
Lahontan Regional Water Quality Control Board

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Draft Five-Year Review Report, Former George Air Force Base, Victorville, San Bernardino County, dated June 2016

Introduction

The Water Board has reviewed the Draft Five-Year Review Report, Former George Air Force Base (Five-Year Review), which addresses CERCLA sites that are under the Operable 1 Record of Decision (OU1 ROD) and the Operable Unit 3 Record of Decision (OU3 ROD). The Water Board finds that the remedies of the two RODs do not provide long-term protectiveness. Evaluation of site data indicate that contaminant sources are continuing to impact groundwater and plume stability. At OU1, the trichloroethene (TCE) plume continues to migrate vertically to the lower, regional aquifer where it is spreading laterally. At OU3, the largest TCE plume, Site OT069e, is also continuing to migrate laterally and the vertical migration has not been investigated.

This letter conveys Water Board comments on the Five-Year Review. Please include Water Comments as an attachment or as part the final Five-Year Review Report. Comments from the Department of Toxic Substances Control, Human and Ecological Risk Office (HERO) on the risk assessment portion will be provided under a separate cover.

Comment 1: Section 4.0 Operable Unit 1 Sites

The Water Board is concerned that the Five-Year Review presents an unrealistic evaluation of the protectiveness and effectiveness of the continued shut down of the pump and treat system that was selected in Operable Unit 1 (OU1) for Site CG070 and of the Air Force's proposed new remedy of monitored natural attenuation (MNA) with institutional controls (ICs). Additionally, the document does not discuss or consider the Water Board's position that active remediation is feasible and MNA alone will not meet regulatory requirements. MNA is not adequate to remediate the contamination (primarily TCE) that extends over 700 acres, impacts two aquifers, and threatens the Mojave River and its

underlying aquifer and supply wells. Additionally, the 2012 Focused Feasibility Study, OU1 TCE Groundwater Plume (Focused FS) estimated the timeframe for achieving remedial goals for MNA is over 500 years, which is an unreasonable and unacceptable timeframe for restoration of the beneficial uses of groundwater, especially in an area of limited water resources such as the Mojave Desert and does not support long-term protectiveness .

The Water Board's position regarding the consideration of MNA in an amendment to the ROD has been conveyed to the Air Force in multiple communications, including 2014 letters on the Proposed Plan in which the Air Force first put forth MNA as its preferred remedy, and most recently, an August 2016 letter, which stated:

The Air Force's plan to go forward with a ROD amendment for a new remedy (i.e., MNA) that the Water Board does not accept is neither productive nor reasonable, and indicates that the Air Force is unwilling to work with the Water Board in good faith to resolve these issues. If the Air Force continues to propose MNA without additional active remediation, the Water Board will be forced to dispute the ROD amendment, which will result in protracted delays. These delays could allow continued groundwater degradation and contaminant migration, potentially increasing the time and cost to achieve cleanup goals and delay restoration of the beneficial uses of groundwater resources. These outcomes are not in the best interest of the federal government or of the people of the State of California.

However, the Five-Year Review does not acknowledge the Water Board's position and, instead, presents a highly unrealistic timeframe of 2017 for the adoption of an amendment to the ROD for MNA with ICs, completion of the remedial design, and implementation of the remedy. The lack of regulatory acceptance represents a significant impediment to the adoption the proposed amendment to the ROD, and the fact that the Five-Year Review does not acknowledge the Water Board technical concerns and its position that active remediation is necessary to comply with regulatory requirements, represents a significant deficiency.

Because of the continued contaminant migration in the Lower Aquifer and the threat it poses to the Mojave River, its aquifer and supply wells, it is imperative that active remediation and an adequate monitoring network be put in place as soon as possible. Further delays, such as those caused by the Air Force's failure to work with the Water Board in good faith during the remedy selection process, will make site remediation more technically challenging, more costly for the federal taxpayers, and deny the citizens of the state access to this water resources for the foreseeable future.

Comment 2: Section 3.6 Geology and Hydrogeology

This section's statement regarding a percolation route from the Upper Aquifer to the Lower Aquifer should be revised to more clearly state that there is a zone west of the bluffs where the perching zone becomes discontinuous and allows migration from the Upper Aquifer to the Lower Aquifer.

Comment 3: Section 3.6 Geology and Hydrogeology

The last sentence of the seventh paragraph in this section states that as a result of groundwater mounding caused by the Victor Valley Wastewater Reclamation Authority (VWVRA) infiltration ponds, the Lower Aquifer discharges to the Flood Plain Aquifer and the side channels of the Mojave River in the vicinity of VWVRA. This statement contradicts the first sentence of that paragraph, which more accurately characterizes the effects of the VWVRA mounding that causes groundwater to flow radially away from the mound to the north, west, and south. Please revise the sentence accordingly.

Comment 4: Section 3.9 Water Use and Well Inventory

This section asserts that there are no current users of the Upper Aquifer and that there are no groundwater users within the area of groundwater contamination. Please reference or describe all Air Force efforts that are the basis of this statement, including field verification.

Comment 5: Section 3.9 Water Use and Well Inventory

The Water Board appreciates the Air Force's efforts to rectify prior misrepresentations regarding the VWVRA water supply wells. However, this section seems to imply that the water from these wells is not used for drinking water. The text should be revised to reflect the fact that, although bottled water is available at VWVRA, there are no restrictions or prohibitions against drinking the water from faucets and taps at the facility because the wells are used as the potable water supply. Therefore, workers and visitors may, in fact, be using the well water for drinking water. The VWVRA wells also provide the water for the adjacent facility, American Organics, which the Water Board understands, also makes bottled water available. Finally, the Five-Year Review refers to these wells inconsistently in this report as production wells, in-plant use wells, and water supply wells. Please revise the text to consistently refer to the wells as water supply wells.

