Certified Mail - Return Receipt Requested

April 10, 2024

ENTERED

Colonel Michael J. Power, USAF
Base Commander
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB, NM 87117

Ms. Melissa Clark
Civil Engineer Office
377 MSG/CEIE
2050 Wyoming Blvd SE
Kirtland AFB, NM 87117

RE: SECOND DISAPPROVAL
REVISED SOURCE ZONE CHARACTERIZATION REPORT BULK FUELS FACILITY SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO
EPA ID# NM6213820974
HWB-KAFB-19-012

Dear Colonel Power and Ms. Clark:

The New Mexico Environment Department (NMED) received the *Source Zone Characterization Report for the Bulk Fuels Facility Solid Waste Management Unit ST-106/SS-111, Revision 1, April 2021* (Report) with cover letter dated April 26, 2021. The revised Report was submitted in response to NMED's August 17, 2020 Disapproval letter (Disapproval). NMED has reviewed the revised Report and hereby issues this second Disapproval with the following comments:

GENERAL COMMENTS

1. **Unsolicited Changes to the Revised Report**

NMED Comment: The Permittee made substantial changes to the revised Report, which were not related to NMED comments provided in the Disapproval. The changes have resulted in the revised Report requiring a full review. Details regarding each of the unsolicited changes and their impact on the revised Report are provided in the General and/or Specific Comments below. Providing unsolicited changes in future document revisions may result in rejections or assessment of fees for a new document review. The Permittee must not make unsolicited changes to revised documents.

2. Statement Claiming that LNAPL at the Site is Not Mobile

NMED Comment: The revised Report repeatedly states that LNAPL at the site is not mobile. ITRC Interstate Technology and Regulatory Council (ITRC) *Light Non-Aqueous Phase Liquid Site Management: LNAPL Conceptual Site Model Evolution, Decision Process, and Remedial Technologies*. LNAPL-3 states "LNAPL is considered mobile when it accumulates in a well (assuming the well is properly constructed and screened across the LNAPL smear zone)." Several lines of evidence from the site data indicate/ that LNAPL at the site is mobile:

a. LNAPL mobility was determined by laboratory LNAPL mobility analyses performed on selected core samples. These data are presented on Table 5-4, Summary of LNAPL Saturation and Mobility for Select Core Samples. A limited number of samples were selected for LNAPL mobility analysis. From the sample cores selected for LNAPL mobility analysis, the laboratory selected a sample interval of 1 to 2.5 inches from the cores for analysis. In addition, based on the lithologic logs it appears that some cores which exhibited high photoionization detector (PID) readings and ultraviolet (UV) fluorescence were not submitted to the laboratory for LNAPL mobility analysis (e.g., KAFB-106S1 core from 486 to 488 ft bgs). The Permittee must discuss the limitations of the LNAPL mobility testing given the limited number of samples sent for analysis and the limited sample size selected by the laboratory in the second revision of the Report;

b. More recent evidence, collected after the source zone characterization field activities were completed, indicates that LNAPL is not defined at the site. For example, significant LNAPL thicknesses were encountered in the Ethylene Dibromide (EBD) pilot test area, based on the March 2021 Final Ethylene Dibromide In Situ Biodegradation Pilot Test Report, Revision 1, Bulk Fuels Facility, Solid Waste Management Units ST-106 And SS-111 (EDB Pilot Test Report). In February 2020, LNAPL was detected in EDB pilot test wells KAFB-106EX1 and KAFB-106EX2 at a thickness of 0.65 ft and 11.2 ft, respectively. In July 2020, one gallon and 16 gallons of LNAPL, respectively, were removed from these two wells, and two subsequent LNAPL removal events were documented in the EDB Pilot Test Report. The presence of 11 ft of LNAPL approximately one year after the investigation activities were complete indicates that LNAPL at the site is mobile and that LNAPL is not yet adequately characterized at the site;

c. Quarterly monitoring reporting for the site indicates that the source area groundwater monitoring well KAFB-106S10, installed in November 2020, contained measurable LNAPL requiring removal in 2021 and 2022. If LNAPL at the site was not mobile, it would not be entering the newly installed well;

d. Quarterly monitoring reporting for the site documents that monitoring well KAFB-106005 contained considerable thicknesses of LNAPL following source zone investigation activities, also indicating that LNAPL is still mobile at the site.

It is inappropriate and inaccurate to state that the LNAPL at the site is not mobile. In the second revision of the Report, the Permittee must provide a discussion on the mobility of LNAPL that not only interprets the data collected during the source zone characterization investigation activities, but also includes more recent data which demonstrates the presence of significant thickness of LNAPL in monitoring wells at the site. Remove the unsupported statement from the second revised Report.

3. **Nature and Extent of LNAPL at the Site**

NMED Comment: According to Figures 5-4, LNAPL Pore Volume Saturation Percent, and 5-5, LNAPL Total Volume Saturation Percent, the horizontal and vertical extent of LNAPL contamination at the site has not been determined. LNAPL was identified in the pore space of every sample that was analyzed for LNAPL. According to Table 3-1, Coring Intervals and Soil Sample Locations, LNAPL samples were not collected at the deepest interval of historical groundwater depth in 2009 (i.e., 494 ft bgs) in several locations. In addition, total petroleum hydrocarbon (TPH) analytical results for soils indicate that free phase LNAPL is present at the site. Therefore, the nature and extent of LNAPL has not been defined at the site. Section 3.1.1 of the December 15, 2017 *Work Plan for Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base (KAFB), New Mexico, Revision RI* (Work Plan), states that the objectives of the continuous coring are to " ... provide supplemental data on the nature and extent of the residual fuels ... ", " ... address the data gaps of horizontal and vertical extent of LNAPL", and "[p]rovide supplemental information on the nature and thickness of the smeared LNAPL zone". Regardless of the mobility of LNAPL, the presence of submerged LNAPL constitutes a continuing source of groundwater contamination at the site, and the horizontal and vertical extents of LNAPL contamination at the site must be defined before remedial alternatives can be evaluated for the site.

4. **Global Replacement of "residual LNAPL" with the terms "diffused and dispersed" LNAPL**

NMED Comment: The global replacement of the term "residual LNAPL" with the term "diffused and dispersed LNAPL" and the concept of the dispersion of LNAPL in the revised Report are misleading. Based on recent LNAPL data from the site, LNAPL is not "diffused and dispersed LNAPL". The Permittee must remove the term "diffused and dispersed LNAPL" and other instances of diffused and/or dispersed from the text, tables, and figures of the second revision of the Report.

5. **Removal of the Model from the Revised Report**

NMED Comment: Instead of providing the information regarding the modeling that was requested in several Disapproval comments (e.g., Disapproval comments 11, 12, 32, 33, 35, 36, 37, etc.), the Permittee chose to completely remove the model from the Report. Visual presentation of data is a necessary component of an investigation report to portray complex subsurface investigation data (e.g. cross sections). Section 3.73, Subsurface Conditions, of NMED's September 2, 2020 letter to KAFB titled Reporting Requirements for All Document Submittals (Reporting Requirements Letter) provided KAFB with the requirements for providing visual representation of site subsurface conditions. At a minimum, subsurface information regarding the location of LNAPL, soil contaminants of concern (COCs), groundwater COCs, qualitative soil vapor COCs, and the subsurface lithology must be depicted on cross sections and submitted with the revision of the Report.

6. **Removal of the Cross Sections from the Revised Report**

NMED Comment: Several Disapproval comments were related to the cross sections provided in the Report (e.g., Disapproval comments 7, 11, 13 b, 44, 45, 49, 50, 59 a, and 59 b.) Instead of addressing the comments, the Permittee chose to remove the cross sections entirely from the Report. Despite the Permittee's general response to these comments that "[c]reating an updated cross section with information presented in this report was not part of the scope in the approved work plan", detailed, draft cross sections were specifically created in April 2019 for the original October 2019 Source Zone Characterization Report. These cross sections summarized the data acquired for the newly installed wells as well as nearby existing wells.

The Permittee's response that "[u]pdated cross sections that will include the data from this investigation as well as the recently installed data gap wells ... will be presented in the upcoming Data Gap report submittal" is a not valid response; stating that the cross sections for this scope of work will be presented in a report for a different scope of work is not appropriate. NMED has received the Investigation Report for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106510, Bulk Fuels Facility Solid Waste Management Units ST- 106/SS-111, dated October 2021. This report has been reviewed by NMED; however, the cross sections provided in that report do not address the Disapproval comments and are not revised versions of the cross-sections created in April 2019 with the added data gap wells. Additionally, directing the reader to refer to several tables, figures, and an appendix illustrates the need for a visual representation of investigation data in the revised Report (i.e., cross sections). The Permittee must provide cross sections specific to the source zone characterization investigation activities in the second revision of the Report.

NMED' s May 20, 2022 Request for Information, Kirtland Air Force Base, New Mexico (Request) directed the Permittee to provide the draft cross sections created in April 2019. The Permittee's July 18, 2022 response states "[r]egarding the April 2019 geologic cross sections requested in the May 20, 2022 letter, the United States Army Corps of Engineers (USACE) consulted with [the contractor] and informed the Air Force that [the contractor] drafted geologic cross sections in April 2019. However, [the contractor] did not save the referenced cross sections because [the contractor] did not include the cross sections in any report it submitted to USACE or the Air Force. USACE and the Air Force never received [the contractors] April 2019 geologic cross sections" Since the Permittee asserts that the cross sections are unavailable, the Permittee must recreate the cross sections containing the information that was originally on the cross sections created in April 2019 for the Report as well as provide other relevant information.

