TBA Plume Information for Sites with Sufficient Data

Plume Location	Maximum MTBE Plume Length (m)	Year Maximum MTBE Plume Observed	Maximum TBA Plume Length (m)	Year Maximum TBA Plume Observed	Maximum MTBE Conc. Observed (mg/L)	Maximum TBA Conc. Observed (mg/L)
Hampton Bays, New York	820	2003	820	2004	320	84
Port Hueneme, California	1460	2002	1430	2010	16	7.7
San Diego, California	2260	2003	1740	2005	78	49

The conversion of MTBE to TBA is further evidenced by the TBA plume lengths being of similar or shorter length to the MTBE plumes. In addition, observed TBA concentrations are generally consistent with concentrations that would be expected from biodegradation. Detailed studies of natural attenuation of MTBE and TBA have been conducted at the Port Hueneme and San Diego, California sites (see site-specific references in the Supporting Information), and studies at both sites conclude that biodegradation of MTBE to TBA is contributing to the attenuation of the MTBE plumes. For example, site-specific information for the San Diego, California site, indicates that approximately 44% (102 kg) of the total estimated MTBE mass (231 kg) within the plume has been removed by natural attenuation from the period of 2002 to 2012 (see site-specific references in the Supporting Information).

Acknowledgments

The authors would like to thank the American Petroleum Institute for the partial funding and technical support for this research, as well as GSI Environmental Inc. for financial support. We would also like to thank Pat Cardone and Kristy Salafrio of NYSDEC Region 1 for their contributions and assistance in obtaining important site information.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Site-specific references and reports.
Table S1. Summary Information on Release Conditions for Nine Exceptional MTBE Plumes
Table S2. Hydrogeologic Characteristics Reported for Nine Exceptional MTBE Plumes
Table S3. Remediation Activities for the Source Zone and Downgradient Plume
Table S4. Reduction in Maximum MTBE Concentration over Time

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Project Proposal Summary

Occurrence of natural and anthropogenic Cr VI in groundwater near a mapped plume, Hinkley, CA

By: John A. Izbicki

Problem: The Pacific Gas and Electric Company (PG&E) Hinkley Compressor Station, 3 miles southeast of Hinkley, CA and 80 miles northeast of Los Angeles, is used to compress natural gas as the gas is transported through pipelines from Texas to California. Between 1952 and 1964, cooling water was treated with a compound containing chromium to prevent corrosion within the compressor station. This water was discharged to unlined ponds, resulting in contamination of soil and groundwater within the underlying alluvial aquifer. In 2007, a study intended to characterize naturally-occurring background concentrations estimated average Cr VI concentrations in the area of 1.2 micrograms per liter (µg/L). The normal 95 percent upper tolerance limit of 3.1 µg/L from the 2007 background study was adopted as the cleanup level for remediation at the site. The Regional Water Quality Control Board subsequently agreed to revisit the 2007 background study in response to criticism of the study's methodology and the increase in mapped extent of the plume between 2008 and 2011.

Objectives: The purpose of this study is to evaluate the occurrence of natural and anthropogenic Cr VI, and estimate naturally-occurring background Cr VI concentrations upgradient, near the plume margins, and downgradient from a mapped Cr VI contamination plume near Hinkley, CA.

Approach: The cooperator for this study is the Lahontan Regional Water Quality Control Board. The scope of the study was developed by the U.S. Geological Survey in collaboration with the Technical Working Group (TWG) composed of local stakeholders (the Hinkley Community Advisory Committee, CAC), community advisors (Project Navigator, Inc.), State regulatory agencies (Lahontan Regional Water Quality Control Board), and Pacific Gas and Electric and their consultants. The scope of the study includes the following tasks: 1) evaluation of existing data; 2) sample collection and analyses of rock and alluvium; 3) sample collection and analysis for water chemistry and multiple tracers, 4) evaluation of geologic, hydrologic, and geochemical conditions in western, northern, and eastern subareas within the study area; 5) evaluation of historic and present-day groundwater movement, 6) evaluation of the occurrence of natural and anthropogenic chromium; 7) determination of background Cr VI concentrations; and 8) assessment of the fate of chromium following in-situ reduction. The study will begin in Federal Fiscal Year 2014 and end in 2018. An initial fact-sheet style report describing the study approach, an interim report describing selected preliminary results, and a final report will be produced.

Relevance and Benefits: This proposal will contribute to the U.S. Geological Survey's ability to "ensure adequate quantity and quality of water to meet human and ecological needs in the face of growing competition among domestic, industrial-commercial, agricultural, and environmental uses" as described in the U.S. Geological Survey Science Strategy (U.S. Geological Survey, 2007; Evenson and others, 2013). The proposal is within the U.S. Geological Survey Water Resources Mission Areas to "define and better protect the quality of the Nation's water resources."

there is a narrow gap separating Hinkley and Water valleys. The Mount General Fault passes through this gap and volcanic rocks are exposed within the gap (fig. 2).

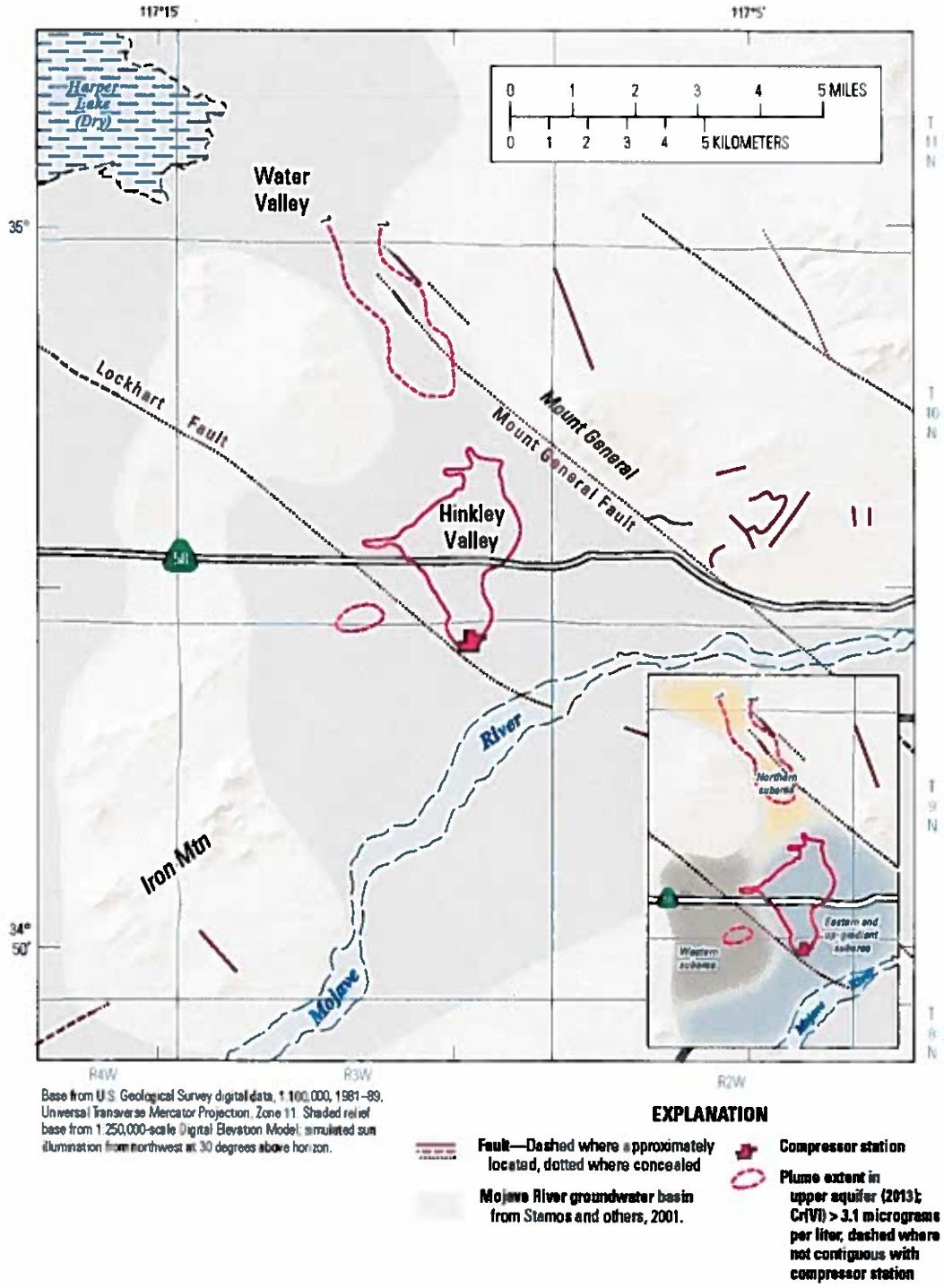

Figure 2.—Study area location.

Alluvial deposits within the valley consist of alluvial-fan deposits eroded from highlands along the valley margins, and alluvium from the Mojave River eroded largely from granitic rock in the San Bernardino Mountains 40 miles to the south. Alluvium within the valley is divided into an upper and lower aquifer

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January 7, 2014

Ms. Anne Holden, PG
Ms. Lisa Dernbach, PG, CHG, CEG
Ms. Lauri Kemper, PE
California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, California 96150

RE: 1. IRP Manager & Community Advisory Committee (CAC) Support and Endorsement of Scope, and
2. USGS's "Actionable Information" Advisory Role to the Background Study's (BGS) Technical Working Group (TWG)[1]: Submission of a BGS "Actionable Information" Decision Tree.

Dear Anne, Lisa and Lauri:

The submission of this BGS-process letter of endorsement, regarding BGS information decision-making, is timely, given that the scope and objectives of USGS's BGS will be presented to the Lahontan Water Board at their meeting in Barstow on January 8, 2013.

BGS stakeholders worked diligently in 2013 to assist USGS's Dr. John Izbicki shape the proposed study's scope of work. A key element of recent discussions has been; "who analyzes and evaluates the incoming information and data, and who has the responsibility for evaluating the quality of such information to make recommendations on possible "project actions? ".