Comment 6: Section 3.9 Water Use and Well Inventory

The statement that Victorville Federal Correction Complex would have to construct a water treatment plant to remove arsenic from groundwater prior to use as water supply wells is incorrect. Water quality data from the wells demonstrate that arsenic levels are below the maximum contaminant level (MCL) and the facility manager informed the Water Board that there are no plans to install a treatment facility prior to using the wells for water supply. The current Division of Drinking Water's status for the wells is "inactive." Please revise the text to reflect this comment.

Comment 7: Section 4.1, Recommendations From Third Five-Year Review Report

The discussions of status under first three bulleted items in this section should be revised to acknowledge that the Water Board did not accept the Proposed Plan and does not concur with the Air Force proposed remedy, i.e., MNA with ICs. See Comment 1. Until there is at least conceptual agreement on remedy components that would achieve regulatory concurrence, the estimate 2017 timeframe for completion of a record

of decision amendment discussed in the first bulleted item is unrealistic and there is a high level of uncertainty associated with the follow-up items described under the second and third bulleted items. The status of resolving outstanding issues should be discussed in the Five-Year Review and considered when estimating time of completion of the various steps.

Comment 8: Section 4.1, Recommendations From Third Five-Year Review Report

The Water Board does not agree with the discussion of status under the fifth bulleted item in this section. Specifically, the Water Board finds that the Air Force has not adequately monitored changes caused by infiltration from VVWRA's discharges and that additional monitoring wells are necessary. See Comment 18.

Comment 9: Section 4.2 Site CG070 Description and Background

The Water Board does not concur with the assertion that the plumes are stable and concentrations are decreasing. See Comment 19.

Comment 10: Section 4.3.2 Remedy Implementation

The text states that one of the sewage treatment plant (STP) ponds was used for disposal of debris at the time of base closure. The text should describe what removal actions were taken in response to this disposal and reference the document that describes these actions. Also see Comment 16 regarding possibility that the STP are a continuing TCE source for CG070 and the occurrence of PFCs in soil samples. Finally, the text states that the STP ponds are to be destroyed by SCLAA. It is not clear why SCLAA is responsible for "destroying" the ponds. If the ponds received other kinds of waste in addition to sewage, they may be subject to closure requirements of California Code of Regulation title 27 requirements.

Comment 11: Section 4.3.2 Remedy Implementation

This section states that after the pump and treatment system was shut down, it was determined that optimization of the system would not be effective. However, earlier documents recommended optimization and use of the system. Please specify where the determination that optimization would not be effective and regulatory concurrence of this determination were documented.

Comment 12: Section 4.3.2 Remedy Implementation

The discussion of the 2012 Focused FS should be included under Section 4.3.4, *Progress Since the Last Five Year Review*, rather under *Remedy Implementation*.

Comment 13: Section 4.3.4 Progress Since the Last Five-Year Review

This section does not discuss two significant documents that have been issued by the Air Force since the last Five-Year Review, i.e., Focused FS and Technical Memorandum, Evidence for Natural Attenuation, Site CG070, Operable Unit 1 (Tech Memo). These documents and the regulators' acceptance should be discussed in this

section. Although the Proposed Plan is briefly discussed, this section should be revised to include a discussion of the regulators' non-concurrence with the Proposed Plan.

The Focused FS evaluated various alternatives, it did not recommend or select a remedy. The regulators accepted Focused FS as adequate to move the remedial selection process forward even though there were still outstanding concerns (e.g., evaluation of feasibility of achieving background levels). The Proposed Plan, which put forth MNA with ICs as the Air Force's preferred remedy, was not accepted by the Water Board primarily because the Focused FS estimated it would take over 500 years to achieve cleanup goals using MNA. In response to Water Board's concerns regarding the unreasonably long cleanup timeframe, the Air Force issued the Tech Memo, which used different assumptions and methodologies that resulted in a shorter estimated cleanup timeframe than the Focused FS. The Water Board does not concur with the technical evaluation or conclusions of the Tech Memo. The Air Force's issuance of the Tech Memo and Water Board's non-concurrence should be mentioned here.

Comment 14: Section 4.4.2 Risk Information

The Water Board does not agree with the statement that "the Upper Aquifer is not a viable source of potable water." The aquifer has designated beneficial uses include municipal and domestic water supply and the aquifer serve as a domestic water supply. Additionally, it is not clear that the Air Force has established that there are no users of the Upper Aquifer. See Comment 4. Therefore, the contaminated groundwater of the Upper Aquifer should be included in a revised risk assessment.

Comment 15: Section 4.4.2 Risk Information

There is currently no effective prohibition on residential uses in offsite areas. Please revise the text to describe surrounding uses in offsite areas where there is a potential risk via indoor air pathway.

Comment 16: Section 4.4.3 Data Review

The Air Force has not demonstrated that all sources have been remediated to the extent that they are not contributing to groundwater contamination and that they do not represent a future threat to groundwater quality. Source control is a particularly critical issue for the Air Force's remedy implementation since any remaining sources will significantly lengthen the cleanup timeframe, could cause further plume migration, and introduce unacceptable uncertainties for remedy protectiveness.

There appear to be continuous and on-going, low-level releases of contaminants to groundwater. For example, the three monitoring wells that define the southern plume core of the Upper Aquifer, NZ-54, NZ-68, and NZ-51, all show relatively low, but increasing trends. The southern plume core is centered under the STP ponds (Site WP026) and the adjacent High Desert Power Plant (FT020). Further characterization and evaluation are needed to determine the cause of the increasing trends at this location and if source control measures at WP026 and FT020 are necessary.

Additionally, a recent Air Force study detected the fire retardant compounds, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), in soil samples at CG070 source areas (including the vicinity WP026 and FT020) and in the underlying groundwater. The current known extent of PFOA and PFOS in soil and groundwater should be discussed in this section.