The cross sections must include at a minimum:

a. All wells installed for this field effort as well as existing wells at the time of the investigation, including KAFB-106117;
b. Lithology based on USCS classifications (as logged by the field geologist);
c. Depth to water at the time of drilling for each borehole, as well as historic high, intermediate, and low water levels at the site (e.g., 396 feet below ground surface (ft bgs) in 1950, 406 ft bgs in 1960;
d. Depictions of key stratigraphic surfaces, such as the top of the ancestral Rio Grande sediments as well as the tops and bottoms of the fine grained, low permeability intervals that occur between approximately 250 and 300 feet bgs;
e. Multiple straight line transects rather than a single transect with multiple directional changes;
f. Surface features on the top horizontal axis including but not limited to the former fuel offloading rack (FFOR), fuel storage tanks, streets, the VA hospital, Bullhead Park, etc.;
g. Both elevations and depths below ground surface;
h. Photoionization detector results;
i. Ultraviolet screening results;
j. Depths of samples collected for laboratory analyses and the results of the analyses depicted at the appropriate depths (e.g., TPH, EDB, benzene);
k. Depths of LNAPL based on UV field screening and laboratory results;

The scale(s) of the cross sections must be such that the relevant information is readily visible. It may be necessary to have various cross sections at different scales showing subsurface conditions across the site and migration pathway conditions surrounding the FFOR. For example, a cross section showing the migration pathway of the contaminants from the FFOR to the groundwater should be on a different scale than a cross section showing the lithology on a long cross section line (e.g., from KAFB-106108 to KAFB-

106124). The cross sections must be presented in a large enough format to allow the details to be discernable. The submitted size must be 24 inches by 36 inches at a minimum.

7. **Removal of the Cross Sections from the Revised Report**

NMED Comment: Section 3.2.12 of the Work Plan states " ... core will be placed in core boxes and photographed using a high resolution digital camera. The core boxes will be secured at the end of the project to the designated Kirtland [Air Force Base] AFB facility currently used to store project cores." The Sonic drill cores were not saved with the drill cores from previous investigations at the site, and instead were discarded (personal observation). The photographs provided in Appendix E, Technical Memorandum for Vadose Zone Core Photography Logs, of the revised Report are provided in low-resolution as PDFs. The only remaining visual record of the subsurface lithology encountered during the source zone characterization activities are the high-resolution photographs of these cores. A compact disk containing all of the original high resolution digital photography files of the drill cores must be provided with the second revision of the Report.

8. **Use of the Term Non-Detect without Context**

NMED Comment: The use of the term non-detect, or ND, without context when reporting analytical results on tables or figures is misleading. The Permittee must qualify the ND by stating that the analysis was ND at the limit of detection (LOD) or reporting limit (RL), depending on the individual analysis, and present the results in a format indicating that the contaminant concentration was less than the numeric LOD or RL (e.g., <0.5). Revise the Report to present numeric analytical results for all constituents in the second revision of the Report in this manner.

SPECIFIC COMMENTS

9. **Section 5.2.5: Microbial Analysis, Page 5-9**

Permittee Statement: "Based on these data, it does not appear that biodegradation of EDB or BTEX can occur at significant rates at these sample locations. However, the analytical laboratory indicated that the low results were likely due to an unidentified substance that appeared to inhibit the PCR. Inhibition of the PCR would cause the gene and bacterial population assays to report lower than what may be present. Based on this, it is not possible to determine whether these data are biased low due to an unknown compound present in the samples or if these organisms and functional genes are truly not widespread in significant numbers in the samples."

NMED Comment: The report from Microbial Insights is not included as an attachment. The Permittee must provide the report in the second Revision. Though the analytical laboratory has indicated the presence of an unidentified substance that might be interfering with the PCR, describe the efforts made to identify the source of interference. Additionally, only methanogens and sulfate-reducing bacteria are indicated, but LNAPL degradation can be brought about by a wider array of both aerobic and anaerobic bacteria.

10. Section 5.2.5: Microbial Analysis, Page 5-10

Permittee Statement: "It is difficult to determine if the low concentrations of these common aerobic BTEX degradation genes were the result of the inhibition of the PCR. However, their presence suggests that aerobic degradation of BTEX and potentially co-metabolic biodegradation of EDB may be significant degradation processes in at least some locations in the source area."

NMED Comment: Without further evidence, aerobic degradation and co-metabolic biodegradation should not be relied upon during remediation. During the Corrective Measures Evaluation stage, the Permittee will need to present more evidence to prove microbial degradation as a remediation solution. The Permittee is reminded that the In Situ Bioremediation Pilot Test Report was disapproved on January 30, 2023, as a viable remedial alternative for EDB contamination.

11. NMED Cover Letter Comment in August 2020 Disapproval; Redline Strikeout Version

NMED Comment: The Disapproval comment stated "[t]he Permittee must submit a complete electronic red line-strikeout version of the revised Report that shows where all changes were made to the Report." The Permittee failed to do so, the electronic redline-strikeout (RLSO) version of the revised Report is not accurate or complete. A brief comparison between the Report, the revised Report, and the RLSO version reveals several inconsistencies. Three examples of inconsistencies are:

a. The revised Report shows that the signatory of the Document Certification page had changed from the original to the revised Report. The RLSO does not reflect this change.

b. Numerous inconsistencies were noted between the original Report Table of Contents and revised Report Table of Contents that are not identified by the RLSO. For example, Section 4.2.2, Groundwater Monitoring Well Gauging and Development was added to the text of the Report; it is not shown in Table of Contents of the RLSO, however, the text of the revised Report does have it added to the Table of Contents.

c. Inconsistencies exist between the Response to Comments (RTC), RLSO, and the revised Report. For example, in Section 4.3, Deviations from Work Plan, the RTC provides several quotes of text that were purportedly added to the revised Report to address NMED Comment 84 of the Disapproval letter. The RLSO and the revised report show that the complete response was given in the RTC, however, the text was not added to the revised report.

The Permittee must ensure that an accurate RLSO is provided with the second revision of the Report All changes to the second revision of the Report text must be accurately provided in the RLSO.

12. NMED Comment 1 from August 2020 Disapproval; Quality Control of Document Submittals

Permittee Response: "The document has been revised to meet these requirements."

NMED Comment: Many errors which the Permittee stated were corrected in the RTC were not corrected, including but not limited to incorrectly numbered pages and missing email attachments. The Permittee must improve its quality control procedures and correct the deficiencies in the second revision of the Report.

13. NMED Comment 2.a.iv from August 2020 Disapproval; Air-Lift Enhanced Bioremediation Pilot Test Details

Permittee Response: "A written request to defer the air-lift enhanced bioremediation pilot test was submitted to the NMED on July 23, 2018 based on discussions with NMED."
and
"These issues included a limited radius of influence and biofouling of the wells that would impede water flow and cause significant maintenance and redevelopment of the wells. A formal response to the request has not been received from the NMED. Further discussions will be provided in the [EDB] In-Situ Bioremediation Report to be submitted to NMED in the future."

NMED Comment: This referenced letter was submitted to NMED's Ground Water Quality Bureau; it was not submitted to the HWB. The details regarding this change were not provided in the EDB Pilot Test Report. A discussion must be added to the text of the second revision of the Report that states why well KAFB-106S1 was not completed in accordance with the well completion specifications in the NMED approved Work Plan.

14. NMED Comment 2.d from August 2020 Disapproval; Other Scopes of Work

Permittee Response: "Table A-1 in Appendix A provides the status for these various scopes of work. This report discusses the work performed to support the vadose zone coring, sampling, and monitor well installation."

NMED Comment: Table A-1 in Appendix A, for "Air-Lift Well Completion KAFB-106S1", in its entirety, states only "Letter Requesting Deferral Submitted to NMED on 7/30/18." Table A-1 provides no explanation of why the air-lift pilot test was not performed, nor why KAFB- 106S1 was not completed according to the approved Work Plan. The explanation for why KAFB-106S1 was not completed as an air-lift well, as outlined in the approved Work Plan must be included in the in the Report sections on well completions, as well as in the Work Plan deviations section of the second revision of the Report. See Comment 11.

15. NMED Comment 3 from August 2020 Disapproval; Historic Groundwater Levels

Permittee Response: "Added the following text to Section 3 (new text in italics), "*The approximate groundwater elevation in the project area was 4,950 ft above mean sea (ams/) level in 1950, 4,940 ft ams/ in 1960, and 4,930 ft ams/ in 1970. The groundwater table elevation began dropping due to the development of the City of Albuquerque well fields and reached its lowest point of approximately 4,852 ft ams/ at the end of 2009. Using KAFB- 10659 as an example, the depth to water was approximately 396 ft bgs in 1950, 406 ft bgs in 1960, 416 ft bgs in 1970, and 494 ft bgs in 2009.*"
And
"UV fluorescence of core samples from KAFB-106S9 identified LNAPL in the saturated zone at a depth that coincides with the former lowest groundwater elevation from 2009 (approximately 494 ft bgs)."