The Technical Working Group (TWG) has extensively discussed these topics, and in both cases, it is the IRP Manager's current opinion that all stakeholders have agreed that within the scope of the BGS proposal, *Dr. Izbicki will be the "decision-maker regarding what information is deemed actionable."* His recommendations regarding such information will then be brought to the TWG for further evaluation.

Equally importantly, this letter introduces a simple BGS decision tree (DT), which the IRP Manager believes the CAC, PG&E, and USGS fully support. This support

[1] The TWG consists of the Water Board (WB), USGS, Pacific Gas and Electric (PG&E) and their consultants Stantec and CH2M Hill, the Community Advisory Committee (CAC) and the IRP Manger.

has been vetted and further verified with these parties since the TWG met in Hinkley in November, 2013.

Key USGS Proposal Discussion Topics at November 21, 2013 TWG Meeting:

Final TWG agreement on the USGS BGS Proposal was reached on November 21, 2013 at a TWG meeting[2] held at the IRP Manager's office. The objective of the meeting was for the TWG to discuss their *final*[3] review of USGS's BGS Proposal, dated September 19, 2013.

In particular, the TWG reviewed and discussed, the aerial extent of the proposed BGS measurements, the path forward on the locations of groundwater sampling for Cr6 measurements, the proposed Cr3 to Cr6 reconversion task (Task 8 of the USGS proposal), the programmatic "adaptive management"[4] style which USGS plans to employ during the conduct of the work, data management, and the recommendations and decision-making process. (On the basis of these key discussions, Dr. Izbicki is also revisiting his projected budgets for each Task).

The objective of this letter is to highlight and report to the Water Board on two important BGS issues and agreements that were reached in the November 21 meeting, and which have subsequently been further verified in separate meetings or discussions the IRP Manager has held separately with the CAC, USGS and PG&E.

The IRP Manager considers these two items to be of such importance, that they are now being submitted in writing to the Water Board:

1. Agreement was reached that Task 8, (Fate of Chromium During *In Situ* Reduction), *will be performed as described* in USGS's draft SOW. There was also recognition and agreement between the TWG members that:
    a) Work on this topic has occurred previously specific to the Hinkley groundwater remediation project[5], and,
    b) The work now planned to be performed by USGS will satisfy the "project stakeholders" as the *last and final* project-specific investigation of Cr3 possible reconversion to Cr6 in the Hinkley Valley groundwaters.

---

[2] The TWG meeting was attended by PG&E, USGS, Water Board, IRP Manager, four CAC Members (Lester White, Daron Banks, Betty Hernandez and Omar Nassar) and the CAC Facilitator (Mindy Meyers).

[3] The planned USGS proposal was discussed at at least six TWG meetings in 2013, held either at USGS in San Diego, or at the IRP Manager's office in Hinkley, CA.

[4] "Adaptive Management" means that the scope and direction of the BGS will be suitably modified when new information is derived via the BGS.

[5] Cr reconversion information discussed in ICF International. *Final Environmental Impact Report: Comprehensive Groundwater Strategy for Historical Chromium Discharges from PG&E's Compressor Station, San Bernardino County.* May 2013. Appendix A.3 pages A.3-1 to A.3-13.

2. The stakeholders' roles in both BGS and global project decision-making were better defined in the meeting. Dr. John Izbicki of USGS will assume the key role in evaluating the importance and quality of information and data being delivered from the BGS for BGS-specific decision making. At a prior November 7, 2013 meeting of the TWG, Dr. Izbicki suggested that, (quote), "solid results can be actionable." This statement was explored further at the November 21, 2013 meeting. Since then, the IRP Manager has condensed the implications of information derived during the conduct of the BGS on the future direction of the BGS, and/or PG&E's activities in general, into a simple **decision-tree (DT)**, which is attached as **Figure 1**. This DT has been reviewed, commented on, and modified via several iterations with USGS, CAC, and PG&E, such that the IRP Manager believes it represents a consensual opinion of how actionable information emanating from the BGS will be generally managed.

Given the collaborative spirit of the BGS planning process to date, and the fact that TWG meetings are immediately pending[6], the IRP Manager considers it prudent and timely to deliver the draft DT to the Water Board for further review and comment.

Should you have any questions or comments, please feel free to contact either of the undersigned at rsanchez@projectnavigator.com or iwebster@projectnavigator.com (714-388-1800 (PNL main number) or 714-388-1821 (RS) or 714-863-0483 (IAW mobile)).

Sincerely yours,

Raudel Sanchez, Ph.D.
Project Manager

Ian A. Webster, Sc.D.
IRP Manager

Attachments

Figure 1: USGS's Cr6 background Study, 2013-2017: "Actionable Information" Decision Tree.

CC:
CAC Members
Patty Kouyoumdjian, Executive Officer, Lahontan Regional Water Quality Control Board
Kevin Sullivan, PG&E
Devin Hassett, Keadjian and Associates
Dr. John Izbicki, USGS
Mindy Meyer, Facilitator, Center for Collaborative Policy

[6] A BGS TWG meeting is planned for January 9, 2014 at the IRP Manager's Office.

FIGURE

HINKLEY Cr6 GROUNDWATER REMEDIATION PROJECT

6th DRAFT

USGS's Cr6 Background Study, 2014-2017

*"Actionable Information" Decision Tree**

USGS Chromium-6 (Cr6) Background Study

- 4 year program
- USGS contracted to Lahontan RWQCB *(Contact: Ann Holden)*
- Budget forecast: TBD
- 8 Main tasks
- Collection and interpretation of data new to Hinkley inciuding:
  - Trend analysis of existing data
  - Sequential extractions from cores and cuttings
  - Tracers of source(s) and hydrologic history of water ($\delta^{18}O$, δD and dissolved gases)
  - Tracers of the age of water (^{3}H, ^{3}He, CFCs, ^{14}C and $^{87/86}Sr$)
  - Tracers of the source(s) of Cr ($\delta^{53}Cr$)
  - Evaluation of local geologic, hydrologic and geochemical conditions
  - Flow modeling (MODFLOW)
  - Fate of Cr6 after *in-situ* reduction

USGS Analysis and Interpretation of Data

- Task specific WPs
- Development of Site Conceptual Model (SCM) from SOW
- Independent data interpretation
- Data Confidence/Quality Assessment

Dr. John Izbicki Defines and Ranks "Actionable Information"†

Range of actions inciude:

- Modifications to direction of BGS (i.e. adaptive management)
- Information which could result in Water Board decision making

Information is Discussed within BGS Technical Working Group (TWG)

- Affects direction of BGS, and/or
- Information could result in Water Board actions

Actions Required?

YES → Conclusions Cause SOW Modifications

NO → No Further Action

- USGS, PG&E, Water Board, CAC Members and IRP Manager met on November 21, 2013 in Hinkley, CA in the presence of Mindy Meyer (facilitator) to discuss the scope of the BGS, and specifically "Actionable Information."

† "Actionable Information" decisions must be based on a limited basis so as not to impede the flow of the BGS. "Actionable Information" may also be reported in the form of USGS short update reports.

- Other technical and programmatic agreements at the November 21, 2013 BGS TWG included (and will be codified separately):
  - The BGS study will employ an "adaptive management philosophy," consistent with above decision-tree.
  - Actionable decisions will be "limited" and occur on reporting timescales of "years."
  - USGS will bring its findings first to the TWG for technical review.
  - BGS Task 8, (investigating Cr3 reconversion), will remain in the BGS scope.
    - There was agreement amongst the Parties that Task 8 will be the "definitive and final word" on the science of Cr3 reconversion (as it applies to the Hinkley project).
    - If Task 8 does show that reconversion could occur, this fact, by itself, does not preclude the use of *in-situ* reductive technologies for Cr6 treatment at Hinkley.
    - Task 8 will also be performed independently of the planned permitting process for expanding/modifying the IRZ(s).

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6th DRAFT

Background Study Decision-Making: Footnotes from Decision Tree

* **USGS, PG&E, Water Board, CAC Members and IRP Manager met on November 21, 2013 in Hinkley, CA in the presence of Mindy Meyer (facilitator) to discuss the scope of the BGS, and specifically "Actionable Information."**

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September 30, 2015

Patty Z. Kouyoumdjian
Executive Officer
California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, California96150

RE: IRP Manager's Comments on the Draft Cleanup and Abatement Order No.R6V-2015-Draft from the California Regional Water Quality Control Board Lahontan Region dated September 1, 2015.

Dear Patty:

The Hinkley Community Chromium-6 Groundwater Remediation Project's Independent Review Panel (IRP) Manager appreciates the opportunity to provide comments to the California Regional Water Quality Control Board Lahontan Region (Water Board) regarding the Draft Cleanup and Abatement Order No. R6V-2015-Draft (Draft CAO) issued on September 1, 2015[1].

The Draft CAO is a critical document which sets the path forward on how the Hinkley Groundwater Remediation Program will be managed for the next few decades. The IRP Manager appreciates the Water Board developing a transparent public "input process" regarding the Draft CAO. The Water Board allowed the Hinkley Community on three separate occasions the opportunity to provide public comment on the Draft and Proposed[2] CAO by holding meetings and workshops as follows:

1. February 26, 2015: Water Board workshop presenting details of the proposed CAO that was originally issued on January 21, 2015. The workshop held at the Hinkley Senior and Community Center;
2. May 28, 2015: Water Board workshop discussing the Six Key Policy Issues[3] from the Proposed CAO. The workshop was held at the Hampton Inn; and

[1] California Regional Water Quality Control Board, Lahontan Region, *Cleanup and Abatement Order No.R6V-2015-Draft, WDID No. 6B369107001*. September 1, 2015.
[2]California Regional Water Quality Control Board, Lahontan Region, Cleanup and Abatement Order No.R6V-2015-Prop, WDID No. 6B369107001. January21, 2015.
[3] IRP Manager, *IRP Manager's Formal Comments and Suggestions Regarding the Six Key Topics from the California Regional Water Control Board Lahontan Region Workshop on May 28, 2015*. June 19, 2015.

3. September 16, 2015: Water Board meeting discussing the September 1st Draft CAO that incorporated consensus language and Advisory Team suggested modifications. Meeting was held at the Holiday Inn and Suites.