Comment 17: Section 4.4.3 Data Review

Please clarify why 2015 data were included for nitrate but not for TCE.

Comment 18: Section 4.4.3.1 Extent of Contamination

The monitoring network is not adequate to delineate the extent of impacts in the Lower Aquifer, especially since VVWRA began discharging to its southern infiltration ponds in 2001. Prior to the use of the ponds, groundwater flow in the Lower Aquifer was to northeast and the Mojave River. The ponds created a very extensive groundwater mound, which drives site groundwater radially to the north, west, and south. Because of the change in flow direction, many formerly downgradient wells are now upgradient and there is inadequate delineation of contamination in the downgradient directions.

Additionally, there are no monitoring wells between the two hot spot wells, NZ-107 and NZ-84, which are over 2,000 feet apart. Therefore, the extent of the elevated TCE concentrations detected in the two wells is not known and contamination may exist as a single area of contamination as shown in monitoring reports prior to 2012 rather than two discrete areas as currently interpreted by the Air Force.

The most northern area of groundwater contamination is monitored by a single well, NZ-72. It has been monitored since 1994 and TCE was mainly non-detect until 2013 when there was a sudden increase in concentrations. The Air Force plans on installing additional wells in this area. Adequate delineation is critical to the evaluation of stability and protectiveness since the regional flow in this portion of the site is still toward the Flood Plain Aquifer and the Mojave River.

Comment 19: Section 4.4.3.2, Plume Stability

The Water Board does concur that the plumes are stable. Water Board's review of the data indicate there is continued contaminant migration from the Upper Aquifer to the Lower Aquifer and the continued plume migration in the Lower Aquifer that is not being adequately monitored by the existing monitoring network.

Upper Aquifer Stability.

The Water Board accepts that the Air Force has demonstrated that the Upper Aquifer's commingled plume is primarily stable laterally at the maximum contaminant level (MCL) for TCE. However, a significant factor in the lateral stability of the Upper Aquifer plume is the fact that the perching zone that creates the Upper Aquifer pinches out in the direction of groundwater flow (northeast). Contaminated groundwater from the Upper Aquifer migrates downward at the eastern and northern edges of the perching zone and into the Lower Aquifer. This creates an apparent stability, but in fact the groundwater

contamination continues to migrate vertically down and into the Lower Aquifer. Based on this continuing contaminant migration into the Lower Aquifer and the increasing TCE trends in the Lower Aquifer, the Upper Aquifer plume cannot be considered *vertically* stable and it is acting as a continuing source of Lower Aquifer contamination.

Additionally, a recent Air Force study found concentrations of PFOS and PFOA in the Upper Aquifer plume were almost two orders of magnitude above the USEPA health advisory. The extent of impacts and stability of these highly mobile and recalcitrant contaminants have not been determined and represent significant uncertainties.

Lower Aquifer Stability.

The Lower Aquifer is clearly not stable and because of the inadequate monitoring network, the Air Force cannot support its statement that the Lower Aquifer plume has decreased in size. Although the existing monitoring network is inadequate to delineate the extent of groundwater impacts, evaluation of the current groundwater flow regime and increasing TCE concentrations in many of the Lower Aquifer wells, indicate that contamination is migrating away from the monitoring network to the north, west, and south, and is causing further degradation of this water supply aquifer.

Finally, concentrations of PFOS and PFOA in the CG070 plumes are one order of magnitude above the USEPA Health Advisory in the Lower Aquifer. The extent of impacts and stability of these highly mobile and recalcitrant contaminants in the Lower Aquifer have not been determined and remain uncertainties.

Comment 20: Section 4.4.3.2. Plume Stability Subheading Stable or Declining TCE Concentrations, Lateral and Vertical Plume Stability.

The text states that the Water Board recommended the use of the triangulated irregular network (TIN) method for contouring plumes. The Water Board comment letter (dated August 10, 2015) on the Draft Tech Memo included technical comments by Department of Toxic Substances Control (DTSC), Geological Services Units (GSU). GSU's Comment #28, which is repeated below.

There is little consistency or rigor in contouring groundwater, delineating plumes, or fitting trends to the data. This reduces confidence in the figures, and makes the results more an opinion and less of a technical result. GSU has asked that the groundwater be contoured using TIN, which produces repeatable and consistent contour maps. GSU has advocated drawing flow lines over the contours and using the flow lines to outline plumes. This method produces highly consistent plume maps that honor the data and are repeatable for the same dataset problems with well network, not sampling high concentration wells.

To further clarify the comment as steps, GSU was recommending the following process

- 1) Use the TIN method to contour groundwater elevations,
- 2) Draw flow lines based on groundwater elevation contours.
- 3) Consider the flow lines when constructing isoconcentration contours for plume delineation.

The Water Board does not object to using TIN directly to construct groundwater isoconcentration contours, but would like to clarify that GSU recommends the method as described above. Additionally, while use of the TIN method is acceptable to the Water Board because it is not subjective and it provides a more consistent basis for evaluation over time, its outputs are the result of the spatial distribution of sample locations and it can produce unrealistic contours if the monitoring network is inadequate or as a result of changes in the sample locations over time. Therefore, changes in the monitoring network should be considered when making conclusions regarding changes in plume configuration over time. The Air Force's evaluation of changes in plume configuration does not include an evaluation of changes in monitoring network, which is necessary to support its conclusions regarding changes in plume configuration over time.