NMED Comment: Due to the dynamic nature of the groundwater elevations at the site, particularly the rise since 2009, the second revision of the Report must include one more historical date, concurrent with the end date of this field investigation (i.e., 2019), to bring the data set up to the date of the work performed for this field effort. Additionally, a brief discussion of the effect of changing groundwater levels on vadose zone contamination, groundwater contamination, and the presence of measurable LNAPL must be included in the second revision of the Report.

16. NMED Comment 4.c and 4.d from August 2020 Disapproval; Laboratory-Assigned Data Qualifiers

Permittee Response: "The data qualifiers presented on Table 5-1 of the report are the final data qualifiers applied to the analytical data once the data has undergone the formal third-party validation process documented in Appendix H-DQER [Data Quality Evaluation Report]. During the formal data validation process, the laboratory assigned qualifiers that are reported in the lab data package (D, Q, etc.) are reviewed through the data quality indicator criteria and revised to the appropriate EPA [United States Environmental Protection Agency]/DoD [Department of Defense] qualifiers identified in the project QAPP [Quality Assurance Project Plan] (J, UJ, U, R). The qualifiers reported by the laboratory will always be maintained in the final data package. The validation qualifiers will be added to the project database and supersedes the lab qualifiers when reporting project data in tables etc. Both the lab assigned qualifiers and the validation qualifiers are maintained in the project database."
and
"Data usability issues determined by the third-party validator are discussed in Section 5.2.2 that includes a discussion of data quality exceedances that resulted in data qualification during validation and a reference to Appendix H for details. A full review and discussion of the formal third-party data validation process and final applied data qualifiers, including potential impact to data quality and usability of analytical results is provided in the report, Appendix H - Data Quality Evaluation Report."

NMED Comment: The Permittee did not address the comments. For example, soil sample VS7- 220119-495 from borehole KAFB-106-S7 at 495 ft bgs required a laboratory dilution of 200 times for the SW8011 EDB analysis. The laboratory data shows a data qualifier of "D" for dilution, while Table 5-1 of the revised Report shows no qualifier at all. As a result of this dilution, the laboratory results which are reported on Table 5-1 are biased low (i.e, higher LOD), meaning the actual concentrations of EDB in this soil sample could be higher than the result reported on Table 5-1 of the Report, with no indication that this may be the case.

The actual laboratory quality control results (i.e., laboratory assigned data qualifiers) are required to be reported in accordance with the KAFB Permit Section 6.5.18.2 and the General Reporting Guidelines Section 3.14.3, Chemical Analytical Program. The Permittee's "validation qualifiers", derived by a third-party data validation process, cannot supersede or replace laboratory provided data qualifiers and case narratives. The Permittee may provide justification in the text and data validation sections of the revised Report for how specific laboratory data qualifiers do not affect the acceptability of the data. However, all tables presenting laboratory results must include a column for the laboratory data qualifiers, with footnotes that adequately define the laboratory qualifier codes, in the second revision of the Report.

17. NMED Comment 4.e from August 2020 Disapproval; Laboratory Dilution of Samples Prior to Analysis

Permittee Response: "The "J" qualifier for sample results on Table 5-1 [Analytical Results for Total Petroleum Hydrocarbons and Volatile Organic Compounds in Soil] does not indicate samples were diluted prior to analysis. The "J" qualifier is not applied to data for that purpose. The "J" qualifier is used to indicate either 1) the result is below the limit of quantitation or reporting limit and therefore considered an estimated value, or 2) the value is estimated based on data validation criteria such as lab control sample recovery, matrix spike recovery, calibration verification exceedance, minor hold time exceedance, field duplicate sample relative percent difference, etc. as documented in Appendix H-DQER.

Project samples are not diluted prior to analysis and only diluted during analysis to bring elevated concentrations of target analytes into the calibration range or if matrix interferences are present. Sample dilution is performed per the EPA SW846 analytical methods. The sample specific dilution factor is included in the Appendix J flat file, column Q (dilution factor). Through review of the Appendix J flat file one can see that the sample analyses where the dilution factor is greater than 1X are associated with high levels of [benzene, toluene, ethylbenzene, xylenes] BTEX, EDB or TPH in sample results"

NMED Comment: The samples were diluted prior to being injected into the analytical instrument; while the samples were diluted during the analytical procedure, the dilution occurred prior to the actual analyses. Permit Section 6.5.18, Laboratory Analyses Requirements for all Environmental Media, states, "[t]he Permittee shall also report whether any dilution of the sample was needed prior to laboratory analysis, and the amount of dilution, if any. The Department will not accept J-coded (estimated) results for samples requiring dilution prior to laboratory analysis." Samples which have been diluted by the laboratory during the analytical process generally result in LODs greater than screening levels (SLs), which is considered a data quality exception. Table 5-1 must include a column that provides the laboratory dilution factor for each sample analysis as well as a column which indicates the LOD and LOQ for the specific sample/analysis. Sample analyses resulting in LODs that are greater than SLs must be identified as such in all text, tables, and figures, and cannot be used for decision making purposes. See Comment 16.

18. NMED Comment 4.f from August 2020 Disapproval; Samples Analyzed Outside of the Holding Time

Permittee Response: "There were exceedances of holding time by the laboratory for some samples and results presented on Table 5-1. A thorough discussion of the holding time exceedances and the resulting data qualifiers are included in Appendix H - DQER ... the results associated with the hold time exceedances have been qualified per EPA and DoD guidelines including "J" for detects and "UJ" for non-detects. If there are data usability issues determined by the third-party validator, those concerns would be discussed in Section 5.2.2 and a reference included to Appendix H for details."

NMED Comment: Analytical laboratory assigned data qualifiers must be used in the Report; third party lab qualifiers cannot be used. The Permittee must address the original comment and revise Table 5-1 to note which samples exceeded holding times and include the applicable laboratory qualifiers on the revised table. See Comments 14 and 15 above.

19. NMED Comment 4.g from August 2020 Disapproval; Table 5-1 DL, LOD, and LOQ Columns

Permittee Response: "The lowest analyte concentration detected per the DoD [Quality Systems Manual] QSM methods is the [detection limit] DL. There are 3 DoD reporting limits (DL, LOD, [limit of quantification] LOQ). The LOD is the lowest for reporting of a non-detect analyte with a 99% confidence. Results reported below the LOQ and above the DL are flagged "J" for estimated data. Non-detects are reported at the LOD which is why that column and value are included on the table 5-1. A flat file of the data was provided in Appendix J [Searchable Flat File of Volatile Organic Compounds, Ethylene Dibromide, and Total Petroleum Hydrocarbon Analytical Data] that includes the 3 DOD reporting limits for each analyte reported."

NMED Comment: While the appropriate columns were added to the flat file of the data in Appendix J, columns for the DL, LOD, and LOQ must also be added to Table 5-1 in the second revision of the Report. See Comment 8. General Reporting Guidelines Section 3.12, Tables, states " This section must provide the following summary tables. Data presented in the tables must include the current data, dates of data collection, analytical methods, detection limits, and significant data quality exceptions. All summary data tables must include only detected analytes and data quality exceptions that could potentially mask detections."

20. NMED Comment 5 from August 2020 Disapproval; Chemical Characterization of Residual LNAPL

Permittee Response: "The approved scope of work did not include an evaluation of changing chemical composition of LNAPL in groundwater over time nor an analysis of the effective solubility of the LNAPL. LNAPL was not present in sufficient quantities for the analytical laboratory to perform chemical composition analysis. The following was added to Section 4.3, Deviations from Work Plan, "LNAPL was not present in sufficient quantities to be able to perform hydrocarbon component analysis." The statement on the notice page was revised to state, "Physical characterization was performed on residual LNAPL samples."

NMED Comment: The collection and analysis of additional LNAPL samples must be performed to determine potential remedies for remediation at the site. Because the release happened over a long period of time and because LNAPL degrades over time, affecting LNAPL effective solubility values, a large data set of LNAPL analyses from the site (i.e., multiple locations and dates of collection) is critical to site characterization. The Permittee must collect samples of LNAPL from wells with recoverable LNAPL for chemical composition analysis anytime it is encountered during normal site activities (e.g., quarterly monitoring, pilot testing, etc.)

21. NMED Comment 7 from August 2020 Disapproval; Clay Units and Cross Sections

Permittee Response: "The Air Force agrees that there is residual source fuel in the saturated zone as well as in the vadose zone above the capillary fringe. Each monitoring well is gauged on a quarterly basis and minor amounts of LNAPL are observed in only a few wells that are located within the boundary of benzene effective solubilities (see Figure 5-7). In addition, LNAPL mobility analysis performed on samples collected above and below the clay in the vadose all indicated that the residual LNAPL is no longer mobile.

Creating cross sections and a site-wide clay isopach map was beyond the scope of this investigation and not included in the approved Work Plan. Additional information regarding the clay pathway will also be included in the forthcoming Data Gap Report.