All three meetings were productive. They allowed the stakeholders to express consensus agreements, and generated further discussion on items of current importance which still needs to be resolved in the Proposed/Draft CAO.

On September 16, 2015,members of the Prosecution and the Advisory Teams from the Water Board presented and discussed the most important issues and changes incorporated into the Draft CAO. The main discussion topics addressed by the Water Board Prosecution and Advisory Teams included the following items, which need to be incorporated into the Draft CAO:

1. Monitoring and Reporting Plan (MRP)
2. Replacement Water Requirements
3. Cleanup Times
4. Northern and Western Areas and USGS Background Study

The above four topics are further discussed below. *The IRP Manager continues to advocate for a flexible CAO permitting for **"adaptive management"** and **"operational optimization."***

The IRP Manager has briefed and extensively consulted with the Community Advisory Committee (CAC), and other key Community stakeholders, over a series of three regularly scheduled Thursday meetings (during September) at the IRP Manager's office on the four above topics. In these two-hour meetings, we summarized and interpreted the Draft CAO for Community participants, and explained how the operational path-forward can be expected to function under the governance of the Draft CAO.

In our "IRP-Manager communicative style," we made extensive use of charts and diagrams to explain the Draft CAO. **Figure 1** shows the timeline we continuously use during our Thursday evening CAC/IRP meetings and community meetings to explain the pathway for long-term cleanup pathway.

1. Monitoring and Reporting Plan

The Monitoring and Reporting Plan (MRP) sets guidelines on the number of sampling locations, sampling frequencies, constituents to be analyzed and reporting requirements in the Draft CAO for the Cr(VI)plume.

The IRP Manager is in agreement with most of the revisions that were made to the MRP. The IRP Manager recommends the use of Decision Trees to

determine the sampling frequency allows the MRP to be flexible and establish the "right size" of a sampling program at monitoring and domestic well locations in the long term. Areas that show a statistical increase will be sampled more frequently based on criteria established in the Decision Tree to ensure that human health and the environment is protected. There are two Decision Trees to evaluate the sampling program for the southern and northern areas.

The Cr(VI) plume's southern area[4] is where the majority of the monitoring program and groundwater data collection is focused. This locale also contains the highest Cr(VI) concentrations as illustrated in **Figure 2**. Annual evaluations of the MRP will allow areas of concern to be sampled more frequently, while other areas are "right sized" based on the most current information. The IRP Manager is in agreement that two Decision Trees should be used to represent and "right size" the southern and northern areas sampling program. As graphically displayed by Figure 2, the vast majority of the mass of Cr(VI) is located in the plumes southern section[5]. So by focusing groundwater monitoring, and accurate plume delineation efforts, in the southern area, the clean-up of the original Cr(VI) discharge, will be accelerated.

Guideline for plume contouring is a critical component of the MRP and was one of the major discussion topics at the September 16th Water Board meeting. The Water Board's Prosecution Team established the following contouring rules outlined on page 11 of the MRP[6]:

Plume boundary lines shall be drawn to connect any monitoring well located within one half mile (2,600 ft.) of any other monitoring well having chromium concentration of 3.1 ppb Cr6 or 3.2 ppb Cr(T) or greater. Where access is not granted to install additional monitoring wells, plume boundary lines shall be drawn to connect monitoring wells exceeding background concentrations up to one mile apart.

The Water Board's Advisory Team proposed different contouring requirements as outlined on Page 11 of the MRP:

[4] Essentially south of Highway 58.
[5] The IRP Manager is in the process of using data and visuals to compute the relative masses of Cr(VI) in the southern plume area (south of Thompson Road) versus the more northerly located island zones. Our calculations preliminarily suggest that the mass of Cr(VI) in the south is more than 100 times greater than in the north.
[6] Included as Attachment 8 (MRP)as part of the Draft CAO issued on September 1.

Plume boundary lines shall be drawn by a California licensed Professional Geologist or Civil Engineer by evaluating and reporting the site conditions using best professional judgement of the following factors, at a minimum:

i. Geology – pertinent subsurface features such as location and depth to bedrock, influences of structure (e.g. folding and faulting), and stratigraphy.

ii. Hydrogeology – location and hydraulic properties of the hydrostratigraphic units including, as appropriate, hydraulic conductivity, hydraulic gradients (e.g. horizontal and vertical, regional and localized due to groundwater extraction or injection), saturated aquifer thickness, groundwater flow velocities and directions, characteristics of confined, unconfined, and vadose zones.

iii. Geochemistry – nature and extent of contamination, pertinent groundwater chemistry, historical data from monitoring wells, and appropriate trend analyses.

The IRP Manager is in agreement that plume contouring requirements should be based on several lines of evidence as listed above by the Water Board's Advisory Team. Currently, the "Best Professional Judgement" for the interpretation of plume contouring is an issue that PG&E's consultants and the Water Board's Prosecution Team are not in agreement. The differences in opinions could be resolved if data and information from the USGS Background Study (BGS) is introduced into the project's dynamics. The BGS will provide "Best Professional Judgement" of areas of natural and anthropogenic Cr(VI) in the Hinkley Valley based on several lines of evidence. Data and learning from the BGS may serve as a bridge towards consensus with key stakeholders to determine the extent of the Cr(VI)plume.

Figure 3 shows an S-Curve of the understanding of plume contouring as a function of time. The S-Curve shows there is a good understanding on the accuracy of plume contouring (specifically in the south where the highest concentrations are reported and highest density of monitoring are located)Once the BGS is completed, within the next few years, it would result in building a comprehensive consensus with all stakeholders.

Community members have expressed their concerns with the change to the contouring requirements in the Draft CAO. One community member, Penny Harper, expressed the following regarding the Water Board's Advisory Team proposed changed to contouring the plume.

"I agree with the present Cr(VI) plume boundaries for the 2nd Quarter 2015. It's important to retain the plume boundaries in the north area of Hinkley. I agree with the Water Board's Prosecution Team on this. The present Cr(VI)

plume boundary should stand until the results of the USGS background study is finalized."

The MRP is flexible and has a mechanism to reevaluate the sampling program each year based on the most current information and science. This mechanism will allow relevant information from the BGS to be incorporated into the MRP based on several lines of evidence that will be collected as part of this key study. Because the USGS BGS is in progress the IRP Manager is in agreement with Water Board Prosecution Team's requirements for plume contouring at this time until the completion of the USGS BGS.

2. Replacement Water Requirements

The replacement water program has always been a key issue to the Hinkley Community. PG&E provided replacement water to community until the replacement water program was discontinued last October. The IRP Manager understands that the Water Board can only require PG&E to supply replacement water to residents that are at, or above, the Cr(VI) MCL as discussed in the Olin Order.

The IRP Manager has received feedback from community members in favor of removing the term "Affected Area" since it generates a negative image for the Hinkley community, according to some community members. Other communities members prefer to keep the term "Affected Area." The IRP Manager has no preference either for or against the term "Affected Area." Language in the Draft CAO defines "Affected Wells[7]" and the IRP Manager agrees that this language in the Draft CAO is protective of human health since PG&E will be required to provide replacement water.

The IRP Manager suggest that replacement water supply requirements outlined in Section VII.2.a should be for all indoor uses and not just for drinking and cooking as revised by the Advisory Team. Bathing should also be part of the indoor water used and the IRP Manager is suggesting that the previous language prepared by the Prosecution Team be used instead.

3. Remedial Cleanup Times

[7] Affected Wells are defined as domestic wells or community wells in the domestic well sampling area defined in the "Groundwater Monitoring and Reporting Program, CAO No.R6V-2015-PORP", Attachment 8, containing chromium in concentrations (measured at any time by PG&E or by local, state or federal agencies) that are above the primary drinking water standards of 10 ppb Cr (VI) or 50 ppb Cr (T) and where the chromium detections are linked to PG&E's historical releases.

As we suggested in our previous comment letters, we recommend the use of remediation cleanup timeframe with adaptive management over specific deadlines. The use of remediation goals with adaptive management approach is the best solution, in our opinion, to strive to reach remediation cleanup times with changing field conditions that could affect performance with a massive influx of data, which can guide the project.

PG&E submitted a remedial timeframe assessment report to the Water Board on June 30, 2014[8]. The objective of the remedial timeframe assessment report was to estimate realistic range of remedial timeframes and to present the certainty of timeframe estimates to guide remedial goals development and cleanup goals. Adaptive Management principles should be used to obtain realistic remediation timeframes by running the PG&E computer model when major field changes occur to ensure that the timeframe is representative of actual field conditions.

PG&E's computer model used in the remedial timeframe assessment is based on many assumptions and uses current field conditions or boundary conditions. Boundary conditions are input conditions that a computer model requires to estimate future field conditions and cleanup times. Boundary conditions consist of the pumping information, amount of ethanol used at the *In-Situ* Reactive Zones (IRZs), location of wells, Agricultural Treatment Units (ATUs) acreage, area of interest, porosity and hydraulic conductivity, to name a few. If any field conditions change in the future, such as, adding or removing ATUs, modifications to the IRZ and modifications to groundwater pumping program then remedial timeframe will not be representative of future conditions and should not be used. For this reason, the IRP Manager recommends using remediation goals with adaptive management to ensure remedial goals are feasible and achievable.

4. **Northern and Western Areas and USGS Background Study**

The Northern and Western Areas are currently being studied as part of the USGS BGS. The IRP Manager is suggesting that any relevant interim results from the BGS should be incorporated into the MRP that guides the monitoring requirements for the Northern and Western Areas. Using adaptive management with data generated from the BGS will ensure a flexible MRP in the Northern and Western Areas.

We recommend that these two areas be monitored in accordance with the MRP until any relevant data is generated in these two areas. We suggest

[8] Arcadis. 2014. *Remedial Timeframe Assessment, PG&E Hinkley Compressor Station, Hinkley, Ca*. June 30.

adopting the MRP until the BGS is completed or consider adjustment if substantive data is generated from the BGS to warrant making an appropriate decision. However, if any major anomalies occur in these two areas, they should be discussed and action items addressed with the Technical Working Group (TWG[9]) to identify the appropriate actions.