Comment 21: Section 4.4.3.2. Plume Stability, Stable or Declining TCE Volume of Impacted Water

The supporting calculations for the analysis of volume were not included. Therefore, the Water Board cannot comment on this analysis or accept its conclusion except for the assumption stated on Table 4-4, which reports the calculated volumes. The assumption on that table states that a saturated thickness of 50 feet was assumed for both the Upper Aquifer and the Lower Aquifer. However, there have been significant changes in water levels in many monitoring wells over that period. For example, Upper Aquifer well, NZ-98, increased by almost 17 feet, representing a 30 percent increase in saturated thickness. Lower Aquifer well, NZ-69, increased approximately 24 feet during that period, representing an increase in thickness of almost 50 percent. Assuming a uniform saturated thickness overtime will result in an apparent decrease in impacted volume that is actually a result in dilution from an increased saturated thickness. Also the increasing groundwater levels in the Lower Aquifer are the result of discharges to VVWRA's infiltration ponds, which has caused the groundwater flow direction to shift and in some case to reverse. The current monitoring network does not adequately monitor the downgradient impacts under the current flow regime, which would result in underestimating the volume of impacted groundwater. See Comments 19, 20, and 21.

Comment 22: Section 4.4.3.3. Mass Estimates of Contaminated Groundwater

The methods and assumptions used to calculate mass are not included so the Water Board cannot comment in detail on this analysis. However, prior Water Board comments on the plume volume calculations, limitation of TINs, and the adequacy of the monitoring network (Comments 18, 20, and 21) apply to this section. Changes in the monitoring network should also be considered. For example, Upper Aquifer monitoring wells with the highest concentrations in the early 2000s, i.e., NZ-40, NZ-55, NZ-82, and NZ-83, have not been sampled since 2004. If these wells were included in the earlier sampling events but not the later, mass estimation could skew the results to show an unsupported decrease in mass over time in the Upper Aquifer. Additionally, using a three year average rather than annual results could be helpful to show more meaningful changes in plume configuration over time.

Comment 23: Section 4.4.3.4 Nitrate in Groundwater

The conclusions regarding nitrate should be qualified since there appear to be so little data that it is difficult to determine trends over time and extent of contamination. Please clarify why no nitrate data are included from the time period between 2006 and 2014.

Comment 24: Section 4.4.3.4 Nitrate in Groundwater

Water Board does not concur with this section's assertion that the rise in water levels is responsible for increase in nitrate and that nitrate will decrease when groundwater levels decrease. This appears to be a new conclusion and no supporting evidence is provided or referenced. And even if true, future rises in groundwater levels may result in increased nitrate concentrations and require remedial actions.

Comment 25: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents?

The discussion in this section is incomplete since it only discusses land use controls that are not part of the remedy selected in the OU1 ROD. The 1994 OU1 ROD estimated the selected remedy, pump and treat, would take 30 years to achieve cleanup goals (that is, cleanup goals would be achieved in the year 2024). The pump and treat system was shut down for optimization in 2003 after nine years of operation and never restarted. Historically, the MCL boundary of the CG070 the plume extended into the Flood Plain Aquifer in the vicinity of VVWRA. The maximum TCE detected was 17 µg/L in Flood Plain Aquifer well, LW-2, in 1994. The leading edge of the plume in this area was largely pulled back by the operation of the pump and treat system and concentrations were reduced to below the MCL by 1999. The text should be revised to discuss the recommendations of the optimization study and the Air Force's justification for the continued non-operation of the remedy.

The shutdown of the pump and treat system for over 12 years has allowed continued migration from the Upper Aquifer to the water supply aquifer (i.e., Lower Aquifer) and migration of contamination in the Lower Aquifer continues to spread beyond the existing monitoring system, further impacting the beneficial uses of the water supply aquifer. The Water Board finds the discussion of ICs inadequate, since they will not result in restoration of the beneficial uses of groundwater and will not prevent continued migration in the Lower Aquifer or predicted impacts to the Flood Plain Aquifer and surface waters of the Mojave River after cessation of the VVWRA discharges. Also see following Comment 26.

Comment 26: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Implementation of Institutional Controls and Other Measures

The proposed ICs described under the heading "On Base" may be adequate to prevent the installation of additional wells within the boundaries of Former George Air Force Base (GAFB) in some but not all land transfers. For example, the memorandum of understanding (MOU) for the transfer of the southern portion of GAFB to the Federal

Bureau of Prisons did not preclude the 1998 installation of groundwater wells by the Bureau of Prisons in an area adjacent to a GAFB pesticide plume (Site OT071) and a nearby GAFB petroleum plume (ST067b). Not only do these wells represent potential receptor points, but the wells were constructed in such a way that they act as vertical conduits for groundwater migration from the Upper Aquifer to the Lower Aquifer. To date, neither the Air Force nor the Bureau of Prisons has properly abandoned the two wells nor are we aware of amendments to the MOU that prohibit future well installations on this portion of GAFB.

Comment 27: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Implementation of Institutional Controls and Other Measures

The transfer of the former residential portion of GAFB to the City of Victorville included a prohibition against ground disturbances that could result in human exposure to pesticide contaminated soils. The discussion of ICs under the subheading "On Base" states that, in response to unauthorized digging that occurred at Site OT071, the Air Force established a formal review/coordination process in April 2015 and a Joint Strategic Planning and Redevelopment Forum which includes regulators. Please specify what entities are members of this forum, how often it meets, where the "formal review/coordination process" is documented, and how this process assures appropriate implementation of ICs.

This section also discusses how an on-site field representative for the Air Force monitors SCLAA's activities and who considers and documents compliance with existing land-use restrictions. However, the unauthorized digging incident described in this section was brought to the attention of the Air Force by Water Board staff (letter dated September 18, 2015) and there have been ground disturbances actions, i.e., building demolish and construction of a paint ball field that have not been prevented by the Air Force. Please briefly describe and reference any enforcement mechanisms that have been put into place to assure future compliance, including after transfer of GAFB is complete and there is no longer an onsite Air Force representative.