The Air Force agrees that it is important to understand the historic LNAPL migration pathway to the extent necessary to support the Corrective Measures Evaluation. The Air Force will summarize the data concerning the historic LNAPL migration pathway in an updated Conceptual Site Model in the RFI Phase II once the investigation phase of the RCRA process has been completed."

NMED Comment: An understanding of the subsurface geology at the site is essential to developing an accurate CSM supporting the CME phase of RCRA corrective action. To clarify, there are fine-grained zones (i.e., clays) in the alluvial deposits and in the Ancestral Rio Grande (ARG) deposits found beneath the site. Within the ARG there are two distinct fine grained units at depths of approximately 250 -300 bgs and another unit at approximately 450 ft bgs beneath the site. There are also the A1 and A2 fine grained units deeper in the ARG. NMED uses the term 'upper and lower clay' to differentiate the two clays in the 250-300 ft bgs zone. These two clays, while not continuous throughout the entire site, are mostly continuous through the middle and eastern parts of the site area for at least 1000 feet laterally. Creating cross sections is relevant to the investigation activities covered by the Report and are required to be included in the second revision of the Report. See Comments 1 and 6. In addition, the Permittee may provide an accurate CSM with the RFI Phase II Report or with an updated Risk Assessment Report.

22. NMED Comment 8 from August 2020 Disapproval; Comprehensive General Overview of the Site History

Permittee Response: "Project background was revised. See Section 2, Facility History and Project Background for the revised text."

NMED Comment: The comment was not adequately addressed as follows:

a. In Section 2, the Permittee inappropriately introduced a new conceptual site model (CSM) into the site history section. See Comment 1. In the second paragraph of Section 2, the Permittee states "[a]s the fuel was released from the underground pipelines over time, it drained vertically downward due to the force of gravity through different parts of the subsurface" and cites the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report for the Bulk Fuels Facility (BFF) Release Solid Waste Management Unit (SWMU) ST-106/SS-111 dated August 2018 (Phase I RFI Report), as the source of this information. It is unclear why the Permittee has cited the Phase I RFI because Section ES-5, Conceptual Site Model, of that Report states "[t]he released LNAPL migrated through the vadose zone soil. LNAPL migrated generally downward ... via a complex pathway influenced by the heterogeneous sediments in the alluvial fan and Ancestral Rio Grande deposits. More permeable sands and gravels allowed the LNAPL to migrate more easily, while less permeable silts and clays slowed LNAPL migration." The Phase I RFI does not discuss vertical migration of fuel directly beneath the release area. The Permittee must remove the statements regarding vertical migration of fuel beneath the release area from the second revision of the Report.

b. On page 2-1 the Permittee states, "[t]he LNAPL is now discontinuously dispersed across the vadose zone and the upper portion of the aquifer." See Comment 4.

c. The first sentence of last paragraph on page 2-1 states "LNAPL constituents (dissolved-phase fuel-related contamination) dissolved into groundwater and followed the flow of groundwater in a north-northeast direction." The process of contaminants such as EDB and benzene partitioning from submerged LNAPL into dissolved phase contaminants in the groundwater is an ongoing process. The Permittee must change the past tense of the word "dissolve" [into groundwater] to the present tense in the second revision of the Report. See Comment 3.

d. The first paragraph on page 2-2 states "Soil vapor extraction systems operated at the site from 2003 to 2015 and removed approximately 775,000 equivalent gallons of jet fuel." Comment 2 of NMEDs *Approval With Modifications, Phase I RCRA Facility Investigation Report, Bulk Fuels Facility, Solid Waste Management Units ST-106 And SS-111 Kirtland Air Force Base, New Mexico* letter dated September 25, 2020 (Phase I RFI Approval with Modifications), specifically states "Section 4.6.2.5 SVE [soil vapor extraction] HC [hydrocarbon] Mass Removal, of the Report does not contain the requested information regarding the equations, defining variables, units, and inputs used to make these calculations, nor was the reason for omitting this information included in the Report. Furthermore, Appendix L-1 (Mass Extraction Calculations) from the 2017 Phase I RFI was removed from the 2018 Report rather than being updated to contain the information specified in NMED 2018 Draft NOD Comments ... [t]herefore, hydrocarbon removal estimates prior to 2016 as a result of the [catalytic oxidizer] CATOX operations or biodegradation cannot be used for decision-making purposes at the site unless the data is re-presented along with the necessary supporting information." The Permittee must either present the data along with the necessary supporting information or remove the unsupported information from the second revision of the Report.

23. NMED Comment 10 from August 2020 Disapproval; Development, Gauging and Sampling

Permittee Response: "Well development and gauging information was provided in the well completion reports that were included as an appendix within the appropriate Quarterly Groundwater Monitoring Report. A Well Completion report is included as Appendix I [Well Completion Report] of this revised report. Sampling information was

also provided in the appropriate Quarterly Groundwater Monitoring Report. The analytical results for the first sampling event for each well are included in Table 4-4 of the included Well Completion Report (Appendix I). In addition, Section 4.2.2 Groundwater Monitoring Well Gauging and development was added to the text."

NMED Comment: The analytical results for the first sampling event for each well are not included in Appendix I. Instead, the results are included in Table 4-4 of the Report. Revise the Report to correct the error.

24. Section 4.2.2, Groundwater Monitoring Well Gauging and Development

Permittee Response: "Development water was contained in 55-gallon steel drums with water-tight lids and transferred to the ... investigation derived waste (IDW) yard located on Kirtland [Air Force Base] AFB for waste management."

NMED Comment: Observations recorded in the field notes indicate that development water was either entirely stored, or also stored, in 65-gallon polyethylene drums with water-tight lids. This observation contradicts the statement in Section 4.2.2, Groundwater Monitoring Well Gauging and Development, of the Report. The Permittee must accurately describe the actual IDW collection, storage, and disposal procedures used in the field and include relevant records and field notes in the second revision of the Report. See Section 3.6 of the Reporting Requirements Letter.

25. NMED Comment 13.a from August 2020 Disapproval; Regional Geology Discussion

Permittee Response: "A discussion of regional geology was added as Section 2.1."

NMED Comment: Some of the Permittee's added discussion of the regional geology requires correction or clarification:

a. The Permittee's statement "[u]nderlying these easterly derived alluvial fan deposits are relatively coarse-grained Ancestral Rio Grande deposits, with few laterally discontinuous fine-grained zones", is not clear. There appear to be many discontinuous fine-grained zones in the lithology at the site. Clarify if this is intended to suggest that there are many continuous fine-grain zones across the site or a few discontinuous fine-grained zones with no continuous fine-grained zones. Clarify what the term "laterally discontinuous" is meant to convey in the second revision of the Report.

b. The Permittee states, "[c]oarse-grained, Ancestral Rio Grande deposits with northeast-southwest oriented channel axes are interbedded with fine-grained silt and clay units. These deposits have been structurally tilted to the east due to

generally down-to-the east faulting along the Sandia Mountains." Regional maps of the area by the New Mexico Bureau of Mines and Mineral Resources (NMBM&MR) show several regional faults which show down to the west faulting rather than to the east. (e.g., *GM-78 - Geologic map of the Albuquerque-Rio Rancho Metropolitan Area and Vicinity, Bernalillo and Sandoval Counties, New Mexico* by Connell, 2008). Cite references for regional "down to the east faulting" and describe why the Air Force disagrees with the NMBM&MR map of the area, which shows the faults oriented down to the west. Otherwise, revise the statement in the second revision of the Report for accuracy.

c. The Permittee states, "[t]he thicknesses of A1 and A2 range from approximately 50 to 200 ft and are observed across the site, extending north of the Ridgecrest well field." and "[t]hough these confining beds play a key role in the transport of dissolved-phased contaminants ... " The regional A1 and A2 clay layers are greater than 600 ft bgs at the site, so it is unlikely the A1 and A2 clay layers have been observed during site investigation activities. The Permittee must provide evidence of the A1 and A2 clay layers being observed at the site in the revised Report or revise the text. Furthermore, there are currently no groundwater wells installed Jn or below the A1 and A2 clay layers at the site. If the Permittee believes the A1 and A2 clay layers play a key role in contaminant transport in groundwater at the site, the Permittee must demonstrate this in the second revision of the Report. If this is a typographical error, the Permittee must correct the text accordingly in the second revision of the Report.

d. There appears to be text missing in the following statement, " ... [F]low direction of the dissolved-phase groundwater plumes is largely influenced by as the hydraulic gradient..." Correct the typographical error in the second revision of the Report.

26. NMED Comment 14 from August 2020 Disapproval; Heated Headspace and PID

Permittee Response: "Text was revised to remove milligrams per kilogram and changed to parts per million by volume. The following text was added to Section 5.1.1 [Field Screening] "Historical water levels (Rice et al., 2014) were added to Table 4-1 [Photoionization Detector and Core Temperature Field Screening Data] to correlate the water table depths to the heated head space concentrations. In each of the borings for wells KAFB-106S1 through KAFB-106S5 and KAFB-106S7 through KAFB-106S9, the data indicates that the deepest historical water table (observed in 2009) correlates closely (within 13 feet or less) with the depths that the highest heated headspace concentration was recorded for each boring (Table 4-1). In these same monitoring wells, heated headspace concentrations increase with depth towards the historically deepest

water level (observed in 2009) to concentrations greater than 1,000 ppmv, then decrease below this depth (Table 4-1)."