The IRP Manager is in agreement with the language in the Draft CAO that incorporating the results of the USGS BGS will contribute to the Final CAO and the Hinkley Groundwater Remediation Program.

5. Conclusions and Recommendations

Overall, the IRP Manger is in agreement with the language outlined in the Draft CAO, except for items 1 and 2 discussed above. The IRP Manager continues to advocate that the Final CAO should be a combination of both prescriptive and performance based requirements but favoring performance based in the long run. Performance based requirements should recognize, and where possible, embrace an Adaptive Management approach to ensure that the Final Remedy is protective of human health and the environment. Having a flexible Final CAO will benefit all stakeholders by ensuring human health and the environment is protected.

Should you have any questions or comments, please feel free to contact either of the undersigned via email or phone:

Dr. Raudel Sanchez: rsanchez@projectnavigator.com, 714-388-1821.
Dr. Ian A. Webster: iwebster@projectnavigator.com, 714-863-0483.

Sincerely yours,

Raudel Sanchez, Ph.D.
Project Manager

Ian A. Webster, Sc.D.
Hinkley IRP Manager

[9] Technical Working Group (TWG) consists of the USGS, Water Board, PG&E, Community Members and the IRP Manager.

cc: CAC Members
Anna Marie Cwieka, Optimum Results, Inc.
Halil I Kavak, Ph.D., Project Navigator, Ltd.
Mark Landress, P.G., Project Navigator Ltd
Lauri Kemper, Lahontan Regional Water Quality Control Board
Anne Holden, Lahontan Regional Water Quality Control Board
Betsy Brunswick, PG&E

Attachments

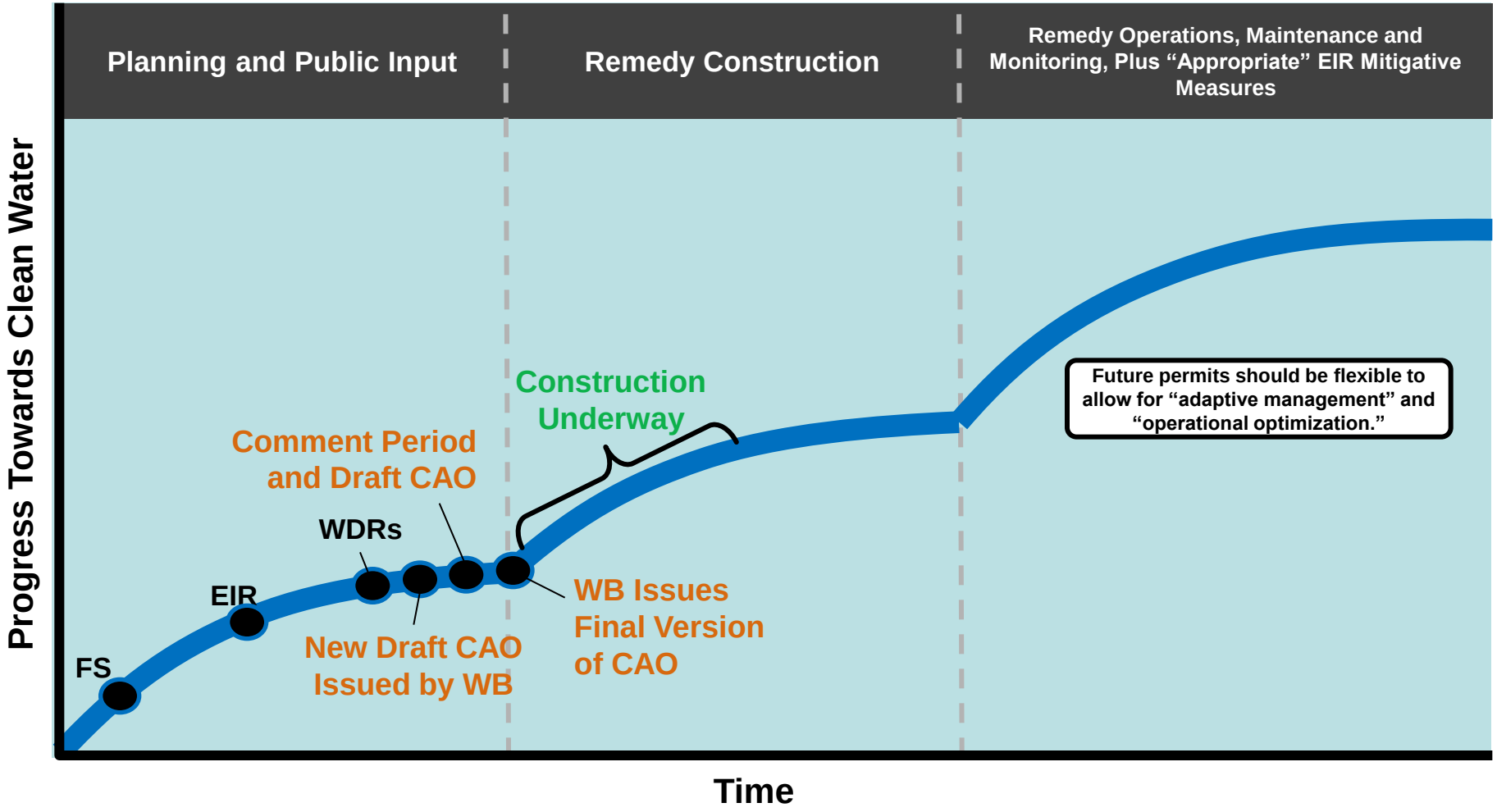
Figure1: Draft Cleanup and Abatement Order (Draft CAO) is a Major Step in the Long Cleanup Pathway

Figure 2: Tower Plot: Cr(VI) Groundwater Concentration Distribution in Hinkley Valley for 2015 Q2

Figure 3: S-Curve: The USGS BGS Will Provide Significant Data Confidence and Plume Contour Consensus

FIGURE 1

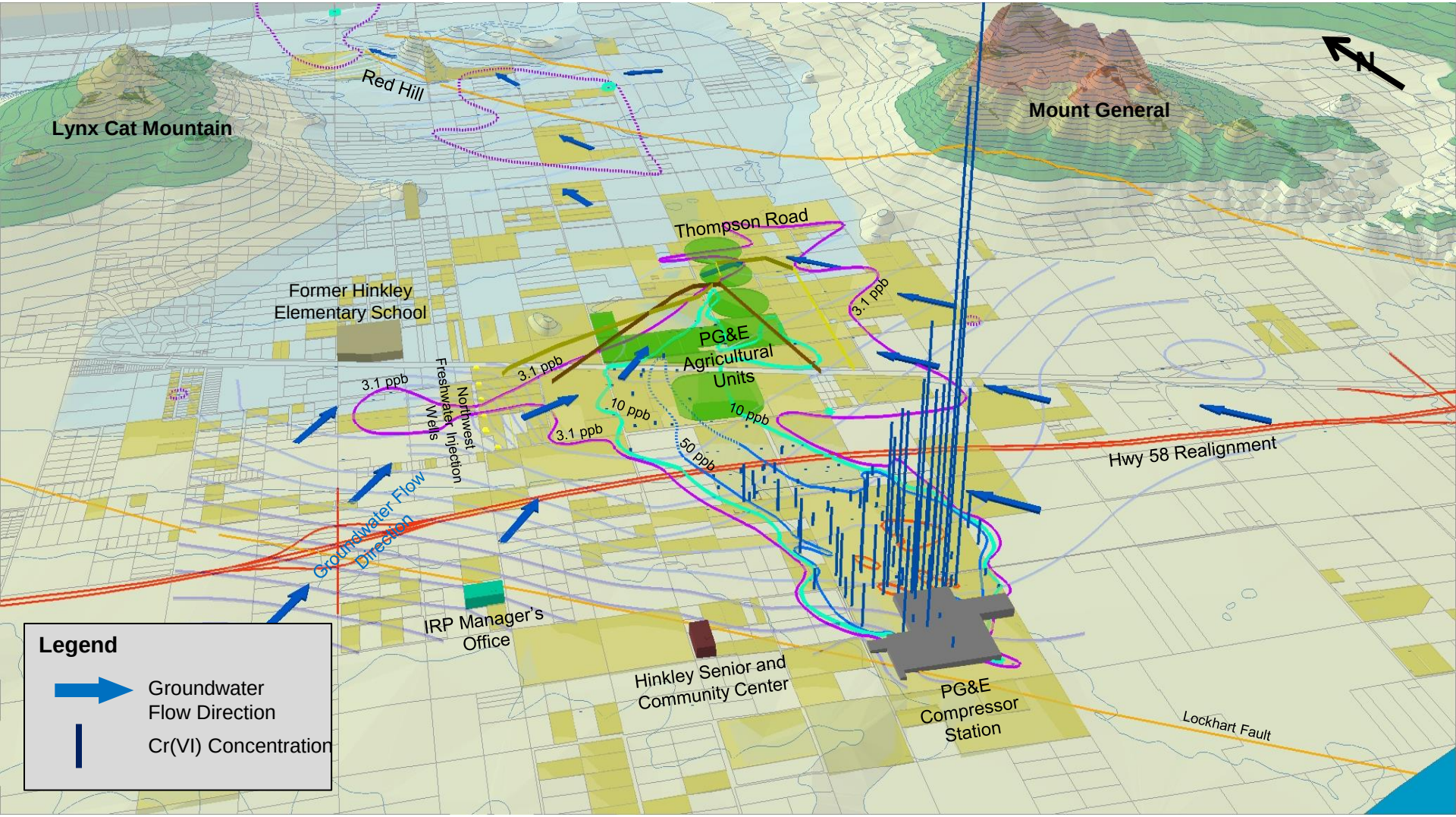
Draft Cleanup and Abatement Order (Draft CAO) is a Major Step in the Long Cleanup Pathway



PROJECT NAVIGATOR, LTD.

