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NMED
Hazardous Waste Bureau

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Mr. David Cobrain
NMED - Hazardous Waste Bureau
2905 Rodeo Park Dr. East
Building One
Santa Fe, NM 87505

RE: Draft Technical Review Comments on the Resource Conservation and Recovery Act Facility Investigation Report, Groundwater Zone, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, New Mexico, Dated March 2014

Dear Mr. Cobrain:

Attached please find draft technical review comments on the subject Kirtland Air Force Base (AFB) report for the Bulk Fuels Facility (BFF) spill site, dated March 2014. This report presents the results of RCRA Facility Investigation (RFI) for the groundwater portion (SWMU SS-111) of the BFF spill site.

We have several general concerns about the report. We also have other specific comments that NMED should consider.

If you or any of your staff have questions, please contact me at (801) 451-2864 or via email at paigewalton@msn.com.

Thank you,

Paige Walton

Paige Walton
AQS Senior Scientist and Program Manager

Enclosure

cc: Ben Wear, NMED (electronic)
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The contents of this deliverable should not be evaluated as a final wc

Draft Technical Review Comments on the Resource Conservation and Recovery Act Facility Investigation Report, Groundwater Zone, Bulk Fuels Facility Spill Solid Waste Management Units ST-106 and SS-111 Kirtland Air Force Base, Albuquerque, New Mexico Dated March 2014

GENERAL COMMENTS

1. The appendices submitted with the Groundwater Zone Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) contain the data, analyses, and other supporting information generated during the performance of the RFI. The RFI references information contained in the appendices as a means of directing the reader to supporting data and analyses or for details that are not furnished in the text. However, the appendices are lengthy and the pages are not numbered; thus, locating the referenced information is difficult. It is recommended that the appendices be subdivided (e.g., subdivide Appendix A by subject of correspondence) and the subdivisions labeled to facilitate the location of the information referenced in text. Revise the appendices submitted with the Groundwater Zone RFI to address this issue.
2. Submerged NAPL – The investigation effort at the Bulk Fuel Farm (BFF) has been ongoing for so long that previously reported non-aqueous phase liquid (NAPL) within several monitoring wells has now been rendered non-recoverable due to increases in groundwater elevation and submergence of the NAPL layer beneath the water table. If left untreated, this submerged NAPL will continue to dissolve petroleum constituents into groundwater for a much longer time than if the NAPL had previously been recovered to the extent possible. However, we agree that the degradation and modeling assessments indicate that petroleum constituents (with the exception of ethylene dibromide [EDB]) are not likely to migrate very far beyond the historic NAPL area. Future monitoring should be performed with the objective of demonstrating continued degradation of the additional contaminant load within the historic NAPL area.
3. Downgradient EDB – Currently, the greatest public health concern with the groundwater plume is the potential for the EDB plume downgradient of the historic NAPL area to adversely impact Kirtland or Albuquerque water supply wells. Future monitoring, risk assessment, and corrective measure evaluation (CME) should specifically address the mitigation of potential EDB impacts in downgradient water supply wells.
4. Degradation Assessment – Overall the Appendix L degradation assessment was well done, and supports the conclusion that petroleum hydrocarbons are being actively biodegraded within major portions of the plume. Biodegradation of EDB within and immediately downgradient of the historic NAPL area is also demonstrated. Additional specific research is required to address the potential for natural or enhanced degradation of EDB in the downgradient plume area, including literature research on biodegradation of EDB (and the chlorinated analogue 1,2-dichloroethane) under anaerobic and aerobic conditions, and the potential for cometabolism of EDB with organic substrate additions. Future CME evaluations should be based on laboratory and potentially pilot testing of EDB degradation in the downgradient plume area.

5. Groundwater Modeling – Overall the Appendix M groundwater modeling assessment was transparent and well documented, and provides a useful tool for future assessment. Limitations and uncertainties of the model were provided, and based on the uncertainties, the model was not used for future projections of EDB plume migration. We agree with the recommendations for future refinement of the model, in particular the collection of additional data regarding water supply well pump rates.