Comment 28: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Implementation of Institutional Controls and Other Measures

Under the subheading of "Off Base" the text states that the Air Force is in close communication with VVWRA regarding its "plant-use wells." Until the recent, May 2016 Tech Memo, Air Force documents did not include these supply wells on figures of wells in the vicinity of GAFB. The wells are the water supply source at VVWRA both for human consumption and industrial purposes.

Comment 29: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Implementation of Institutional Controls and Other Measures

Approximately half of the CG070 plume extends off site. The text states a Notification Zone involving the County of San Bernardino and the City of Victorville will be used to limit the installation of wells in areas above or in the vicinity of the CG070 TCE plume. However, the Notification Zone does not provide a sufficient basis to support that there are adequate ICs in place to protect potential receptors because they are not actual legally enforceable rules or ordinances. The proposed ICs represent reasonable steps; include zoning ordinances, which can be changed; Consultation Zones, that are unenforceable; a well permitting process that is contingent upon a consultation process with other agencies that relies on those other agencies to maintain an internal processes to identify potentially contaminated areas; and a building permit process that does not have the ability to prohibit the installation of wells based upon their location. However, these mechanisms cannot be relied on as the sole mechanisms. For the non-Air Force owned properties there are no proprietary controls, such as a deed restriction. Please describe any efforts or discussions by Air Force to secure proprietary controls on the non-Air Force owned sites.

Comment 30: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Implementation of Institutional Controls and Other Measures

The discussion of ICs should include a summary of the land use controls for the FOSET in progress for transfer of off-base Parcel L-1.

Comment 31: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Remedial Action Performance

The Water Board disagrees with the assertions in the second item under the first bullet that there is a comprehensive understanding of the migration pathways, plume extent and potential receptors. See Comments 18, 19, 20, and 21.

Comment 32: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Remedial Action Performance

The third item under the first bullet implies the VVWRA wells are not used for drinking water should be modified in accordance with Comment 5.

Comment 33: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Remedial Action Performance

Water Board disagrees that the remedial action objective (RAO) of reduction of TCE concentrations in groundwater to below the MCL of 5 micrograms/liter ($\mu\text{g/L}$) is being addressed since the pump and treat system was turned off in 2003. The Focused FS estimated that MNA would require over 500 years to reach the MCL and this timeframe is not acceptable to the Water Board. Active remediation is necessary to restore

groundwater to its beneficial uses and prevent further migration and potential impacts to receptors.

Comment 34: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Remedial Action Performance

The Water Board does not agree with the assertions regarding plume stability. See Comments 19, 20, and 21

Comment 35: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Remedial Action Performance

The discussion in this section does not address the relevant question, i.e., is the remedy functioning as intended. The 1994 OU1 ROD estimated that it would take 30 years (the year 2024) to achieve cleanup goals using the selected remedy of pump and treat. The pump and treat system was shut down for optimization in 2003 after 9 years of operation and never restarted. The pump and treat remedy provided plume control while in operation. Based on the Focused FS MNA it will take 500 years to achieve cleanup goals at CG070. The disparity between the performance predicted in the OU1 ROD, and the intended performance for the proposed MNA remedy should be discussed under this heading.

Comment 36: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Remedial Action Performance

Water Board disagrees with the following conclusions under the discussion of the RAO to eliminate or reduce the potential for further migration of the groundwater contamination.

- The Water Board does not agree with Air Force's assertion that compliance with this RAO has been achieved. See Comments 19, 20, and 21
- Water Board disagrees with the assertion that all vadose zone source areas are controlled. See Comment 16.
- Water Board disagrees with the assertion that the extent of and magnitude of contamination have been defined in the Lower Aquifer. See Comment 18.
- Water Board disagrees with the assertion that the plumes are stable in the Lower Aquifer. See Comments 19, 20, and 21.
- The Water disagrees with the assertion that the Air Force's current monitoring is adequate to ensure compliance with this RAO. See Comments 18 and 25.

Comment 37: Section 4.5.1 Question A: Is the remedy functioning as intended by the decision documents? Remedial Action Performance

The Water Board does not agree with the assertion that an expansion of the pump and treat system is not needed. Continued monitoring with no active remediation will not restore the beneficial use of the groundwater resources and will allow the contamination

to represent continuing threats to groundwater users and the Mojave River for hundreds of years.

Comment 38: Section 4.5.1 Question A: Is the remedy functioning as intended by the decision documents? System Operations/Operations and Maintenance

This section states that “It became clear that optimization” of the pump and treat remedy would not be effective.” Please provide the supporting justification for this statement or reference the document that contains the analysis supporting this statement.

Comment 39: Section 4.5.1 Question A: Is the remedy functioning as intended by the decision documents? System Operations/Operations and Maintenance

This section should acknowledge that the Water Board did not concur with the remedy proposed of MNA in the Proposed Plan and as stated in Comment 1 the Water Board does not concur the Air Force evaluation and conclusions regarding the effectiveness and protectiveness of MNA at CG070 and does not support the issuance of a ROD amendment for MNA with ICs (Water Board letter dated August 5, 2016). Based on the lack of regulatory concurrence, the estimate 2017 timeframe for completion of a record of decision amendment, remedial design, and implementation of the remedy is highly unrealistic.

Comment 40: Section 4.5.1, Question A: Is the remedy functioning as intended by the decision documents? Early Indications of Remedy Failure

The change of the selected remedy to MNA, as proposed by the Air Force, does not have State acceptance, is not protective, and will not result in restoration of the beneficial uses of groundwater in 500 years. Therefore, there is high likelihood the propose remedy, if put forth, will fail in attaining RAOs.

Comment 41: Section 4.5.1, Question B: Are the assumptions used at the time of the remedy selection still valid? Changes in standards and to be considered.