FIGURE 2

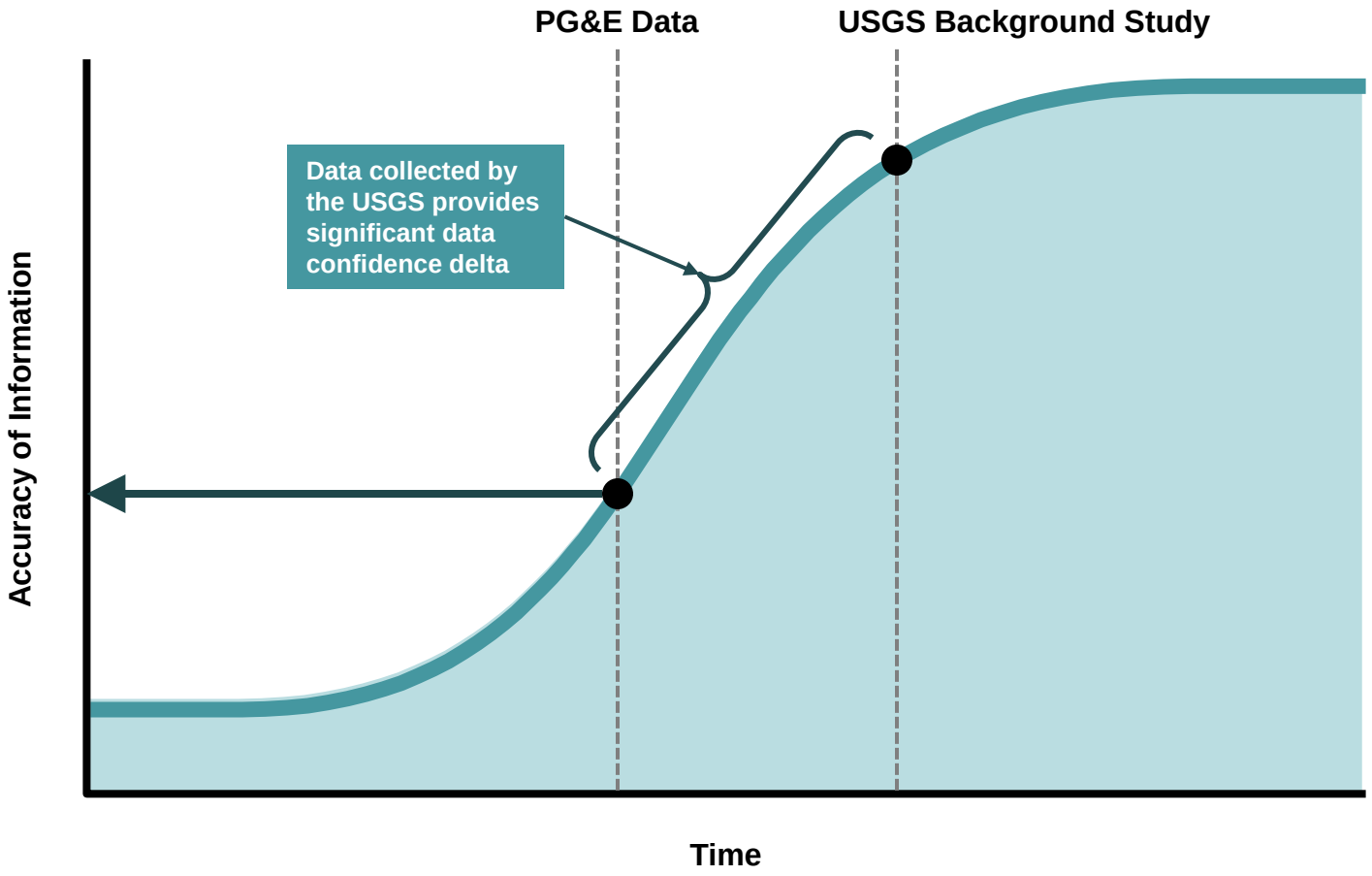
Tower Plot: Cr(VI) Groundwater Concentration Distribution in Hinkley Valley for 2015 Q2



PROJECT NAVIGATOR, LTD.

FIGURE 3

S-Curve: The USGS BGS Will Provide Significant Data Confidence and Plume Contour Consensus



PROJECT NAVIGATOR, LTD.

From: [redacted]
To: RB6enfproceed@waterboards
Subject: Re: PG&E Proposed CAO
Date: Wednesday, September 30, 2015 5:23:53 PM

Hello,
In addition to my comments below. I would also like to bring to your attention that PG&E should be required to provide whole house water to affected well owners who exceed chromium 6 concentrations of the drinking wate standard. They should not be able to get away with just providing water for drinking such as an evasive RO unit that ruins the infrastructure of the counter tops and takes up a lot of space in the house where space is limited. They need to provide WHOLE HOUSE SYSTEMS where they are responsible for the contamination. For example if I am running a business out of my house and have employees, than OSHA requirement number 1910.141(b)(1)(I) requires that potable water shall be provided in all places of employment, for drinking, washing of the person, cooking, washing of foods, washing of cooking or eating utensils, washing of food preparation or processing premises, and personal service rooms. The under sink RO units that they provide do not meet this requirement and it is not fair that as a business owner I would have to spend a ton of money in order to comply with OSHA requirements because PG&E contaminated my property. I also think that the way the plume is currently being drawn should remain the same. There is no need to change this because PG&E's expert could say that they just believe the plume should be draw a certain way and not have any burden of proof on their end. What if it turns out that the plume is being drawn incorrectly based on PG&E's expert? Are you going to fine PG&E a civil penalty for each day the plume was drawn incorrectly? There is no checks and balances with regards to the proposed way the plume should be drawn and there is no wording stating that the expert has to be 100% sure that this is the way the new plume should be drawn.

Sincerely,
Sam

On Friday, March 13, 2015 11:29 AM, Sam Knott [redacted] wrote:
I own property in Hinkley and would like to submit comments on the water boards proposed hinkley PG&E cleanup order. The water board should require PG&E to monitor the northern plumes more than what is proposed. The use of monitoring wells and domestic wells is important. PG&E should supply the residents in the northern area with complete whole house replacement water systems if there is an increase of chromium 6 concentrations measured in domestic and or monitoring wells. Residents in the northern plume areas have been forced to drill deep wells to avoid PG&E contaminated water but also due to that are now drinking water high in aresenic (can't win). The water board should order full whole house replacement water in the north and not just undersink reverse osmosis units just because PG&E doesnt want to monitor in that area as much as they do in the south, for the residents that show increasing trends of chromium in either domestic and monitoring wells. The water board has even shown proof that the chromium in the north is PG&E's responsibility. This order should also increase the monitoring for arsenic and uranium in the north due to PG&E remediation activity and also require PG&E to supply whole house water to residents that are affected by PG&E arsenic, uranium, and water elevation dropping due to their remediation. Everyone is now focusing only on the "south" plume and not the north plume. The north plume is just as important as the south plume because this could have been stopped from migrating several years ago.

Sincerely,
Sam

From: [redacted]
To: RB6enfproceed@waterboards; [redacted]
Subject: FW: Comments for PG&E
Date: Wednesday, September 30, 2015 8:06:12 AM
Attachments: Comments PGE 9-30-2015.pdf
CR 6 Report.pdf

Please feel free to call if you have any questions in regard to these comments. Eldert Van Dam 760-954-9548

[redacted]

To whom it may concern,

I’m asking that PG&E be required to do some testing outside their so called box.

I live to the east of Lenwood Road at 26599 Community Blvd. Any time I have mentioned to staff about my concerns of CR6 to the east of Lenwood Road it would fall on a deaf ear, staff would only comment, not PG&E’s responsibility. I ask why?? PG&E has not tested east of Lenwood Rd, why not? My comment to staff is "Lahontan can require PGE to test east of Lenwood Rd. for CR6 and any other contaminants related to the mess." Attached are about 180 CR6 tests dating back to 2000 when all CR6 tests would come back as "ND". Then as time went by results would fluctuate up and down to a high of "6.6". All of these tests are to the east of Lenwood Rd. In 2000 you can see that the back ground of CR6 would be "ND" so where did this CR6 come from??
So PG&E should be ordered to test until they find their eastern boundary of "ND" and then continue testing in the east to make sure the plume isn't moving.
Remember PG&E put some kind of water curtain up on the westerly side to stop the plume's westerly movement, they claim it worked, so now that they plugged that hole in the leaky bucket where is the water flowing now?? Well common sense says the next easiest way for water to flow is the path it will take, could that be to the east?? There are times that there may be adequate pumping in the plume area to maintain the plume in that local area, but as soon as pumping slows down and the inflow to that aquifer exceeds the pumping rate, the CR6 is on the move as it was to the west at one time. So with all that said I hope you can incorporate some kind of solution to the complexed problem that I have presented.
I've had my dairy for sale some time back for a reasonable price and nobody would touch it, as I had to disclose that I had knowledge of the CR6 in the water. So until this issue is resolved there is no way out for me, as this property is my 401k and retirement income.

Issue #2
Nitrates
As this CR6 laced water flows in an easterly direction it also will bring with it the nitrate problem that is associated with the Hinkley area. Having a dairy, all of a sudden, I become the guilty one with nitrate contamination, not because of my doings. The inflow of water has a nitrate concentration that is already higher than safe drinking levels. I have some tests showing high nitrates to the west of my Dairy. Actually just to the east of Lenwood Road and Hwy 58 Nitrates as Nitrogen (No3) is at 64 with the MLC being 45 or less and the CR6 is 1.2. Looking north from this location the old dump (Lenwood-Hinkley Land Fill) is not far away as the crow fly's. Looking at a water flow map from Geo-Logic dated November, 2014 it shows the water flow is due south right at the south-west boundary of the dump looking at the monitoring reports there is some very high nitrates in that area, (LH-21D and LH-22S both three times the MCL) so as nitrate loaded water migrates south I would say it is a likely chance that it will intercept the easterly flow somewhere between HWY 58 and Community Blvd. So with that said does anybody really have all the **scientific** results as to where the nitrates come from??

Driving by one of the new ag. units I see a huge pile of sludge that has been imported to the Hinkley Valley I ask why? My famous line is when people ask if I have manure, I tell them, "I have fresh daily" In the upcoming CAO please address the nitrate issue's. The use of imported nutrients is second choice to local, economically priced materials. Our price is right when it comes to the manure we will beat anybody's price!