SPECIFIC COMMENTS

1. **Pg. 1-3, Section 1.2.** The last sentence, states: "In order for a contaminant to be considered a COC [constituent of concern], it must have an applicable screening level." Constituents in groundwater that do not have applicable screening levels (or other NMED-approved toxicity values) could still be of concern if they are known to impact human health, bioaccumulate, and/or are mobile and persistent in the environment. In addition to the identified COCs, the Groundwater RFI should identify constituents that do not have screening criteria but could be of concern in characterizing the BFF spills or in assessing risks associated with these spills. Revise the Groundwater RFI to address this issue. Ensure that any such constituents known to impact human health are addressed in the forthcoming risk assessment as constituents of potential concern (e.g., qualitative assessment of carcinogenic risk and/or noncarcinogenic hazard).
2. **Pg. 2-6, Section 2.3.4, 4th bulleted item.** The text indicates Remediation Service International Units 335, 344, and 345 were moved to increase system performance. While it is clear that these units were moved to KAFB-106149-484, KAFB-106161, and KAFB-106160, respectively, and likely were previously located at KAFB-1065, KAFB-1066, and KAFB-1068, it is not clear which unit was located at which groundwater monitoring well. Revise the second and third bulleted items on page 2-6 of the Groundwater RFI to include the name of the Remediation Service International unit associated with the SVE ICE system at KAFB-1065, KAFB-1066, and KAFB-1068.
3. **Pg. 3-1, Section 3.1, 1st paragraph.** Land use at Kirtland AFB and the BFF is described; however, Respondents must also consider the land use of offsite areas impacted by the NAPL and groundwater plume, including residential land use.
4. **Section 3.2.** This section discusses meteorological conditions such as seasonal daily high and low temperatures, rainfall, snowfall, prevailing wind direction, and wind speed. In addition, Section 3.4 includes a discussion of precipitation rate, evapotranspiration rate, and recharge to ground surface. However, a table listing the monthly and annual average values for these parameters is not included in the RFI. Revise the Groundwater RFI to include a table that presents the monthly values, as well as the annual average, and if desired seasonal averages, for the meteorological parameters discussed in Sections 3.2 and 3.4.
5. **Sections 3.3 and 3.4.** These sections describe the regional geology and regional hydrogeology, respectively. However, figures supporting the text descriptions are not included in the RFI. Revise the Groundwater RFI to include figures illustrating the regional geology and regional hydrology to support the descriptions provided in the report texts.
6. **Pg. 3-6, Section 3.4.2 City of Albuquerque Production Zones, 2nd paragraph.** Provide tabulated data of completion intervals for water supply wells shown on Figure 3-1, to support

the first sentence stating "...the top of the well screen is typically greater than 1,000 feet bgs...." This information is important for the RFI evaluation as well as future risk management decisions.

7. **Pg. 4-1, Section 4.1.1**. This section describes the installation of eighty seven groundwater monitoring wells (GMWs) at the BFF site between December 2010 and October 2013. The discussion references external documents for information on well locations even though the locations of all wells (including the eighty seven GMWs addressed in Section 4.1.1) are illustrated in Figure 4-1. Revise Section 4.1.1 to include a reference to Figure 4-1 for the locations of the GMWs installed between December 2010 and October 2013. Ensure the legend of Figure 4-1 is revised to include a means of differentiating the eighty seven GWMs installed between December 2010 and October 2013 and those installed before that time period.

8. **Pg. 4-1, Section 4.1.1**. The fourth sentence indicates a cluster of three monitoring wells was installed at twenty eight locations between December 2010 and August 2011. However, information provided later in this section (page 4-2) states that shallow wells were not installed at six of the locations. Thus, a cluster of three wells was installed at twenty two of the locations and only two wells were installed at the remaining six locations. Revise the fourth sentence in this section to state that a cluster of three wells was installed at twenty two locations while two wells were installed at the remaining six locations.