The federal standard for nitrate should be included as a cleanup standard. Additionally, State Water Resources Control Board Resolution 92-49 requires cleanup to background conditions.

Comment 42: Section 4.5.2, Question B: Are the assumptions used at the time of the remedy selection still valid? Changes in Exposure Pathway.

Water Board does not agree that groundwater use is effectively prohibited, and therefore, there is no exposure route for groundwater. See Comments 26, 27, 28, and 29.

Comment 43: Section 4.5.3. Question C: Has any other information come to light that would call into question the protectiveness of the remedy.

The cessation of VVWRA discharges will allow plume migration to the Flood Plain Aquifer, VVWRA supply wells, and the Mojave River. VVWRA has begun reducing discharges and may cease as early as the summer 2017. The document states that it

will take 6 to 8 years for the mound to dissipate based on the time it took for NPP groundwater mounds to dissipate in the Upper Aquifer. This statement is highly speculative. Conditions in the Lower Aquifer and Flood Plain Aquifer are very different from the Upper Aquifer and the quantity and nature of VVWRA discharges are also different from the NPP. This statement should be supported by site specific modeling. This is a critical protectiveness issue since there are no measures in place to prevent the migration of the plume toward the Mojave River, Flood Plain Aquifer, and water supply wells once the discharges cease.

Comment 44: Section 4.5.3. Question C: Has any other information come to light that would call into question the protectiveness of the remedy.

A recent Air Force study detected the fire retardant compounds, PFOA and PFOS, in soil samples at CG070 source areas and in the underlying groundwater. PFOS and PFOA in the Upper Aquifer plume were almost two orders of magnitude above the USEPA health advisory and one order of magnitude above the advisory in the Lower Aquifer. The extent of impacts and stability of these highly mobile and recalcitrant contaminants have not been determined and represent significant uncertainties for the protectiveness of the proposed remedy. The Five-Year Review should be revised to discuss this emerging contaminant, how the potential extent of PFOA and PFOS contamination will be assessed, including recommendations and a timeframe to address the recommendations.

Comment 45: Section 4.6 Site CG070 Issues

The USEPA's 2001 Comprehensive Five Year Review Guidance states that "unresolved concerns or items raised by support agencies and community" should be discussed under this heading. This section should be revised to include such a discussion. See Introduction and Comment 1 regarding the Water Board's stated position and summary of concerns.

Comment 46: Section 4.6 Site CG070 Issues

The Water Board does not agree with the Air Forces assertions regarding the following issues.

Issue 2. Water Board does not agree that the current ICs are adequate to protect against the use of TCE contaminated groundwater from Site CG070 over the long term. See Comments 26, 27, 28, and 29.

Issue 3. Water Board does not agree that the planned cessation of VVWRA discharges does not impact the current protectiveness of the continued non-operation of the selected remedy. See Comment 43.

Comment 47: Section 4.6 Site CG070 Issues

Major site issues discussed under this heading should include the following.

- The selected remedy of pump and treat is no longer in operation and contaminant migration is uncontrolled and spreading vertically down into the

Lower Aquifer and migrating in the Lower Aquifer. The Lower Aquifer plume has migrated beyond the current monitoring network and is impacting previously unimpacted groundwater.

- The extensive groundwater contamination, its continuing migration, and cleanup timeframe estimated for the proposed MNA remedy represent continuing unacceptable impacts to existing and anticipated future beneficial uses of groundwater, and threats to human health and the environment.
- The extent of impacts in the Lower Aquifer has not delineated under current conditions.
- The expected cessation of VVWRA discharges in 2017 will allow contaminant migration to the Flood Plain Aquifer, water supply wells, and the Mojave River. There is currently no mechanism in place to protect these receptors and it is not clear that the current monitor program is adequate to evaluate this threat.
- The threats to human health and the environment from PFOA and PFOS in site groundwater have not been evaluated and remain significant uncertainties.
- Current ICs on property transferred to the Federal Bureau of Prisons failed to prevent the installation of water supply wells. These wells not only represent a failure of the ICs that the Air Force proposes on relying on for hundreds of years, but also are vertical conduits between the Upper and Lower Aquifers that are allowing or could allow contamination migration into the water supply aquifer.
- For non-Air Force owned properties the Air Force is proposing unreliable and untested ICs to prevent the use of contaminated groundwater for human consumption. Therefore, MNA with the proposed ICs is not protective of human health, especially considering the existing problems with enforcement of ICs and that these ICs would have to be maintained for hundreds of years.
- The current ICs are inadequate to prevent infiltration sources that could influence plume migration, such as the leaking City of Victorville pond which are creating a groundwater mound and potentially spreading dieldrin contamination in groundwater (Site OT071).

Comment 48: Section 4.6 Site CG070 Issues

The reference to VVWRA NPP is incorrect. The NPP are the GAFB “new percolation ponds,” which were used as part of the pump and treat system and not the same as the VVWRA infiltration ponds. Please revise the text accordingly.

Comment 49: Section 4.7 Site CG070 Assessment

Water Board does not agree with the Air Force’s assessment of CG070, specifically,

- The Water Board does not agree that the lateral and vertical extent of the groundwater plumes are stable or decreasing. See Comments 19, 20, and 21.

- The Water Board does not agree that potential receptors are currently protected. See Comments 18 and 43
- The Water Board does not agree that long-term monitoring is sufficient to protect ecological receptors. See Comment 43

Comment 50: Section 4.8 Site CG070 Recommendations and Follow-up Actions

Water Board does not concur with the that the planned amendment to the ROD will provide long-term protectiveness and compliance with RAOs. See Comment 49.

Issue 1. Water Board does not concur that the planned amendment to the ROD changing the remedy from pump and treat to MNA with ICs will achieve ROAs and meet regulatory requirements as stated in Water Board letter dated August 5, 2016. Proposing a ROD amendment for a remedy that does not meet state requirements does not move the project forward.