NMED Comment: The Permittee did not adequately address the comment. The Permittee must add a discussion to Section 5.1.1 in the second revision of the Report discussing the consistent historical drop in groundwater elevation over time at the site and the creation of a smear zone. In addition, a discussion of the subsequent groundwater rise and its interaction with the smear zone must be included. The second revision of the Report must provide the approximate depths and corresponding years of the groundwater elevation up to the time of the investigation. The Permittee must provide a discussion detailing how the groundwater elevations resulted in the planned sample collection locations as stated in the Cover Letter, Section 3.1.1.2, (Rationale for Sampling Depth Intervals), and Table 3-3, (Proposed Sampling Plan for Continuous Coring) of the approved December 2017 *Work Plan for Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility.* The Permittee must also include a discussion of the potential effects of continued groundwater elevation rise at the site (e.g., the effect on dissolved phase contaminant concentrations at the site) in the second revision of the Report.

The Permittee failed to correct all units for PID readings from milligrams per kilogram (mg/kg) to parts per million by volume (ppmv). For example, the term mg/kg is still used in paragraph 3 of Section 5.1.1, Field Screening. Also, the units ppmv and ppm are both used in Section 5.3, Light Non-Aqueous Phase Liquid and Fuel Hydrocarbon Spatial Distribution. Revise the Report for consistency. See Comment 11.

27. NMED Comment 15 from August 2020 Disapproval; Impact of Elevated Soil Coring Temperatures on PID Readings and Analytical Results for Organic Compounds

Permittee Response: "The request for the variance on coring temperatures during drilling was based on the lack of significant hydrocarbon concentrations being observed within the specified depths of the vadose zone. The request included continued heated headspace monitoring of these depths. If concentrations above 100 ppm were detected, temperature control would be implemented. However, heated headspace concentrations in these zones did not exceed 100 ppm for any of the samples collected within these depths. Due to this, increasing drilling speeds did not present an impact to the quality of the data being collected and is why the NMED approved the request."
and
"A discussion of the precautions taken to minimize volatilization was included in Sections 4.1.2 and 4.1.3. The text was revised in section 4.1.2 as follows (new text in italics), "Soil cores were stored within a refrigerated truck after the coring and logging process was completed. The temperature in the refrigerated truck was maintained at approximately 4 degrees Celsius. Core temperature measurements were never collected

to the notes of Figure 5-7 to indicate that the contour is approximate to the effective solubility of benzene."

NMED Comment: Figure 5-7 still depicts the outline of the dissolved benzene plume where concentrations exceed the EPA maximum contaminant level (MCL) of 5 µg/L in groundwater rather than the contour for the effective solubility concentration of benzene 1.43 mg/L. The Permittee must clarify in the legend of Figure 5-7 if this contour is equivalent to the effective solubility of benzene (1.43 mg/L), and if it is not, revise Figure 5-7 to depict the isocontour for 1.43 mg/L benzene in the second revision of the Report. In addition, benzene alone is not an adequate indicator of the absence of LNAPL since benzene tends to degrade faster than the other BTEX constituents. The concentration of the other BTEX compounds in well KAFB-106076 indicate that LNAPL is present. Also, TPH was not evaluated in the example provided.

Also depicted in the figure is an outline of the estimated extent of LNAPL/residual LNAPL in groundwater. It is unclear as to what data was used to create the LNAPL outline. The Permittee's statement refers to use of the effective solubility concentration of 1.43 mg/L to construct the LNAPL isocontour; however, the well identification numbers and analytical data used to construct the contour have not been provided. The Permittee must revise the legend of Figure 5-7 to indicate the source of the data used to create the LNAPL isocontour, include the wells used to calculate the contour on the figure, and include a table that identifies the wells, dates of data collection, and concentration data used to create the LNAPL isocontour in the second revision of the Report. See Comments 1, 2, and 3.

34. NMED Comment 25 from August 2020 Disapproval; Biodegradation of BTEX Plume

Permittee Response: "The text has been revised as follows (changed text in italics): "Figure 5-7 indicates that the BTEX plume *attenuates* within a relatively short distance (less than 500 ft) from the diffused and dispersed LNAPL source and is fully attenuated before it reaches Ridgecrest Drive SE."

NMED Comment: The revised text is inaccurate. The Permittee indicates that the BTEX plume has attenuated before reaching Ridgecrest Drive SE. The Permittee must provide justification to support the claim that the plume has attenuated before reaching Ridgecrest Drive SE. See Comments 1.b, 2, 3, and **4**. Revise the Report accordingly.

35. NMED Comment 26.b from August 2020 Disapproval; Effective Solubility Calculations

Permittee Response: "Added the following text to Section 5.2.3, "It should be noted that this only represents two data points, and the effective solubility will vary depending on the original composition of the LNAPL and degree of degradation in the subsurface.

The analysis of additional LNAPL samples may provide a better range of effective solubility."

NMED Comment: Collecting and analyzing additional LNAPL samples from the site must be conducted to evaluate potential remedies. Because the release happened over a long period of time and the fact that LNAPL degrades over time, which affects LNAPL effective solubility values, a large data set of LNAPL analyses from the site (i.e., multiple locations and dates of collection) is critical to assess remedial alternatives. The Permitee must collect LNAPL samples from wells with recoverable LNAPL for analyses when encountered at any well (e.g., KAFB-106EX2, KAFB-106S10, KAFB-106005) and submit the results to NMED in the associated report (i.e., related investigation report or periodic monitoring report. If the Permittee or their contractor has already performed additional LNAPL analyses, the results of these analyses must be submitted under separate cover no later than October 30, 2024. See Comment 2.

36. NMED Comment 27 from August 2020 Disapproval; Screening Level Exceedances

Permittee Response: "The following text was added To Section 5.2.3, "A total of 50 wells were sampled for BTEX in Q2 2019; all 50 wells are located south of Ridgecrest Drive SE. Benzene was detected in groundwater samples collected from 23 of the 50 groundwater monitoring wells (Figure 5-6); 18 exceeded the 5.0 µg/L maximum contaminant level. Seventeen exceedances were in REI [reference elevation interval] 4857 and one was in REI 4838. The highest benzene concentration was detected in KAFB-106149-484 (26,000 µg/L) in the source area."

NMED Comment: The added text does not clarify where the wells with the highest concentrations are located. The response stated that all but one exceedance were at a specific depth interval (REI 4857) but did not provide the well identification or location, other than "south of Ridgecrest Drive SE". Also, the response did not indicate the well identification, well location, and concentration of the sample in REI 4838. The response did not indicate which REI the sample from well KAFB-106149-484 represents (REI 4857 or REI 4833). The Permittee must provide the missing information in the second revision of the Report.

37. NMED Comment 28 from August 2020 Disapproval; Quantitative Enzyme Comparison

Permittee Response: "Because there are a number of variables that affect the population growth of bacteria, standards of bacterial populations have not been established and cannot be included in a table or the text. The following text has been added to section 5.2.5, "Note that Microbial Insights uses the qualitative terms "low", "moderate", and "high" or "significant" when describing numbers of gene copies and/or bacterial numbers. These qualitative terms are relative to results obtained from other

in the refrigerated truck. *Samples were unopened and allowed to cool prior to soil sample collection. Lithologic logging and sample photography occurred after sample collection to minimize volatile constituent losses. Based on this process, it is unlikely that significant volatile constituent losses occurred.* To maintain sample custody, the refrigerated truck was kept locked when no one was present. Cores that were selected for LNAPL properties analyses were placed in a freezer and shipped frozen via overnight delivery. All cores from the entire borehole were kept in refrigerated storage until soil sample intervals were selected for analyses. Once intervals were selected based on Work Plan selection criteria, the core was retrieved from a shelving system installed within the refrigerated truck and the soil sample was collected."

NMED Comment: The Permittee's response in the first paragraph of the RTC was not added to the Report; this text must be included in the second revision of the Report. The Permittee must also specify which depth intervals were covered by the variance in the second revision of the Report. See Comment 11.c and 12.

The second revision of the Report must include a discussion on the uncertainties associated with the elevated core temperatures in relation to PID readings, sample integrity, and representativeness of the laboratory analytical results in the revised Report. Furthermore, the Permittee's presents two statements which are inaccurate 1) "Lithologic logging and sample photography occurred after sample collection to minimize volatile constituent losses." and 2) "Samples were unopened and allowed to cool prior to soil sample collection." Observations in the field indicate that core bags were opened, cores were logged, resealed, and then placed in the refrigerated truck to cool prior to collection of samples for analysis. The Permittee must accurately describe the actual sample collection process used in the field and include relevant records and field notes in the in the second revision of the Report.

28. NMED Comment 16 from August 2020 Disapproval; Other Organic Constituents of Potential Concern

Permittee Response: "As stated in the approved work plan, "The objectives of the continuous coring are to provide supplemental data on the nature and extent of the residual fuels, and to characterize the subsurface biogeochemical conditions relative to residual hydrocarbon and EDB treatment potential." Addressing other constituents of potential concern was not part of the approved work plan and would detract from the focus of the investigation."