9. **Pg. 4-2, Section 4.1.1, last sentence on page**. This sentence appears both redundant and inconsistent with the preceding sentence; how can a 14-inch diameter borehole be advanced below the 12-inch diameter borehole?

10. **Pg. 4-6, Section 4.1.6**. The first full paragraph states: "The three wells at Cluster 5 (KAFB-106141, KAFB-106142, and KAFB-106143) were installed such that the tops of the screens were too shallow..." However, the Field Variance form for Cluster 5 identifies the impacted wells as KAFB-106041, KAFB-106042, and KAFB-106043. Revise the cited paragraph to ensure the correct well numbers are included in the discussion.

11. **Pg. 4-7, Section 4.1.7 Well Surveying, third sentence.** The report states that the survey plates are located in Appendix D-3. However, in Appendix D Field Sampling Data and Records, there is no segregation of the different types of information. This appendix needs to be better organized and provided with a Table of Contents.

12. **Pg. 4-8, Section 4.1.9 NAPL Sampling, first paragraph.** How did the field samplers obtain a NAPL sample, when elsewhere it is stated there is no longer recoverable NAPL in the wells? Were there any differences between field collection requirements from KAFB-1066 as compared to KAFB-106076 that would help explain the resulting differences in NAPL properties (such as the flashpoint results for each sample)?

13. **Pg. 4-10, Section 4.2.1.** The last sentence of the second paragraph states that "water level field forms are located in Appendix D-4." Examination of Appendix D indicated that the appendix was not subdivided and all information was presented as Appendix D. However, the forms were found within Appendix D. Revise the Groundwater RFI to include a more specific reference to the location of the water level field forms.

14. **Pg. 4-11, Section 4.2.1, 4th and 5th bullets.** These entries appear to be redundant; they describe the same QC procedures, although different tolerances (0.5 vs. 1.0 ft) are described in each bullet.

15. **Pg. 4-14, Section 4.2.2, last paragraph in Section.** The report refers to Appendix D-1 and D-2; however, these cover sheets were not present in the appendix. Again, this appendix needs to be better organized and provided with a Table of Contents.

    Also the first sentence, last paragraph states: "Groundwater purge logs and sample collection logs are presented in Appendix D-1 and D-2, respectively." Examination of Appendix D indicated that the appendix was not subdivided and all information was presented as Appendix D. However, the purge and sample logs were located within Appendix D. Revise the Groundwater RFI to include more specific references to the locations of the groundwater purge logs and the sample collection logs included in Appendix D.

16. **Pg. 4-17, Section 4.2.5**. This section describes the slug testing conducted as part of the Groundwater RFI. The second paragraph of Section 4.2.5 indicates slug tests were performed on thirty seven GMWs and references Table 4-4 of the Groundwater RFI report. Table 4-4 lists the thirty seven GMWs that were slug tested. Section 4.2.5 also references Appendix H as the location of the full report on slug testing. Appendix H includes an index of the individual slug test analysis sheets presented in the appendix. The index indicates that forty eight wells were subjected to slug testing. This is supported by Table 5-9 of the Groundwater RFI which lists slug test results for forty eight wells. Based on the noted discrepancy in the number of wells subjected to slug testing, it appears likely that the number of mechanical and pneumatic tests cited in the text (fifty four and eighty eight, respectively) may not agree with the information contained in Appendix H and Table 5-9. Review the information regarding slug testing provided in Section 4.2.5, Tables 4-4 and 5-9, and Appendix H. Revise the Groundwater RFI as necessary to provide accurate and consistent information on the number of wells subjected to slug testing and the number of mechanical and pneumatic tests conducted on those wells.