Issue 2. Water Board does not agree that the current ICs are adequate to prevent the use of CG070 groundwater containing TCE above the MCL. This is especially true for the offsite portion of the plumes. See Comments 26, 27, 28, and 29.

Issue 3. Water Board does not agree with the assertion that cessation of VVWRA discharges does not impact the current protectiveness. See Comment 43.

Comment 51: Section 4.8 Site CG070 Recommendations and Follow-up Actions

This section references revised RAOs. Please include the revised RAOs and specify where they were documented.

Comment 52: Section 4.9 Protectiveness Statement

The Water Board does not agree with the assertion that the proposed remedy of MNA with ICs is protective over the long term because it would require prohibit the use of valuable water resources and important recharge storage capacity of the aquifer for many decades, potentially affecting water usage rights for off-base property owners. Groundwater contamination extends over 700 acres, impacts two aquifers, and threatens the Mojave River, the Flood Plain Aquifer, and water supply wells. Currently, there is no active remediation, inadequate monitoring, and no mechanism to prevent anticipated migration to human and ecological receptors.

Comment 53: Section 5.1 Recommendations from Third Five-Year Review, All OU3 Sites

It appears the recommendation for the last "status" heading on Page 5-4 is missing or there is a formatting error that caused it to be included in the preceding status discussion. Please rectify.

Comment 54: Section 5.4.3.3 Data Review

The data review should discuss the impacts from the emergent contaminants, PFOA and PFOS detected in FT019 soil.

Comment 55: Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

A recent Air Force study detected the fire retardant compounds, PFOA and PFOS, in soil samples at FT019 and in the underlying groundwater. The Five-Year Review should discuss these emerging contaminants, how the potential extent of PFOA and PFOS contamination will be assessed, including recommendations and a timeframe to address the recommendations.

Comment 56: Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The mislocation of the soil vapor extraction (SVE) system at the FT019c and how this will be addressed should be discussed under this question.

Comment 57: Section 5.4.5 Site FT019 Issues

The mislocation of the FT019c SVE system should be included as an issue that impacts the remedy's protectiveness.

Comment 58: Section 5.4.5 Site FT019 Issues

The first issue should be modified to state that remediation is required to mitigate site risks *and threat to groundwater*.

Comment 59: Section 5.4.7, Site FT019 Recommendations and Follow-up Actions

This section recommends the implementation of the optimization work plan. However, since then, the Air Force has discovered that the remedial system was mislocated. This mislocation must be addressed and considered prior to the optimization effort. This section should be revised to include recommendations and follow-up actions for this issue.

Comment 60: Section 5.4.8 Site FT019 Protectiveness Statement

The protectiveness statement should be revised to include the uncertainties introduced by the mislocation of the remedial system.

Comment 61: Section 5.5.1, Site OT069 Description and Background, Historic

Please provide the information or reference the document that supports the statement that wells completed to the base of the Upper Aquifer contain no contaminants of potential concern.

Comment 62: Section 5.5.1, Site OT069 Description and Background, Historic

Please clarify what is meant by the statement that the source area of SD025, the Industrial Storm Drain is “inactive.”

Comment 63: Section 5.5.2.1 Remedy Selection

The 1998 OU3 ROD estimated that the time to reach cleanup goals using MNA for the OT069e groundwater plume was 46 years, (i.e., 2044). A modeling effort was conducted in 2009 because concentrations were not declining as predicted in the ROD. The 2009 model predicted that plume would continue migrating an additional 500 feet over the next 30 years and that the MCLs would be reached in another 50 years (i.e., in 2059). Based on 2014 and 2015 results, the plume has migrated almost 2,000 feet since 2009. Of the seven shallow and intermediate depth wells that monitor this plume, five show overall increasing trends. Additionally, MW-57, a monitoring well approximately 1,500 feet downgradient of the nearest OT069e well, has increased to above or at the TCE MCL for the past two years. There is overall poor delineation of this 100-acre plume in the downgradient direction. Based on the overall increasing trends in site monitoring wells and the plume’s continued expansion into previously unimpacted areas and beyond what was estimated by the 2009 modeling effort, the plume is not stable and MNA is not adequate to prevent further plume migration or to restore water quality in a reasonable timeframe. According to the trigger of the “TCE concentrations exceed the MCL at a monitoring well where concentrations are predicted to remain below the MCL” cited in Table 5-1, active remediation should be considered. Additionally, plume migration is more easterly than the 2009 model predicted; therefore the designated trigger wells are not appropriate located to evaluate downgradient migration.

Comment 64: Section 5.5.2.1 Remedy Selection

The statement regarding state land use controls (SLUCs) should be revised since there are no existing SLUCs at the former GAFB properties.

Comment 65: Section 5.5.3.2 Risk Information

The Water Board does not agree that the groundwater pathway is incomplete. The site groundwater has potential beneficial uses and the impacts to those uses should be evaluated. Additionally, the Upper Aquifer could serve as viable domestic water supply, and the Lower Aquifer is a regional water supply aquifer. It is not clear that the Air Force has established that there are no users of the Upper Aquifer. See Comment 4. The contaminated groundwater of the Upper Aquifer should be included in a revised risk assessment. Additionally, the Air Force has not demonstrated that the contamination has not migrated into the Lower Aquifer and does not pose a threat to users of groundwater in the vicinity. This is especially of concern since the OT069e plume has increased in size significantly since the 1998 ROD for Operable Unit 3.

Comment 66: Section 5.5.3.2 Data Review, Plume Stability

The Water Board is concerned by the increasing trends at OT069e and the continued migration of the plume. See Comment 63.