Will these ag. units have a nutrient management plan, and monitoring reports?

427	USGS			009N003W01R005S	6/25/1992	USGS	Cr6			ug/L		
80	Well 1	Dairy 1			8/29/2000	Clinical Lab	Cr6	SM 3500-Cr	ND	ug/L	5	
81	Well 2	Dairy 2			8/29/2000	Clinical Lab	Cr6	SM 3500-Cr	ND	ug/L	5	
462	Well 1				8/29/2000	Clinical Lab	Cr6	SM3500-CR	ND	ug/L	5	
463	Well 2				8/29/2000	Clinical Lab	Cr6	SM3500-CR	ND	ug/L	5	
544	Fresh Water		G50419-1A		7/11/2005	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
430	USGS			009N003W01R005S	12/10/2009	USGS	Cr6		1.7	ug/L		
79	Test Well	West	ISL1837-01	09N02W03E03	12/15/2009	Test America	Cr6	EPA 218.6	ND	mg/L	0.001	
288	Test Well	West	ISL1837-01	09N02W03E03	12/15/2009	Test America	Cr6	EPA 218.6	ND	mg/L	0.001	
296	Test Well		ISL1892-02	09N02W03E01	12/16/2009	Test America	Cr6	EPA 218.6	0.002	mg/L	0.001	
77	Test Well	East	ISL1892-01	09N02W03E02	12/16/2009	Test America	Cr6	EPA 218.6	ND	mg/L	0.001	
82	Test Well	East	ISL1892-01	09N02W03E02	12/16/2009	Test America	Cr6	EPA 218.6	ND	mg/L	0.001	
295	Test Well	East	ISL1892-01	09N02W03E02	12/16/2009	Test America	Cr6	EPA 218.6	ND	mg/L	0.001	
12	#5 Clean Water	Dairy 2			12/13/2010	Clinical Lab	Cr6	EPA 218.6	1.4	ug/L	1.0	
221	5# Cleanwater 2A	Dairy 2			12/13/2010	Clinical Lab	Cr6	EPA 218.6	1.4	ug/L	1	
18	#7 Clean Water	Dairy 1			12/13/2010	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
227	7# Cleanwater 4A	Dairy 1			12/13/2010	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
203	2 Dairy #2	Dairy 2			3/1/2011	Clinical Lab	Cr6	EPA 218.6	1	ug/L	1	
215	6 Hwy 58	Hwy 58			3/1/2011	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
206	3 Test Well S.W.	West		09N02W03E01-03	3/1/2011	Clinical Lab	Cr6	EPA 218.6	4.7	mg/L	1	
200	1 Dairy #1	Dairy 1			3/1/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
209	4 Dairy 1	Dairy 1			3/1/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
212	5 Dougs House	Bordock			3/1/2011	Clinical Lab	Cr6	EPA 218.6	ND	mg/L	1	
658	Hwy 58	Hwy 58			3/22/2011	Clinical Lab	Cr6	EPA 218.6	1.4	ug/L	1.1	
649	Dairy 1	Dairy 1			3/22/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
652	Dairy 2	Dairy 2			3/22/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
655	Bordock	Bordock			3/22/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1.1	
661	West Test Well	West			3/22/2011	Clinical Lab	Cr6	EPA 218.7	ND	ug/L	1.1	
664	East Test Well	East			3/22/2011	Clinical Lab	Cr6	EPA 218.8	ND	ug/L	1	
57	#2 Raul's House Hwy 58	Hwy 58			4/1/2011	Clinical Lab	Cr6	EPA 218.6	1.4	ug/L	1.1	
54	#1 Dough's House=Jimmy	Bordock			4/1/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
60	#3-3 Test Well SW	West		09N02W03E01-03	4/1/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1.1	
63	#4-2 Test Well	East		09N02W03E01-02	4/1/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
66	#5 Dairy 1#	Dairy 1			4/1/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
69	#6 Dairy 2#	Dairy 2			4/1/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
348	#4 Pig Farm	East			6/27/2011	Clinical Lab	Cr6	EPA 218.6	1.3	ug/L	1	
339	#1 Doug's House	Bordock			6/27/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
342	#2 Rauls House	Hwy 58			6/27/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
345	#3 Test Well SW	West		09N02W03E01-03	6/27/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
351	#5 Dairy 1# Clean Water	Dairy 1			6/27/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
354	#6 Diary 2# Clean Water	Dairy 2			6/27/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	

323	3 Doug House	Bordock			11/17/2011	Clinical Lab	Cr6	EPA 218.6	0.081	ug/L		
317	1# Test Well #1-SW by pen #1	West			11/17/2011	Clinical Lab	Cr6	EPA 218.6	0.26	ug/L		
329	5 Dairy 1# Clean	Dairy 1			11/17/2011	Clinical Lab	Cr6	EPA 218.6	0.66	ug/L		
334	7 Dairy 2# Clean	Dairy 2			11/17/2011	Clinical Lab	Cr6	EPA 218.6	0.98	ug/L		
326	4 Rauls House	Hwy 58			11/17/2011	Clinical Lab	Cr6	EPA 218.6	1.1	ug/L	1	
320	2# Test Well #2 SE by Pig Farm	East			11/17/2011	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
107	#8 Wash Water	Dairy 2			12/28/2011	Clinical Lab	Cr6	EPA 218.6	0.089	ug/L		
92	#3 Bordock- Jimmy Doug	Bordock			12/28/2011	Clinical Lab	Cr6	EPA 218.6	0.18	ug/L		
86	#1 West Test Well SW by pen 1#	West			12/28/2011	Clinical Lab	Cr6	EPA 218.6	0.27	ug/L		
98	#5 Clean Water	Dairy 1			12/28/2011	Clinical Lab	Cr6	EPA 218.6	0.84	ug/L		
95	#4 Hwy 58 Rauls House	Hwy 58			12/28/2011	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
104	#7 Clean Water	Dairy 2			12/28/2011	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
89	#2 East Test Well SE by Pig Pen	East			12/28/2011	Clinical Lab	Cr6	EPA 218.6	1.8	ug/L	1	
101	#6 Wash water	Dairy 1			12/28/2011	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
682	Dairy 2 Wash Water	Dairy 2			5/21/2012	Clinical Lab	Cr6	EPA 218.6	0.022	ug/L	1	
676	Dairy 1 Wash Water	Dairy 1			5/21/2012	Clinical Lab	Cr6	EPA 218.6	0.049	ug/L	1	
688	Myers	Myers			5/21/2012	Clinical Lab	Cr6	EPA 218.6	0.13	ug/L	1	
697	Hills Ranch	Hills			5/21/2012	Clinical Lab	Cr6	EPA 218.6	0.2	ug/L	1	
667	Bordock	Bordock			5/21/2012	Clinical Lab	Cr6	EPA 218.6	0.3	ug/L	1	
691	West Test Well	West			5/21/2012	Clinical Lab	Cr6	EPA 218.6	0.31	ug/L	1	
673	Dairy 1	Dairy 1			5/21/2012	Clinical Lab	Cr6	EPA 218.6	0.72	ug/L	1	
685	Mark & Judy	Zimmerman			5/21/2012	Clinical Lab	Cr6	EPA 218.6	0.84	ug/L	1	
679	Dairy 2	Dairy 2			5/21/2012	Clinical Lab	Cr6	EPA 218.6	1.1	ug/L	1	
694	East Test Well	East			5/21/2012	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
670	Hwy 58	Hwy 58			5/21/2012	Clinical Lab	Cr6	EPA 218.6	1.7	ug/L	1	
36	#6 New Dirty	Dairy 2			6/4/2012	Clinical Lab	Cr6	EPA 218.6	0.022	ug/L	1	
30	#4 Old Dirty	Dairy 1			6/4/2012	Clinical Lab	Cr6	EPA 218.6	0.049	ug/L	1	
42	#8 Myer's	Myers			6/4/2012	Clinical Lab	Cr6	EPA 218.6	0.13	ug/L	1	
51	#11 Hills Ranch	Hills			6/4/2012	Clinical Lab	Cr6	EPA 218.6	0.2	ug/L	1	
21	#1 Bordock=Jimmy	Bordock			6/4/2012	Clinical Lab	Cr6	EPA 218.6	0.30	ug/L	1	
45	#9 West Test Well	West		09N0W03E01-03	6/4/2012	Clinical Lab	Cr6	EPA 218.6	0.31	ug/L	1	
27	#3 Old Clean	Dairy 1			6/4/2012	Clinical Lab	Cr6	EPA 218.6	0.72	ug/L	1	
39	#7 Zimmerman's	Zimmerman			6/4/2012	Clinical Lab	Cr6	EPA 218.6	0.84	ug/L	1	
33	#5 New Clean	Dairy 2			6/4/2012	Clinical Lab	Cr6	EPA 218.6	1.1	ug/L	1	
48	#10 East Test Well	East		09N02W02E-01	6/4/2012	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
24	#2 Hwy 58 House	Hwy 58			6/4/2012	Clinical Lab	Cr6	EPA 218.6	1.7	ug/L	1	
72	3A Dairy 1	Dairy 1	1210528-03		6/12/2012	BC Lab	Cr6	EPA 218.6	0.62	ug/L	0.2	
700	Dairy 1	Dairy 1			6/12/2012	BC Labs	Cr6	EPA 218.6	0.62	ug/L		
74	5A Zimmerman	Zimmerman	1210528-05		6/12/2012	BC Lab	Cr6	EPA 218.6	0.7	ug/L	0.2	
702	Zimmerman	Zimmerman			6/12/2012	BC Labs	Cr6	EPA 218.6	0.7	ug/L		
73	4A Diary 2	Dairy 2	1210528-04		6/12/2012	BC Lab	Cr6	EPA 218.6	0.95	ug/L	0.2	
701	Dairy 2	Dairy 2			6/12/2012	BC Labs	Cr6	EPA 218.6	0.95	ug/L		