17. **Pg. 4-21, Section 4.3.** The discussion of Quality Assurance and Quality Control indicates that field work variances are located in Appendix A-1. Examination of Appendix A indicated that the appendix was not subdivided and the field work variance forms as well as all correspondence were presented in Appendix A. Revise the Groundwater RFI to include a more specific reference to the location of the field work variance forms within Appendix A. For example, the appendix could be subdivided and each subdivision could be identified by a title page.

18. **Pg. 5-4, Section 5.1.4.** This section summarizes the results of the air/water and water/NAPL capillary tests presented in Table 5-5 of the Groundwater RFI. In addition to the range of values presented in Table 5-5, the discussion in the text provides the average values for the van Genuchten alpha, n, and m parameters for both the air/water and water/NAPL capillary tests. However, the average values of the van Genuchten parameters are not included in Table 5-5. Revise Section 5.1.4 to indicate how the average values of the van Genuchten alpha, n, and m parameters were determined (e.g., arithmetic average of test results listed in Table 5-5). . Continuous Core Sampling Results, page 5-4, summarizes the results of the air/water and water/NAPL capillary tests presented in Table 5-5 of the Groundwater RFI. In addition to the range of values presented in Table 5-5, the discussion in the text provides the

average values for the van Genuchten alpha, n, and m parameters for both the air/water and water/NAPL capillary tests. However, the average values of the van Genuchten parameters are not included in Table 5-5. Revise Section 5.1.4 to indicate how the average values of the van Genuchten alpha, n, and m parameters were determined (e.g., arithmetic average of test results listed in Table 5-5).

19. **Pg. 5-4, Section 5.1.5.** The discussion at the top of page 5-4 states: "As of April 2013, 15 Shallow Zone wells have flooded screens...." The impact on the capability of these wells to effectively monitor the shallow zone is not discussed in the Groundwater RFI. In addition, there is no discussion of actions that could be taken to ensure these monitoring locations remain a viable part of monitoring network for the shallow zone. Revise Section 5.1.5 to discuss the impact that the flooded screens have on the affected wells and identify actions that could be taken to ensure these monitoring locations remain an effective part of the monitoring network for the shallow zone.

20. **Pg. 5-4, Section 5.1.5.** The first bulleted item reports a NAPL viscosity of 1.40 centipoise and NAPL-air and NAPL-water interfacial tension values of 25.3 and 13.1 dynes per centimeter (dynes/cm), respectively. However, the text does not explain how these values were obtained. Appendix C lists kinematic viscosities of 1.07 centistokes and 1.84 centistokes for KAFB 1066 and KAFB 10676, respectively. Interfacial tension values of 45.3 millinewtons per meter (mN/meter) and 31.2 mN/meter are reported in Appendix C for KAFB 1066 and KAFB 10676, respectively; the surface tensions for KAFB 1066 and KAFB 10676 are 25 and 32.6 mN/meter, respectively. Revise the first bulleted item in Section 5.1.5 to summarize how the values for viscosity and NAPL-air and NAPL-water interfacial tension reported in Section 5.1.5 were determined from the NAPL sampling results.

21. **Table 5-6 (Example).** Section 4 or 5 should discuss the monitor well nomenclature convention for this site. Table 5-6 presents results for well KAFB-106005, which seems to be designated as KAFB-1065 on Figure 5-11. Similar inconsistencies (especially for earlier wells) are noted in comparing the text, tables, figures, and appendices (for example, the time series plots in Appendix G). Rather than making all the well designations identical, we suggest explaining the convention in the text (i.e., that KAFB-106001 is the same as KAFB-1061, etc.).

22. **Pg. 5-5, Section 5.2.1, 2nd paragraph, 3rd sentence**. What is the Air Force's position regarding the operation of water supply well KAFB-3? The hydraulic influence of this well on the EDB plume appears very significant; consequently, it is surprising that the influence of this well is only mentioned briefly here in this section. Has the Air Force considered discontinuing extraction from this well? Or alternatively, is it considered a useful means of hydraulic capture? On Figure 5-10 it is noted that KAFB-3 has the greatest amount of drawdown indicated in comparison to other Kirtland water supply wells.