NMED Comment: COC's are present at the site which are not related to the fuel spill. For example, Table 5-1, Analytical Results for Total Petroleum Hydrocarbons and Volatile Organic Compounds in Soil, indicates that the 1,1,2-trichloroethane concentration in KAFB-106V2 was 3.8 mg/kg. Site characterization is not restricted to

fuels if other COCs are present, regardless of whether the source of those COCs is related to the fuel spill or not, and the data may be useful to other investigations at KAFB. For example, the Permittee is currently investigating a solvent release at the adjacent Air National Guard (ANG) site. Analytical data from the BFF site related to solvents, such as 1,1,2-trichloroethane, detected in KAFB-106V2, may provide important information regarding the ANG site investigation. A discussion regarding the other COCs detected at the site must be provided in the second revision of the Report.

29. NMED Comment 17 from August 2020 Disapproval; KAFB-106V2 Organic Compound Trends and Stratigraphic Properties Controlling Vadose Zone Contaminant Migration

Permittee Response: "The following text was added to Section 5.2.1 (new text in italics), *The following summarizes the detected laboratory concentration ranges in the vadose zone by constituent (not including non-detected constituents):*

- *Detected concentrations of TPH in the vadose zone ranged from a low of 1.3 J mg/kg (KAFB-106S9 at 252 ft bgs) to a high of 32,000 mg/kg (KAFB-106V1 at 254 ft bgs) (Figures 5-1 through 5-3, Table 5-1).*
- *Detected benzene concentrations ranged from a low of 0.0061 mg/kg (KAFB-106S2 at 474 ft bgs) to a high of 110 mg/kg (KAFB-106V1 at 254 ft bgs).*
- *Detected toluene concentrations ranged from a low of 0.00091 J mg/kg (KAFB-106S5 at 417 ft bgs) to a high of 3,100 mg/kg (KAFB-106V1 at 254 ft bgs).*
- *Detected ethylbenzene concentrations ranged from a low of 0.045 J mg/kg (KAFB-106S8 at 475 ft bgs) to a high of 770 mg/kg (KAFB-106V1 at 254 ft bgs).*
- *Detected xylenes concentrations ranged from a low of 0.0011 J mg/kg (KAFB-106S9 at 252 ft bgs) to a high of 3,690 mg/kg (KAFB-106V1 at 254 ft bgs).*
- *Detected EDB concentrations ranged from a low of 0.0003 mg/kg (KAFB-106V1 at 161 ft bgs) to a high of 2.1 mg/kg (KAFB-106V1 at 254 ft bgs). (Figures 5-1 through 5-3, Table 5-1).*

The highest hydrocarbon concentrations in the vadose zone were found in well KAFB-106V1 (Figures 5-1 through 5-3, Table 5-1). Both boreholes KAFB-106V1 and KAFB-106V2 are located within the source area and the observed concentrations are indicative of the release location. Elevated petroleum hydrocarbon concentrations were observed in a poorly graded sand at depths located above a clay layer located at 266 ft bgs (See KAFB-106V1 boring log located in Appendix D). The highest hydrocarbon concentrations were observed from the soil sample collected from borehole KAFB-106V1 at a depth of 254 ft bgs (Figures 5-1 through 5-3, Table 5-1). Petroleum hydrocarbon concentrations increase with depth in KAFB-106V1 until reaching a depth of approximately 266 ft bgs (Table 5-1). A clay layer is present at this depth (See KAFB-106V1 boring log located in Appendix D) whereby concentrations decrease significantly at depths of 271 and 285 ft bgs (Table 5-1)."

NMED Comment: The Permittee did not include a discussion of organic compound trends in well KAFB-106V2. A discussion of organic compound trends in KAFB-106V2 as well as the occurrence, depths, and concentrations of solvents in KAFB-106V1 and KAFB-106V2 must be provided in the second revision of the Report. See Comment 28.

The Permittee's statement that "[p]etroleum hydrocarbon concentrations increase with depth in KAFB-106V1 until reaching a depth of approximately 266 ft bgs ... A clay layer is present at this depth ... whereby concentrations decrease significantly at depths of 271 and 285 ft bgs" contradicts the revised CSM presented in the Report which asserts that contamination altered the clay and migrated vertically through the clay to the groundwater. In addition, in Section 5.1.1, Field Screening, the Permittee states "[h]eated headspace field screening values in the vadose zone are most significant at the source area (KAFB-106V1 and KAFB-106V2) from a depth of 10 ft bgs to a clay unit observed at a depth of approximately 265 ft bgs (Table 4-1). Below this depth, heated headspace concentrations decrease significantly. Analytical hydrocarbon concentrations were also observed to decrease through this clay layer at KAFB-106V2 (Section 5.2.1 below and Figures 5-1 through 5-3), correlating with the heated headspace data." This statement also contradicts the CSM's assertion that LNAPL altered the clay and migrated vertically through it. The Permittee must resolve the discrepancies using site-specific data in the second revision of the Report. See Comments 1 and 22.

30. NMED Comment 19 from August 2020 Disapproval; Depth to Water in Well KAFB-106S1

Permittee Response: "KAFB-106S1 soil boring log and well construction schematic has been revised. Changed water level to 469.8' bgs."

NMED Comment: The Permittee must provide supporting evidence for the change of the depth to water on the KAFB-106S1 soil boring log and well construction diagram to 469.8 ft bgs in the text of the second revision of the Report.

31. NMED Comment 20 from August 2020 Disapproval; Contaminants in Off-Base Wells

Permittee Response: "The following text was added to Section 5.2.1 (revised text in italics), *"In wells located off-Base (KAFB-10655 and KAFB-10657), toluene was the only BTEX constituent detected in KAFB-10655 (farthest from source area) at concentrations of 0.00091 milligrams per kilogram (mg/kg) (417 ft bgs) and 0.00094 mg/kg (467 ft bgs). TPH was detected in this borehole at a concentration of 5.6 J mg/kg at a depth of 467 ft bgs."*

NMED Comment: The presence of LNAPL in the pore space in soils collected from off base well borings, whether mobile or not, is a continuing source of dissolved phase groundwater contamination. See Comment 3.

32. NMED Comment 23.j from August 2020 Disapproval; LNAPL Analysis

Permittee Response: "The following text was added to Section 3, "However, in some cases, carbonate minerals also fluoresced under UV light. In these instances, the unfluoresced and fluoresced photos were compared. Fluorescent minerals typically appear spherical or lightcolored in the unfluoresced photo. When these were observed to correspond to the same location in the UV light photo, these areas were not considered to have LNAPL present."

NMED Comment: Appendix G-2, PTS Laboratories, contains the photos of the five soil cores from KAFB-106V2, taken with and without UV light. The core selected for LNAPL mobility analysis exhibited no fluorescence and had the lowest PID readings of all five cores. Two other samples exhibited fluorescence and higher PID readings, by a factor of 1,000. Either core would have been a more appropriate selection for mobility analysis based on PID data alone. The Permittee must ensure that appropriate samples for site characterization are selected in future investigation activities. No response is necessary.

33. NMED Comment 24 from August 2020 Disapproval; Contaminant Contours

Permittee Response: "The data used to create the estimated extent of LNAPL/residual LNAPL can be found in the following text (Section 5.2.3, paragraph 11), "Effective solubility represents the concentration that may occur at equilibrium under ideal conditions. Locations where groundwater concentrations exceed the calculated effective solubility may indicate that LNAPL remains in the saturated zone in that area. LNAPL samples collected from KAFB-106006 (alias KAFB-1066) and KAFB-106076 (alias KAFB-10676) in 2011 were used to calculate the effective solubility of BTEX in both samples (Kirtland AFB, 2018a). Solubility values from NMED guidance (NMED, 2019g) were used to calculate the molar fractions for each constituent. The effective solubility of BTEX (average of ortho-, meta-, and paraxylenes) in KAFB-106006 was calculated to be 6.44, 17.25, 1.03, and 1.37 milligrams per liter (mg/L), respectively. The effective solubility of BTEX in KAFB-106076 was calculated to be 1.43, 6.89, 0.78, and 0.94 mg/L, respectively (Table 5-5). For the purpose of assessing the location of LNAPL in the saturated zone, the more conservative effective solubility concentration of 1.43 mg/L benzene is used as a line of evidence of potential LNAPL occurrence." The identification of the wells, dates of collection (Q3 2011), and concentration data can be found in Table 5-5. The data was obtained from the Phase I RFI Report which was recently approved. Table 5-5 and the Phase I RFI Report are referenced on Figure 5-7. Text has been added

samples submitted to Microbial Insights for analysis as described previously. Microbial Insights laboratory reports are presented in Appendix G-3 for more information."
and
"Please note that the term "LNAPL Plume" is not appropriate since the data in the report supports the fact that the LNAPL is residual."

NMED Comment: The comment was addressed with regard to the enzymes associated with EDB degradation. However, the Permittee's statement in the response that "LNAPL Plume" is not an appropriate term is misleading. LNAPL is present at the site based on actual site data; the presence of LNAPL in existing and newly installed wells, indicates that there is a mobile fraction of LNAPL at the site. The term "residual" must be defined. Remove this statement in the second revision of the Report. See Comments 2, 3, and 4.