71	2A Hwy 58	Hwy 58	1210528-02		6/12/2012	BC Lab	Cr6	EPA 218.6	1.1	ug/L	0.2	
699	Hwy 58	Hwy 58			6/12/2012	BC Labs	Cr6	EPA 218.6	1.1	ug/L	0.2	
76	7A Test Well Pig Farm	East	1210528-07		6/12/2012	BC Lab	Cr6	EPA 218.6	1.4	ug/L	0.2	
704	East Test Well	East			6/12/2012	BC Labs	Cr6	EPA 218.6	1.4	ug/L		
70	1A Jimmy	Bordock	1210528-01		6/12/2012	BC Lab	Cr6	EPA 218.6	<0.20	ug/L	0.2	
75	6A Test Well by pen 1#	West	1210528-06		6/12/2012	BC Lab	Cr6	EPA 218.6	<0.20	ug/L	0.2	
698	Bordock	Bordock			6/12/2012	BC Labs	Cr6	EPA 218.6	<0.20	ug/L	0.2	
703	West Test Well	West			6/12/2012	BC Labs	Cr6	EPA 218.6	<0.20	ug/L		
122	5 Old Dirty	Dairy 1			10/1/2012	Clinical Lab	Cr6	EPA 218.6	0.028	ug/L	1	
128	7 New Dirty	Dairy 2			10/1/2012	Clinical Lab	Cr6	EPA 218.6	0.034	ug/L	1	
131	8 SW Field 53 ft	West			10/1/2012	Clinical Lab	Cr6	EPA 218.6	0.23	ug/L	1	
110	1 Jimmy Bordock	Bordock			10/1/2012	Clinical Lab	Cr6	EPA 218.6	0.47	ug/L	1	
119	4 Old Clean	Dairy 1			10/1/2012	Clinical Lab	Cr6	EPA 218.6	0.75	ug/L	1	
113	2 Zimmerman	Zimmerman			10/1/2012	Clinical Lab	Cr6	EPA 218.6	0.88	ug/L	1	
125	6 New Clean	Dairy 2			10/1/2012	Clinical Lab	Cr6	EPA 218.6	1.2	ug/L	1	
116	3 Hector Hwy 58	Hwy 58			10/1/2012	Clinical Lab	Cr6	EPA 218.6	1.3	ug/L	1	
134	9 SE Field 56 ft	East			10/1/2012	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
140	#2 West	West			12/18/2012	Clinical Lab	Cr6	EPA 218.6	0.24	ug/L	1	
143	#3 Bordock- Jimmy Doug	Bordock			12/18/2012	Clinical Lab	Cr6	EPA 218.6	0.38	ug/L	1	
146	#4 Zimmerman	Zimmerman			12/18/2012	Clinical Lab	Cr6	EPA 218.6	0.7	ug/L	1	
152	#6 1# Dairy Clean	Dairy 1			12/18/2012	Clinical Lab	Cr6	EPA 218.6	0.73	ug/L	1	
157	#8 2# Clean Water	Dairy 2			12/18/2012	Clinical Lab	Cr6	EPA 218.6	1.1	ug/L	1	
149	#5 Hwy 58 House	Hwy 58			12/18/2012	Clinical Lab	Cr6	EPA 218.6	1.2	ug/L	1	
137	#1 East	East		09N02W02E-01	12/18/2012	Clinical Lab	Cr6	EPA 218.6	1.4	ug/L	1	
710	West Test Well	West			3/29/2013	Clinical Lab	Cr6	EPA 218.6	0.22	ug/L	1	
713	Bordock	Bordock			3/29/2013	Clinical Lab	Cr6	EPA 218.6	0.26	ug/L	1	
728	Howels	Howels			3/29/2013	Clinical Lab	Cr6	EPA 218.6	0.66	ug/L	1	
719	Hwy 58	Hwy 58			3/29/2013	Clinical Lab	Cr6	EPA 218.6	0.71	ug/L	1	
716	Zimmerman	Zimmerman			3/29/2013	Clinical Lab	Cr6	EPA 218.6	0.72	ug/L	1	
722	Dairy 1	Dairy 1			3/29/2013	Clinical Lab	Cr6	EPA 218.6	0.74	ug/L	1	
707	East Test Well	East			3/29/2013	Clinical Lab	Cr6	EPA 218.6	1.6	ug/L	1	
725	Irrigaiton Well	Irrigation Well			3/29/2013	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
737	Irrigaiton Well	Irrigation Well			4/12/2013	Clinical Lab	Cr6	EPA 218.6	0.14	ug/L	1	
749	Bordock	Bordock			4/12/2013	Clinical Lab	Cr6	EPA 218.6	0.14	ug/L	1	
746	Pivot Lenwood/Community	Pivot Lenwood/Community			4/12/2013	Clinical Lab	Cr6	EPA 218.6	0.26	ug/L	1	
734	Dairy 2	Dairy 2			4/12/2013	Clinical Lab	Cr6	EPA 218.6	0.66	ug/L	1	
740	Hwy 58	Hwy 58			4/12/2013	Clinical Lab	Cr6	EPA 218.6	1.1	ug/L	1	
731	Dairy 1	Dairy 1			4/12/2013	Clinical Lab	Cr6	EPA 218.6	1.2	ug/L	1	
743	J. Arrodondo	J. Arrodondo			4/12/2013	Clinical Lab	Cr6	EPA 218.6	1.2	ug/L	1	
752	Adam Lara	Adam Lara			4/12/2013	Clinical Lab	Cr6	EPA 218.6	1.9	ug/L	1	
779	Pivot Lenwood/Community	Pivot Lenwood/Community			6/17/2013	Clinical Lab	Cr6	EPA 218.6	0.27	ug/L	1	
761	Bordock	Bordock			6/17/2013	Clinical Lab	Cr6	EPA 218.6	0.42	ug/L	1	

773	Irrigaiton Well	Irrigation Well			6/17/2013	Clinical Lab	Cr6	EPA 218.6	0.49	ug/L	1	
776	Howels	Howels			6/17/2013	Clinical Lab	Cr6	EPA 218.6	0.71	ug/L	1	
770	Dairy 1	Dairy 1			6/17/2013	Clinical Lab	Cr6	EPA 218.6	0.79	ug/L	1	
764	Zimmerman	Zimmerman			6/17/2013	Clinical Lab	Cr6	EPA 218.6	0.83	ug/L	1	
767	Hwy 58	Hwy 58			6/17/2013	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
755	East Test Well	East			6/17/2013	Clinical Lab	Cr6	EPA 218.6	1.7	ug/L	1	
758	West Test Well	West			6/17/2013	Clinical Lab	Cr6	EPA 218.6	6.1	ug/L	1	
785	Irrigaiton Well	Irrigation Well			7/16/2013	Clinical Lab	Cr6	EPA 218.6	0.27	ug/L	1	
782	Bordock	Bordock			7/16/2013	Clinical Lab	Cr6	EPA 218.6	0.42	ug/L	1	
784	Dairy 1	Dairy 1			7/16/2013	Clinical Lab	Cr6	EPA 218.6	0.77	ug/L	1	
783	Hwy 58	Hwy 58			7/16/2013	Clinical Lab	Cr6	EPA 218.6	1.2	ug/L	1	
786	Dairy 2	Dairy 2			7/16/2013	Clinical Lab	Cr6	EPA 218.6	1.4	ug/L	1	
780	East Test Well	East			7/16/2013	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
781	West Test Well	West			7/16/2013	Clinical Lab	Cr6	EPA 218.6	6.6	ug/L	1	
641	Bordock	Bordock			8/5/2013	Clinical Lab	Cr6	EPA 218.6	0.34	ug/L	1	
643	Irrigaiton Well	Irrigation Well			8/5/2013	Clinical Lab	Cr6	EPA 218.6	0.64	ug/L	1	
646	Howard by Track	Howard by Track			8/5/2013	Clinical Lab	Cr6	EPA 218.6	0.66	ug/L	1	
644	Dairy 2	Dairy 2			8/5/2013	Clinical Lab	Cr6	EPA 218.6	1.2	ug/L	1	
642	Hwy 58	Hwy 58			8/5/2013	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
645	Howard	Howard			8/5/2013	Clinical Lab	Cr6	EPA 218.6	1.5	ug/L	1	
640	West	West			8/5/2013	Clinical Lab	Cr6	EPA 218.6	1.8	ug/L	1	
639	East	East			8/5/2013	Clinical Lab	Cr6	EPA 218.6	6.6	ug/L	1	
795	OLD DAIRY SUPPLY WELL	DAIRY 1			12/18/2013	Clinical Lab	Cr6	EPA 218.6	0.17	ug/L	1	
801	DAIRY #2 SUPPLY WELL	DAIRY 2			12/18/2013	Clinical Lab	Cr6	EPA 218.6	0.86	ug/L	1	
789	Test Well 09N02W02E01	East		09N02W02E01	12/18/2013	Clinical Lab	Cr6	EPA 218.6	1.6	ug/L	1	
792	Test Well 09N02W0301-03	West		09N02W0301-03	12/18/2013	Clinical Lab	Cr6	EPA 218.6	5.2	ug/L	1	
798	Irrigaiton Well	Irrigation Well			12/18/2013	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
808	JIMMY'S HOUSE BORDOCK	Bordock			1/10/2014	DE LAVALLE	Cr6	EPA 218.6	0.37	ug/L		
810	OLD DAIRY SUPPLY WELL	DAIRY 1			1/10/2014	DE LAVALLE	Cr6	EPA 218.6	0.75	ug/L		
812	NEW DAIRY SUPPLY WELL	DAIRY 2			1/10/2014	DE LAVALLE	Cr6	EPA 218.6	1.1	ug/L		
809	Hwy 58	Hwy 58			1/10/2014	DE LAVALLE	Cr6	EPA 218.6	1.3	ug/L		
806	PIG FARM	East	#1 MW	09N02W02E01	1/10/2014	DE LAVALLE	Cr6	EPA 218.6	1.6	ug/L		
807	PEN #1	West		09n02w0301-03	1/10/2014	DE LAVALLE	Cr6	EPA 218.6	5.8	ug/L		
811	Irrigaiton Well	Irrigation Well			1/10/2014	DE LAVALLE	Cr6	EPA 218.6	ND	ug/L		
830	Irrigaiton Well	Irrigation Well			3/11/2014	Clinical Lab	Cr6	EPA 218.6	0.35	ug/L	1	
818	West Test Well BY PEN 1	West		09N02W0301-03	3/11/2014	Clinical Lab	Cr6	EPA 218.6	0.36	ug/L	1	
821	Bordock	Bordock			3/11/2014	Clinical Lab	Cr6	EPA 218.6	0.36	ug/L	1	
827	DAIRY 1# SUPPLY WELL	DAIRY 1			3/11/2014	Clinical Lab	Cr6	EPA 218.6	0.8	ug/L	1	
833	DAIRY #2 SUPPLY WELL	DAIRY 2			3/11/2014	Clinical Lab	Cr6	EPA 218.6	0.81	ug/L	1	
824	Hwy 58	Hwy 58			3/11/2014	Clinical Lab	Cr6	EPA 218.6	1.4	ug/L	1	
815	East Test Well	East			3/11/2014	Clinical Lab	Cr6	EPA 218.6	1.6	ug/L	1	
845	Hwy 58	Hwy 58			6/10/2014	Clinical Lab	Cr6	EPA 218.6	1.3	ug/L	1	