23. **Figure 5-10**. Why is there no posting of water level data from the VA water supply well? Respondent need to make a priority to develop an access agreement with the VA, monitor this well (including water levels), and publish the data in periodic monitoring reports.

24. **Pg. 5-5, Section 5.2.1, 3rd paragraph**. A groundwater elevation decrease of 140 feet is reported, referencing Appendix F water level data for KAFB-3. This statement is based on three water level measurements from 1949, 1953, and 1975 as reported in Appendix F-3 Historical Data. What is the primary source of this older historical information?

25. **Pgs. 5-7 through 5-9, Section 5.2.2.1.** The RFI indicates that screening analyses were performed to identify constituents of concern (COCs) in groundwater and soil and soil vapor, respectively. Page 5-7 list the criteria that COCs must meet; pages 5-7 and 5-8 present a list of the COCs identified in the Shallow Groundwater Zone while COCs in the Intermediate Groundwater Zone and Deep Groundwater Zone are listed on page 5-9. No other information on these screening analyses was found in the report text or the accompanying appendices. The discussion of the screening analysis should be expanded to include additional information on the application of the criteria used to identify COCs. This discussion should define the data set used in the COC screening analysis and the constituents eliminated under criterion 1 and criterion 2 should be identified. A table summarizing the COC Screening Analysis for groundwater should also be included. The tables should present the data set used as well as the number of available samples, the number of detections, and the applicable screening values for each constituent. In addition, each table should include a column that indicates if the constituent is identified as a COC. The reasons for selection or elimination as a COC should also be provided. If the size of these tables is a concern, they can be submitted as self-contained appendices to the RFI report and referenced in the report text. Revise the Groundwater RFI to address this issue.

    Further, the third criterion addresses the screening values used and states that if NMED Groundwater Standards and EPA Maximum Contaminant Levels (MCLs) are not available for a constituent, the EPA Regional Screening Level (RSL) for tap water was used. Note that EPA revises the RSLs in May and November each year. Thus, a reference is needed for the EPA RSLs to demonstrate that the most recent version (at the time the screening analysis was performed) was used as the source for the tap water screening values. Revise the third criterion to include a reference for the EPA RSLs for tap water. Ensure the reference is listed among the References for the Groundwater RFI.

26. **Pg. 5-8, Section 5.2.2.1.** The text indicates acetone was identified as a COC in the screening analysis but was not addressed as such in the Groundwater RFI because "it is not a fuel-related contaminant and is attributed to laboratory contamination." No additional information on the exclusion of acetone is provided in the text; this statement alone is not sufficient justification to exclude acetone as a COC. Revise the discussion on page 5-8 to address the information considered and the decision criteria applied to determine that acetone was attributable to laboratory contamination.

27. **Pgs. 5-11 through 5-15, Section 5.2.2.2.** This section describes the spatial analysis conducted on selected COCs with sufficient detections to warrant interpolation of concentration contours. The discussions for TPH-GRO, TPH-DRO, EDB, Benzene, Toluene, Total Xylenes, 1,2,4-TMB, and Naphthalene list the results of a screening analysis based on Second Quarter 2013 sampling results. No additional information on these analyses was found in the Groundwater RFI or accompanying appendices. Revise these COC-specific discussions to include a table summarizing the screening analysis conducted on Second Quarter 2013 sampling results.

28. **Pg. 5-5, Section 5.2.1, 1st paragraph, and Figure 5-7.** To better characterize the local groundwater conditions, please provide an explanation of the "Groundwater Depression" centered on well KAFB-106075. A similar feature is also shown as a "horseshoe" shape in the contour on Figure 5-8 (intermediate) and 5-9 (deep). This is in the immediate vicinity of

the active SVE system; is it possible that the cause is enhanced groundwater/capillary fringe evaporation from SVE?