Comment 67: Section 5.5.3.2 Data Review, Geochemical Factors

Please provide or reference where abiotic process have been demonstration. The 2009 model assumed there were not destructive methods including abiotic processes and attenuation was occurring through dilution and diffusion.

Comment 68: Section 5.5.3.2 Data Review, Geochemical Factors

The Water Board does not agree that the difference of detected TCE concentrations in MW-136 of 4.4 µg/L in 2013 and 4.0 µg/L in 2015 represents a decreasing trend in concentrations in this well. This difference is insignificant and within the range of normal variability of sampling and analysis.

Comment 69: Section 5.5.4.1 Question A: Is the remedy functioning as intended by the decision document? Implementation of ICs and Other Measures

This section should be revised to address Comment 64 regarding SLUCs and Comments 26, 27, 28, and 29 regarding ICs.

Comment 70: Section 5.5.4.1 Question A: Is the remedy functioning as intended by the decision document? Remedial Action Performance

Natural attenuation processes are not adequate to reduce concentrations to MCLs at OT069e and meet the RAO. Concentrations are increasing and the plume continues to migrate beyond what was predicted in 2009.

Comment 71: Section 5.5.4.1 Question A: Is the remedy functioning as intended by the decision document? System Operations/Operations and Maintenance

The Water Board does not agree that the existing monitoring is adequate to determine the effectiveness of MNA at OT069e. There is inadequate downgradient delineation of the plume and no monitoring of the Lower Aquifer.

Comment 72: Section 5.5.4.2 Question B: Are the assumptions used at the time of the remedy selection still valid? Changes in "Standards" and "To Be Considered"

The U.S. Environmental Protection Agency (USEPA) Directive, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, 1999 (USEPA MNA Policy), should be included as "To Be Considered." The USEPA MNA Policy outlines basic criteria and considerations for MNA, which OT069e does not meet, such as plume stability, adequate site characterization, and achieving goals in a reasonable timeframe.

Comment 73: Section 5.5.4.2 Question B: Are the assumptions used at the time of the remedy selection still valid? Changes in Exposure pathway

Water Board does not concur with the statement that the groundwater pathway is incomplete. See Comment 65.

Comment 74: Section 5.5.4.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy.

The Water Board does not agree that the answer to this question is “no.” See Comments 63 and 65.

Comment 75: 5.5.5 Site OT069 Issues

Additional issues that should be included in this section are the following:

- According to the trigger of the “TCE concentrations exceed the MCL at a monitoring well where concentrations are predicted to remain below the MCL” concentrations in MW-57, active remediation of OT069e should be considered.
- Additional monitoring wells are needed in the downgradient portion of the OT069e Plume.
- The appropriateness of the existing triggers should be reevaluated since the OT069e plume migration is more easterly than the 2009 model predicted and the trigger wells are not appropriate located in this direction.
- Potential impacts to the Lower Aquifer from the OT069e plume should be investigated.
- The site should be evaluated in accordance to USEPA MNA Policy.

Comment 76: Section 5.5.6 Site OT069 Assessment

Water Board does not agree with the assertion that MNA has been effective at OT069e. See Comments 63, 65, 70, and 71.

Comment 77: Section 5.5.7 Site OT069 Recommendations and Follow-up Actions

Recommendations and follow-up actions should be revised to address the issues identified under Comment 75.

Comment 78: Section 5.5.8 Site OT069 Protectiveness Statement

The Water Board does not agree the remedy is protective in the long term. See Comments 26, 27, 28, 29, 65, and 71.

Comment 79: Section 5.7.1, Site ZZ051 Description and Background

The Water Board appreciates the additional actions planned for 2016. However, it unlikely that the additional evaluation will be completed in 2016, since it will entail additional soil sampling of polycyclic aromatic hydrocarbons (PAHs), a risk evaluation, and additional groundwater sampling to evaluate the detection of benzene at borehole SB28. The text should be revised to provide a more realistic estimate of time to complete.

Comment 80: Section 5.7.2.4, Site ZZ051 Progress Since the Last Five-Year Review.

The fourth bulleted item appears to be an incomplete statement. Additionally, the sixth bulleted item is redundant with the fourth bullet. Please revise for clarity and eliminate redundancies.

Comment 81: Section 5.7.3.2 Risk Assessment

This section should be revised to state that the risk assessment will also have to be revised based on the results of the additional soil sampling and analysis for PAHs.

Comment 82: Section 5.7.3.3. Data Review

The results of the groundwater sample for SB028 should be discussed in more detail. Specifically, the constituents of concern that were detected, included fuel and waste fuel related, such as PAHS, and the concentrations of the detections. The Water Board does not agree that these constituents of concern can be dismissed as from cross-contamination and additional characterization is necessary.

Comment 83: Section 5.7.4.2 Question B: Are the assumptions used at the time of the remedy selection still valid?

The need for additional evaluation of PAHs should be discussed under this question.

Comment 84: Section 5.7.5 Site ZZ051 Issues

Two outstanding issues that should be identified here are:

- The need for additional evaluation of PAHs
- The need for representative groundwater samples in the vicinity of SB28.

Comment 85: Section 5.7.7 Site ZZ051 Recommendations and Follow-Up Actions

This section should be revised to address the need for follow-up actions for the two issues identified in the previous comment.

Comment 86: Section 5.7.8 Site ZZ051 Protectiveness Statement

The Air Force's conclusion that the remedy is protective should be qualified pending the results of the additional evaluation of PAHs and groundwater contamination in the vicinity of SB028

Thank you for the opportunity to comment on the Five-Year Review. You may contact me at (530) 542-5471 (linda.stone@waterboards.ca.gov), or Cindi Mitton, Senior Water Resources Control Engineer, at (760) 241-7413 (cindi.mitton@waterboards.ca.gov), if you have any questions regarding this letter.



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