38. **NMED Comment 29.a from August 2020 Disapproval; Revise Table 5-7 to attribute the appropriate soil type to each individual sample. Please revise all Tables containing USCS data to consistently report accurate USCS classifications for the samples**

NMED Comment: Table 5-7 contains an error in the footnote at the bottom of the table that states, "[i]t is also likely that the moisture contents of saturated sand and gravel samples collected below the water table have been biased low due to gravity drainage within the sample bags." Revise any related text to also include fluid losses due to gravity drainage from the core barrel on retrieval to the surface in the second revision of the Report.

39. **NMED Comment 31 from August 2020 Disapproval; LNAPL Percentages**

Permittee Response: "LNAPL Percentages were removed from the Table to focus only on moisture contents. Laboratory methods and descriptions were added to the notes by laboratory. Note added, "Moisture content is gravimetric moisture content (mass of water /mass of solids) expressed in percent."

NMED Comment: The presentation of LNAPL percentage data on Table 5-7 is useful to correlate LNAPL percentages at specific depths in each boring. The Permittee must address the original comment. The column with LNAPL percentage data must be returned to Table 5-7 and include a footnote clarifying what the LNAPL percentage represents (e.g., pore volume percent) in the second revision of the Report.

40. **NMED Comment 34 from August 2020 Disapproval; Migration Pathway**

Permittee Response: "Studies have shown that organic liquids can physically alter clay structure. Izdebska-Mucha, et. al. (2011) showed the influence of hydrocarbon contamination in clay soil resulted in more open porosity and larger voids. Mosavat and

Nalbantoblu (2012) showed that pure toluene resulted in diminution in plasticity and considerable flocculation of clay particles causing granularity in the soil structure. Finally, Nasir (2011) showed contamination of clay with motor oil entailed substantial microstructural changes: looser packing of clay particles and grain surface detachment, reduction in Atterberg limits in the first 3 months, and substantial increase in coefficient of permeability." Once the LNAPL entered the clay, structural changes to the clay facilitated greater permeability and ability to transmit the LNAPL through the clay to the underlying permeable soil. This mechanism is contrary to the concept that the clay formed an impermeable layer to the LNAPL, LNAPL migrated vertically through the clay, and laterally through the clay by capillarity. A "hole" or other discontinuity in the clay layer is not required to explain the deeper migration of LNAPL to the water table."

NMED Comment: The Permittee's response to this comment introduces a new site conceptual model for the BFFS site which was not included in the original Report. There may be evidence that hydrocarbons may cause structural changes to clay permeability, however, all of the papers cited were bench scale studies. No field scale studies were cited. It appears that there are no site-specific studies or site-specific data to show that this process has occurred at the BFFS.

In addition, the concept of a clay layer forming a barrier to contaminants such as LNAPL migrating vertically beneath the FFOR, which causes LNAPL to then migrate laterally down-dip on a clay surface, is a reasonable condition in a braided stream fluvial environment such as the Ancestral Rio Grande sediments below the BFFS. The site-specific data, provided by the Permittee, indicates that the LNAPL did not migrate vertically through the clay directly beneath the FFOR to reach the groundwater. These data include, but are not limited to:

a. The Stage 2 Abatement Plan for the Bulk Fuels Facility, Kirtland AFB dated February 14, 2002 (Stage 2 Abatement Plan), show that TPH contamination directly below the FFOR reduces significantly below a clay zone at approximately 285 ft bgs. See Figures 2-2, Geologic Cross Section and Estimated Extent of Subsurface Contamination, illustrating the Total Recoverable Petroleum Hydrocarbon (TPH) > 100 mg/kg, Figure 2-3, Geologic Cross Section and Estimated Extent of Subsurface Contamination, illustrating TPH > 1,000 mg/kg, and Figure 2-4, Geologic Cross Section and Estimated Extent of Subsurface Contamination, illustrating the Total Recoverable TPH >5,000 mg/kg in the Stage 2 Abatement Plan;

b. Historical and current groundwater monitoring indicates that contaminant concentrations and LNAPL thicknesses do not exist at higher concentrations/ thicknesses directly beneath the FFOR and that the plumes are offset to the east/southeast. See Figure 3-1, Groundwater Monitoring Well Locations, in the Quarterly Remediation and Site Investigation Report for the Bulk Fuels Facility Spill,

April 2010 through June 2010, dated August 2010 as well as current quarterly monitoring reports.

c. Semiannual soil vapor sampling data collected in June 2011 also indicate that soil vapor contaminant concentrations decrease directly beneath the FFOR with depth and increase with depth to the southeast of the FFOR. The noted decrease in the area below the FFOR and the noted increase in the area to the southeast of the FFOR also occurs at the level of a clay layer.

d. Qualitative Pneulog® soil vapor data from the site, collected in 2011, suggests that directly beneath the source of the release at the FFOR, soil vapor contaminant concentrations increase with depth down to a clay layer, and then decrease in and below the clay. However, there are low values of soil vapor concentrations above the clay with increased values with depth below the clay to the southeast of the FFOR.

e. The soil vapor rebound data collected in 2015 for the Pilot Soil-Vapor Extraction System Shutdown Test Bulk Fuels Facility Site Solid Waste Management Unit ST-106/SS-111, dated July 2016 suggests that soil vapor contaminant concentrations decrease directly beneath the FFOR with depth and increase with depth to the southeast of the FFOR. The noted decrease in the area below the FFOR and the noted increase in the area to the southeast of the FFOR occurs at the level of a clay layer. Additionally, the Permittee is reminded that any soil vapor data collected after 2014 is not accurate or representative of subsurface conditions. However, this soil vapor data is qualitatively indicative of a decrease in concentrations below the clay directly beneath the FFOR indicating contamination did not migrate vertically beneath the FFOR.

The above examples indicate that the noted decrease in the contaminant concentrations occur below the clay in the area of the FFOR and the noted increase in contaminant concentrations occur below the clay in the area to the south and east of the FFOR indicating that the clay perched the downward migration of contaminant below the FFOR while the downward migration pathway continued in an area to the southeast of the FFOR. The Permittee must provide site-specific evidence to support the claim that the fuel released from the FFOR physically altered the clay structure throughout its thickness and allowed the LNAPL to migrate vertically through the clay to the groundwater in the second revision of the Report, or remove the unproven theory from the Report.

In addition, if the Permittee cites academic articles, the cited documents must be submitted to NMED as reference documents for inclusion in the KAFB RCRA Administrative Record to support the Report if the citations remain in the second revision. See Comments 1, 2, 3, and 4.

41. NMED Comment 35.a from August 2020 Disapproval; Gravity Drainage, Permeability, and Contaminant Migration

Permittee Response: "...gravity was the force that caused the fuel to move downwards through the vadose zone through higher permeability units (sands/gravels). Lower permeability units (clays/silts) likely caused lateral migration of the fuel in the subsurface, but the investigation did not uncover direct evidence of this. For example, the lower clay layer in KAFB-106S9 (the closest well to the release area) was observed from 270 to 283 ft bgs. Heated headspace concentrations at 269, 280, and 289 ft bgs (above, within, and below the lower clay) were less than 10 ppmv. If lateral migration occurred along the lower clay unit identified in KAFB-106S9, it did not migrate as far east as the well location."
and
"Additional information regarding the lower clay unit will be presented in the upcoming Data Gap report that will include information for wells KAFB-106S10 and KAFB-106V3 that are located closer to the release area."

NMED Comment: According to data collected prior to the submittal of the Report, LNAPL had migrated farther to the east than KAFB-106S9, as evidenced in the EDB pilot test area wells by the presence of LNAPL up to 11 ft thick, located approximately 1,000 ft northeast of the source area. This knowledge was acquired prior to the submittal of the Report, and the presence of a considerable thickness of LNAPL should have been considered in the CSM modification. Remove the inaccurate statement that LNAPL did not migrate as far east as KAFB-106S9 in the second revision of the Report. See Comments 1, 2, 3, and 4.

42. NMED Comment 35.b from August 2020 Disapproval; Differentiation of Clay Layers Beneath the Site

Permittee Response: "[I]nformation on the depositional environment can be found in Section 2.1. Bed thickness can be found in the lithologic logs. Sufficient samples to distinguish physical and interstitial properties between the two clay layers were not collected from the borings. This, and the assessment of the clay bed geometry, was not one of the objectives of the approved work plan. The lateral continuity of the clay beds will be provided in cross sections in the upcoming Data Gap Report."

NMED Comment: A discussion of the LNAPL migration pathway is relevant to the characterization of the source area. The lower clay (i.e., the clay encountered at approximately 266 feet bgs in KAFB-106V1) appears to be the dominant control mechanism influencing the migration pathway and must be discussed in the revised Report. See Comment 29. The Permittee must include cross sections that clearly depict the two predominant clay layers at the site. See Comments 1 and 6.

43. NMED Comment 38 from August 2020 Disapproval; Impact of Historical and Current Groundwater Elevations on Adsorbed Hydrocarbons

Permittee Response: "The model and the associated discussion were removed from the report. However, historic groundwater levels were added to Table 4-1. A review of this table indicates that the highest PID readings generally correlate with the deepest water levels. The approximate water table depth for each 10-year period and source of data can be found on Table 4-1. The related laboratory results can be found on Table 5-1 and the corresponding lithologies can be found in the lithologic logs in Appendix D."