29. **Pg. 5-8, Section 5.2.2.1, Shallow Zone COCs.** Where are the PCE, 1,2-dichloroethane, and bis(2-ethylhexyl)phthalate occurrences with respect to the hydrocarbon plume? There should be some explanation of these occurrences. PCE is noteworthy since it is not commonly associated with jet fuel. 1,2-Dichloroethane may have been used as a lead scavenger in fuel, similar to EDB.

30. **Figures 5-26 through 5-40 plume maps.** These figures (in conjunction with other evidence) make a pretty good case that benzene, toluene, xylenes, naphthalene, and 1,2,4-trimethylbenzene are constrained by natural attenuation processes to the historical NAPL area. Not a lot of plume contraction is shown over 1 year of quarterly data, but that is to be expected since it does not represent much time duration. Similar plume maps in Figures 6-36 through 6-44 make an even better case for benzene, toluene, and xylenes since a 3-year time period is shown there.

31. **Pg. 5-15, Section 5.2.3 bubble sampling**. We agree with the conclusion that there is no indication of faulty sampling apparatus from the bubble sampling results.

32. **Pg. 6-2, Section 6, 1st paragraph on page**. Minor/typo: In the last sentence, groundwater is presented as an example of an aquatic environment, but in Pg. 6-1, 2nd paragraph, groundwater is defined as part of the terrestrial environment instead of the aquatic environment. Please reconcile.

33. **Pg. 6-6, Section 6.1.2, EDB bullet.** This sentence "biodegradation under anaerobic conditions is faster "for EDB is significant and should be documented with appropriate references. This may give cause for not using oxidants or enhance aerobic biodegradation for the hydrocarbons plume. Please also add a reference for the statement "EDB will also degrade abiotically under anaerobic conditions, catalyzed by the presence of iron sulfide (FeS)." Additional references for EDB degradation mechanisms would be appropriate in Appendix L.

34. **Pg. 6-7, Section 6.1.2**. A discussion of fate and transport characteristics of 1,2,4-trimethylbenzen (1,2,4-TMB) is provided. The discussion present different values of the Henry's Law Constant for 1,2,4-TMB. The Groundwater RFI reports a value of 5.18×10^{-3} atmospheres-cubic meter per mole (atm-m^3/mol) (it is noted a value of 6.16×10^{-3} atm-m^3/mol is reported in the Vadose Zone RFI). Both values are referenced to EPA's *Health Effects Assessment for Trimethylbenzenes* dated 1987. It is believed the different values are based on different temperatures; however, neither discussion references the temperature for the value reported in the text. Information in the discussions of 1,2,4-TMB regarding the Henry's Law Constant should be reviewed for accuracy and consistency. It is preferred that a single value of the Henry's Law Constant be reported and the reported value reflect the value used in fate and transport calculations. In addition, the reference temperature for any reported value of the Henry's Law Constant should be provided. Revise the 1,2,4-TMB discussions in Section 6.1 to include the reference temperature for the reported value of the Henry's Law Constant. Ensure the information source for the reported value is accurately and appropriately referenced and included among the list of References.

35. **Pg. 6-11, Section 6.3.** The fourth bulleted item, states "It is unlikely that the petroleum hydrocarbon contamination, excluding EDB, will reach any existing receptor well." Information supporting this assertion is not presented, and the sentence should be removed from the discussion. Conclusions should be presented in Section 7, Conclusions and Recommendations, and be supported by the results of the analyses conducted during the groundwater investigation. Revise Section 6.3 to eliminate the quoted sentence from the fourth bulleted item.

36. **Pg. 6-14, Section 6.4.2, first sentence**. Reference to Section 3.1 is in error. The reference to Section 3.1 should be revised to indicate that Section 3.1 is located in Appendix M. Revise the first sentence of Section 6.4.2 to reference readers to Section 3.1 of Appendix M.