836	PIG FARM	East			6/10/2014	Clinical Lab	Cr6	EPA 218.6	1.6	ug/L	1	
839	PEN #1	West		09n02w0301-03	6/10/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
842	JIMMY'S HOUSE BORDOCK	Bordock			6/10/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
848	DAIRY 1	DAIRY1			6/10/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
851	Irrigaiton Well	Irrigation Well			6/10/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
854	DAIRY 2	DAIRY2			6/10/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
857	DAIRY 1# WASH WATER	DAIRY 1			6/10/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
860	DAIRY 2# WASH WATER	DAIRY 2			6/10/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	1	
877	JOSE ARRODONDO	J. Arrodondo			9/9/2014	Clinical Lab	Cr6	EPA 218.6	1.1	ug/L	10	
886	DAIRY 2 SUPPLY WELL	DAIRY 2			9/9/2014	Clinical Lab	Cr6	EPA 218.6	1.1	ug/L	10	
882	NORHT EAST TEST WELL	north east test		09N02W03A01	9/9/2014	Clinical Lab	Cr6	EPA 218.6	1.2	ug/L	10	
880	PIG FARM SOUTH EAST TEST WELL	East			9/9/2014	Clinical Lab	Cr6	EPA 218.6	1.7	ug/L	10	
876	H & B SUPPLY WELL				9/9/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	10	
878	HECTOR ALVARESS				9/9/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	10	
879	BORDOCK	Bordock			9/9/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	10	
881	PEN 1# SOUTHWEST TEST WELL	West		09N02W03E01-03	9/9/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	10	
883	Hwy 58	Hwy 58			9/9/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	10	
884	DAIRY 1 SUPPLY WELL	DAIRY 1			9/9/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	10	
885	Irrigaiton Well	Irrigation Well			9/9/2014	Clinical Lab	Cr6	EPA 218.6	ND	ug/L	10	
#	**Name**	**Dairy**	**Sample Id**	**Well #**	**Date**	**Lab Name**	**Chemical**	**Method**	**Result**	**Units**	**Rep. Limit**	**MCL**

September 30, 2015

California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, California 96150

Dear Lahontan Regional Water Quality Control Board Members and Staff:

This comment letter is regarding the draft CAO that was issued on September 1 and was discussed at the September 16th and 17th Board meetings in Barstow. First I have had many conversations with community members about the Water Board, specifically about the last few years. On many occasions promises were made and not followed through or the complete opposite was done. We are concerned about the Water Board's Advisory team meeting with PG&E and making major changes to the Draft CAO, changes that clearly favors PG&E with no discussion with the other stakeholders involved. The community was given the word of the executive officer that this would not happen. The Water Board's leadership needs to listen to the Enforcement/Prosecution Team whom has the education, background, history, Hinkley experience and qualifications to make the best and just decisions for the Hinkley community. The Water Board Advisory Team has proposed major changes to the draft CAO that are not in the best interest of the community or the environment, one example is the plume contouring requirements. The Board members have to make decisions based on the information from your most qualified, experienced and informed people. Those people are your Enforcement/Prosecution Team and not the Advisory Team which is basing their conclusions on one sided discussions and politics. The members of the Enforcement/Prosecution Team have sat through hundreds of hours of discussions with all the stakeholders and many more hours separately sifting through piles of data. The Enforcement/Prosecution Team has more than a combined fifty plus years working on the Hinkley Groundwater Remediation Program. Below are some of the changes that are in the best interest of the community in regards to the CAO.

- Plume drawing should be based on the Enforcement/Prosecution team's recommendation on connecting monitoring wells above background levels and within 2600 feet. The discharger should also be required to close any data gaps in the plume contouring that are beyond 2600 feet or include that area in the plume map. These requirement need to be in place until the completion of the USGS Background Study. The USGS Background Study is an ***independent scientific study*** that will be based on ***"Best Professional Judgement"*** to understand and identify chromium six distributions throughout the Hinkley Valley. ***We do not agree with the Advisory Team to allow PG&E's consultant to draw the plume based on their "Best Professional Judgement", since it is not in the best interest of the Hinkley Community.***
- We also strongly disagree with the Advisory Team's use of language in the quarterly mapping. Using all available science including PG&E's conclusions, the plume has traveled as far north as

Harper Dry Lake. Allowing the discharger to input their opinion on a contouring map ordered by the state is confusing and is a big concern for the Hinkley Community that the Advisory Team would allowed that to happen. PG&E has to be required to draw the plume line as required by the state water board.

- We agree with the Enforcement/Prosecution Team that replacement water should be for ***"all indoor uses"***. If a domestic well is impacted by PG&E's historical discharges then community members should have the right to feel safe to take showers/baths and not just for cooking and drinking purposes. Swamp coolers are used the majority of the year and require water to work. This alone should warrant the continuing of whole house replacement. Community members should not be afraid to use water at their home especially when it comes to bathing or breathing.
- We also request that the board continue to protect public health by continuing to enforce a ***minimum of a half mile buffer*** around the PG&E defined plume. This is a common practice which protects public health and awareness.
- I would like to request that the board continue to support the CAC in the CAO as in the past. The people that dedicate hours of their time to learn the extremely complicated issues of this cleanup deserve nothing less than what was promised from the beginning. The other groups discussed in the draft have different concerns or agendas that are not the responsibilities of the Water Board and do not take the time to understand the complexity of our situation. Their concerns are important but do not deal with the contamination rather above ground issues like real estate the school and community growth. None of these problems are the responsibility of the Lahontan Water Board they are community issues with PG&E.

In closing, there is a great concern with in the Hinkley Community about the path the Board has taken in the past few years. The division between board staff (Prosecution and Advisory Teams) is clear and has led to unfair practices that reflect on the Board itself. We all still have a difficult and long road ahead as a community that deserves and asks only for fairness and justice. We all need to remember the world is watching, the decision made will be looked at and scrutinized for years to come. The community that's left and others will be asked if those responsible for ensuring that the largest plume of its kind was properly cleaned with the interests of the people and environment taken into consideration. The decisions you make now will affect the answers given in the future.

Daron Banks

[redacted]

[redacted]

From: [redacted]
To: RB6enfproceed@waterboards
Date: Wednesday, September 30, 2015 3:50:12 PM

I would also like to remind the board the original intent of the CAC and what your requirements were. Outlined in the CAO NO. R6V-2011-0005A1 pages 8 section 31 and 13 section 4. This was and still is the intent of the CAC as outlined by the board. I request that the board remember this intent. Please read your own orders and do not lose focus of what everyone's responsibilities are. The water board and staff are in the Hinkley community to do regulate and hold to discharger accountable for the contamination and protect human health. No where does its authority reach to other issues. Please continue the order in page 8 section 31 and support the CAC this is the only group that's main concern is the contamination of Hinkley ground water and the eventual cleanup.

Daron Banks

From: [redacted]
To: RB6enfproceed@waterboards
Subject: Comments to CAO
Date: Wednesday, September 30, 2015 6:11:14 AM

The Hinkley Community Advisory Committee (CAC) is submitting formal comments to the California Regional Water Quality Lahotan Region regarding the Draft Cleanup and Abatement Order (Draft CAO) issued on September 1, 2015. The two main areas of concern that the CAC is submitting comments include the following:

--[if !supportLists]-->1. <!--[endif]-->Plume Drawing- We agree with the Prosecution Team that the plume drawing should be based on connecting Cr(VI) and Cr(T) values about 3.1 ppb and 3.2 ppb, respectively between monitoring wells within 2,600 ft. This will avoid any confusion that the Hinkley Community may have with the different interpretations from the Water Board and PG&E. The Plume drawing should be based on the current method proposed by the Water Board's Prosecution Team until the USGS background study is completed.

--[if !supportLists]-->2. <!--[endif]-->Whole House Water should include all indoor usage and not just cooking and drinking. Hinkley residents should be able to take showers/baths with clean water as well as run their swamp coolers with clean water to assure safe inhalation of water vapor.

Sincerely ,
Barbara Ray
Roger Killian

I agree with the present Cr6 plume boundaries for the 2nd Quarter 2015. It's important to retain the plume boundaries in the north area of Hinkley. I agree with the Water Board's Prosecution Team on this. The present Cr6 plume boundary should stand until the results of the USGS background study is finalized.

Penny Harper

I agree with the Water Board's Prosecution Team that plume contouring should be based on the current method of connecting monitoring wells within 2,600 feet that are at or above background. This will insure a "Check and Balances";

with the changes being proposed, there are none. One person, hired by PG&E is ludicrous to interpret the plume shape. With all the previous bad feelings between the Hinkley Valley Residents and PG&E, do you really think the residents will believe anyone PG&E hires? I think not, would you? Also, this proposed CAO must be flexible and based upon scientific data, neutral scientific data. Also, no changes to the existing CAO until the end of Dr. Izbicki's study: consolidations are ok, but changes are not. Changes as written and promised originally are not acceptable and nothing short of manipulation to the residents of Hinkley Valley, and we see through these changes, which magically seem to favor PG&E.

Betty Hernandez