37. **Table 6-4**. We note that the first order rate constant used for EDB in the groundwater model is 0, which assumes no attenuation or biodegradation. This is conservative since it is likely that some degradation of EDB is occurring, but is appropriate for the downgradient extent of the EDB plume where degradation is not conclusive.

38. **Pg. 6-18, Section 6.4.7, 2nd paragraph; also pg. 6-19, Section 6.4.9, last bullet**. The regional groundwater flow model indicated reversal of the groundwater flow direction in the vicinity after installation of water supply wells to the northeast. Figure 6-26 indicates that the 1970's plume and perhaps the 1980's plume would flow over the VA water supply well. If so, it is quite possible that the VA well was extracting contaminated water, although the depth of VA well completion may have mitigated this. Are there any operational records for the VA hospital from the 1970s and 1980s that could shed light on this possibility? We understand Respondent's arguments to the contrary, that a residual plume would be present if this flow scenario were true.

39. **Figure 6-29**. Check figure title, it should likely be GRO results for deep groundwater instead of shallow.

40. **Pg. 7-1, Section 7, 2nd bullet**. We do not agree with reducing the COCs to the "primary COCs" shown. There was no justification provided for dropping other COCs such as PCE, manganese, nitrate, 1- and 2-methylnaphthalene, bis(2-ethylhexy)phthalate, etc.

41. **Pg. 7-1, Section 7.** The first sentence of the fourth bulleted item indicates that based on groundwater fate and transport modeling, EDB reached the water table in 1980. However, Section 6.49, Model Uncertainty, indicates that there is uncertainty associated with this estimate. Revise the first sentence of the fourth bulleted item of Section 7 to read "Based on the groundwater fate and transport modeling performed to date, the fuel source reached the groundwater around 1980. However, there is some uncertainty associated with this date." In addition, ensure the similar bulleted item on page ES-7 of the Executive Summary is revised accordingly.

42. **Pg. 7-1, Section 7.** The seventh bulleted item indicates there are no remaining data gaps for SWMU SS-111. This assertion should be modified to reflect the need to further evaluate the value for specific storage used in the local model as indicated in Section 6.4.9, Model Uncertainty, and the need for additional data to complete a plume stability analysis as indicated in Section 6.5, Plume Map Analysis. Revise the seventh bulleted item to include these caveats. In addition, ensure the similar bulleted item on page ES-7 of the Executive Summary is revised accordingly.

43. **Pg. 7-2, bullet at top of page**. In absence of forward projections of the groundwater modeling, what is the schedule for performing the plume stability analysis?

44. **Pg. 7-2, last sentence**. What is meant by "inform the CME"?

45. **Figure 7-1.** Based on the information presented in the RFI, Figure 7-1 does not present a robust conceptual site model (CSM) suitable for use as an initial CSM for a baseline risk assessment. While the description of Figure 7-1 in Section 7 indicates that exposure pathways and exposure routes are linked to the current understanding of groundwater and vadose zone contamination, CSM does not identify potential exposure pathways and exposure routes for all receptors that will be addressed in the forthcoming baseline risk assessment for the BFF spills. Potential exposure points, but no exposure pathways or exposure routes are identified for current receptors within the BFF boundary. However, the baseline risk assessment must also consider the potential for exposure of sensitive subpopulations (e.g., on-base day care, on-base hospital) and impacts to future receptor populations such as a hypothetical future residential receptor. Vapor emissions can potentially impact recreational users at Bullhead Park and on-base residents. Figure 7-1 should be revised to list the exposure pathways and exposure routes associated with the potential exposure points shown on the CSM. For example, it is not clear that direct exposure of workers to contaminated shallow subsurface soils in the FFOR area is accounted for in the CSM. In addition, the title of Figure 7-1 should be changed to "Conceptual Site Model for Current On-Site Receptors." The description of Figure 7-1 in the text should be modified to indicate that the linkage between contamination and receptors is depicted for current on-site receptors only. In addition, the description should note that the CSM will be expanded to include off-site receptor populations (e.g., recreational users of Bullhead Park), future receptor populations, and additional exposure pathways, if necessary as part of the forthcoming risk assessment. Revise Figure 7-1 and Section 7 to address these issues.

46. **Appendix G, Pg. G1-13**. Regarding the hydrograph for KAFB-106005 (same as -1065), why does the NAPL red line vertically drop between 1/2012 and first quarter 2013? This comment also applies to pg. G1-14, G1-16 to G1-18, G1-36, G1-66, G1-71, and G1-83. We note that this appendix is generally better organized than the others.

47. **Appendix L Degradation Analysis**. This analysis is very good, quite thorough, and well documented.

48. **Appendix L, Pg. L-23, Section 4.1.2, first full paragraph.** While we do not dispute the statement that the stable isotope analysis provides "limited evidence that EDB degradation is continuing to occur downgradient from the NAPL", the more important analysis is whether the biodegradation is occurring at a sufficient rate to control migration; in this case, it is probably not.

49. **Appendix L, Pg. L-24, first bullet, third sub-bullet**. The report states that "EDB has a step-function increase at the downgradient edge of the NAPL where the $\delta^{13}C$ isotope ratio increases from -34 to -28‰, thus indicating that most of the degradation is occurring within this zone." Since the carbon-isotope indication of biodegradation changes suddenly at the edge of the NAPL, it seems plausible that EDB is degrading through co-metabolism of the hydrocarbon degradation. Otherwise, if EDB degradation was simply related to anaerobic biodegradation, one would expect a gradual decrease in the carbon isotope ratios further downgradient (since, ORP, manganese, etc. gradually changes in this direction). "Step-

function" decrease may be better demonstrated with EDB concentrations along the flow path; see Appendix L, Figure 4-33. Future consideration of co-metabolic EDB biodegradation in the downgradient plume may be warranted, as well as anaerobic respiration.

50. **Pg. L-26, last paragraph**. We generally agree with statement "The main difference between these two compounds is that benzene can degrade under anaerobic and aerobic conditions, whereas at Kirtland, EDB is primarily degrading under anaerobic conditions." However, the data is also consistent with co-metabolism of EDB under anaerobic conditions.

51. **Appendix M, Executive Summary, Pg. M-x top of page.** The report states that "While the flow and transport calibrations of the local model were acceptable, there are several areas of uncertainty in the local model that will be addressed before the model can be used for final corrective measures evaluations". This should be more clearly stated in the text of the RFI; instead, the model results were presented in the text up to emulating the present plume concentrations, but no reason was given for why forward-projection modeling was not presented.

52. **Pg. M-10, Section 3.1, Paragraph 2.** The report states "This was accomplished by updating the municipal supply well pumping rates (approximately 90 wells) through early 2013." What is the source of the water supply well pumping rates, and where can they be reviewed? Is it provided in the USGS modeling report? Respondents must provide a table showing each water supply well used in the regional model and local model, with associated extraction rates. Also, future pump rate, water level and analytical monitoring should be provided for nearby water supply wells (at a minimum, the VA, Ridgecrest-3, and Ridgecrest-5 wells), both to support future runs of the local model as well as to provide protective monitoring of receptors. Similarly, pg. M-11, paragraph 3.d states "the Veterans Affairs (VA) Medical Center water supply well, and Ridgecrest/Burton wells located within the local model area were then mapped into the model with pump rates established through 2013", what is the source of this assumed pump rate information?

53. **Pg. M-27, last bullet**. We agree that "The largest uncertainty for use of the local model in future-scenario predictions is the assumed pumping rates and locations for the municipal and local water supply wells." Actual pumping rates for local water supply wells should be monitored for a year to reduce this uncertainty.