NMED Comment: NMED's Disapproval Comment 38 did not refer to the model. The Permittee must add the groundwater levels concurrent with the period of the investigation to Table 4-1. See Comment 15. In addition, provide cross sections using all investigation data, including historical groundwater levels as they are critical to understating site conditions at the time of the investigation. See Comments 5 and 6.

44. NMED Comment 39 from August 2020 Disapproval; Submerged LNAPL as a Source of Dissolved Phase Contamination

Permittee Response: "The Revised statement as follows (revised text in italics), "*LNAPL continues to provide a persistent source of benzene contamination to groundwater. In the vadose zone, LNAPL and soil contamination partition benzene into pore water, which in turn leaches to groundwater. At the current water table and LNAPL smear zone, benzene partitions directly from LNAPL to groundwater, sourcing the solute plume. As the water table rises, it places groundwater in direct communication with soil contamination and LNAPL in the lower vadose zone, again directly sourcing benzene to groundwater. Finally, submerged LNAPL in response to the rising water is a persistent source to benzene solute contamination by direct partitioning of benzene from LNAPL to groundwater. These LNAPL sources will continue to source solute plumes of all site contaminants of concern - EDB, toluene, ethyl benzene, and xylenes, until depleted by dissolution into pore water or groundwater, degradation by natural attenuation processes, or by active remediation."*

NMED Comment: The Permittee must add TPH concentrations to this discussion in the second revision of the Report.

45. NMED Comment 40 and Comments 71.a through 71.c from August 2020 Disapproval; Benzene Concentrations in Groundwater

Permittee Response: "...the model and the associated discussion was removed from the report."

NMED Comment: Despite the model being removed from the Report, data regarding concentrations of benzene in groundwater and qualitative benzene soil vapor concentrations measured at the time of the investigation activities is relevant to the source zone characterization. The second revision of the Report must include a figure depicting benzene concentrations in groundwater and soil vapor at the time of the investigation. The Permittee must include the benzene concentrations in groundwater for each well used to create this boundary in the revised Report (i.e., include the relevant figure from a contemporaneous quarterly monitoring report). Soil vapor data, while determined to not be representative of subsurface conditions, can be used for qualitative purposes. The Figure must visibly and clearly state that the soil vapor data is being presented for qualitative use only.

46. NMED Comment 43 from August 2020 Disapproval; Investigation Derived Waste (IDW) Information

Permittee Response: "These descriptions were included in the Well Completion Reports. The Well Completion Report is included as Appendix I [Well Completion Report] of this revised report."

NMED Comment: Report Section 6.4 Non-Hazardous Solids states "[a]n additional 28 cubic yards of non-hazardous mud was generated and disposed of at Twin Enviro Services in Penrose, Colorado. Disposal is summarized in Appendix K-4, Tables K-4-1, through K-4-3." Section 4.3 Decontamination Wastes, of Appendix I states, "[t]he remaining non-hazardous high solids, water, mud, and sand were transported by Advanced Chemical Transport, Inc. to the Twin Enviro Services Penrose, Colorado disposal facility." A brief review of the waste manifests included in Appendix I indicates that complete waste disposal information was not included in the Report. For example, the waste manifest for the waste associated with Roll-off no. KAFB-106247 was included in Appendix I; however, the chain of custody and the laboratory results for the roll-off are not included. Include complete waste disposal information, including all laboratory results, in the second revision of the Report. In addition, Table 4-1, Investigation-Derived Waste Quantities, of Appendix I includes a footnote "a", which is not defined, include a definition for the footnote in the second revision of the Report.

47. NMED Comment 50 from August 2020 Disapproval; Figures and Cross Sections

Permittee Response: As stated in the RTC, "The rate of degradation for magnetite is approximately 20-40 times slower than ferrous sulfide and has resulted in undetectable EDB attenuation."

NMED Comment: The response as stated in the RTC is sufficient, however, the complete text that the RTC states was added to the Report is missing. Include the full text in the second revision of the Report. See Comments 11.c and 12.

48. NMED Comment 55 from August 2020 Disapproval; Impact of Clay Layers on the Lateral Migration of LNAPL

Permittee Response: "The following text was removed, "The clays do not appear to have significantly affected lateral migration of the LNAPL." As previously discussed ... if lateral migration occurred, it is bounded on the east by KAFB-106S9, Additional information regarding the lower clay unit will be presented in the upcoming Data Gap report that will include information for wells KAFB-106S10 and KAFB-106V3 that are located closer to the release area."

NMED Comment: The statement is not accurate. LNAPL is not bounded on the east by KAFB-106S9 based on the 11 ft of LNAPL found in well KAFB-106EX2 subsequent to source zone characterization activities. The Permittee must discuss the impact of clays on contaminant migration at the site in the second revision of the Report. See Comments 2, 3, 4, and 45.

49. NMED Comment 58 from August 2020 Disapproval; Documentation

Permittee Response: "The correspondence is included in Appendix A."

NMED Comment: Formal NMED approval allowing the Permittee to forego the installation of KAFB-106S6 was not provided in Appendix A. The figure with a handwritten approval dated 1/25/19 is not acceptable. Provide the formal approval (e.g., letter or email) in the second revision of the Report. See Comment 12.

50. NMED Comment 60 from August 2020 Disapproval; Adding Soil Screening Levels to Figures

Permittee Response: "NMED Soil Screening Levels (SSL) were not added to Figures 5-3, 5-4, and 5-5 because site conditions depart substantially from the conceptual model used to derive the soil leaching to groundwater SSLs ... For the Corrective Measure Evaluation development of Site-Specific SSLs for protection of groundwater may be

developed ... For the Corrective Measure Evaluation, SSLs for protection of groundwater will be evaluated in accordance NMED's Risk Assessment Guidance for Site Investigations and Remediation ... "

NMED Comment: NMED's comment did not ask for site-specific SSLs or dilution attenuation factor (DAF) levels to be added to the figures. The Permittee must use the SSLs in the 2022 NMED Risk Assessment Guidance for Site Investigations and Remediation (NMED RAG). The Permittee must revise these figures to include the appropriate SSL for each COC and reference the screening levels in the "Notes" section of the figures in the Revised report.

51. NMED Comment 62 from August 2020 Disapproval; Figure 5-6, Benzene Concentrations in Groundwater Reference Elevation Interval 4857

Permittee Response: "... A discussion of reference elevation intervals is not appropriate since the focus of the investigation was the assessment of LNAPL and not deeper REIs that are used for semiannual plume capture modeling. Due to this, a discussion of REIs would add confusion. References to the REIs were removed from the figure."

NMED Comment: The title of Figure 5-6 remains "Benzene Concentration In Groundwater Reference Elevation Interval 4857, Q2 2019"; therefore, all references to the REI's were not removed from the figure. A discussion regarding reference to REI is appropriate, as REI's are mentioned three times in Report Section 5.2.3, Light Non-Aqueous Phase Liquid Saturation, Mobility, and Effective Solubility. The comment must be addressed in the second revision of the Report.

52. NMED Comment 63 from August 2020 Disapproval; Figure 5-6, Benzene Concentrations in Groundwater Reference Elevation Interval 4857

Permittee Response: "See response to [Comment 37] for the wells sampled for benzene. A discussion of historic benzene in groundwater is not appropriate since the focus of the investigation was the assessment of LNAPL in the vadose and saturated zones. Due to this, a discussion of historic benzene in the groundwater north of Ridgecrest Drive SE would add confusion. The wells north of Ridgecrest Drive SE were left on the figure to show wells within the groundwater monitoring well network. A note was added to the figure, "Figure shows wells sampled in accordance with approved work plans"."

NMED Comment: A discussion of benzene north of Ridgecrest Drive SE is relevant to the report as benzene is used as the evidence for inferring the location of LNAPL in saturated zones. Correct the omissions and add a discussion with regard to benzene

north of Ridgecrest Drive SE to the second revision of the Report to address the original comment. See Comment 36.

53. NMED Comment 64 from August 2020 Disapproval; Figure 5-7, LNAPL-Filled Porosity from Continuous Coring

Permittee Response: "Changed the figure title to "Estimated Extent of LNAPL/Diffused and Dispersed LNAPL in Groundwater". Added "The LNAPL/diffused and dispersed LNAPL contour is approximate to the effective solubility of benzene, 1.43 milligrams per liter (Kirtland AFB, 2018a and Table 5-5 of this report)" to the notes of the figure. Diffused and dispersed LNAPL present in wells is discontinuous and typically only found periodically in specific wells, and therefore it is not possible to provide a contour of the free phase LNAPL found in wells. However, Figures 5-4 LNAPL Pore Volume Saturation Percent and 5-5 LNAPL Total Volume Saturation Percent were created that show location and depth LNAPL found in soil samples in the saturated zone.

NMED Comment: The figure has not been changed. The Permittee must address the comment and revise the figure for clarity in the second revision of the Report.

54. NMED Comment 65.a through 65.d, 66, 67, 68, 69, and 70.a through d from August 2020 Disapproval; Figures

Permittee Response: "As discussed in comment 21, the model and the associated discussion was removed from the report." This relates to Item 21, which is the response to Disapproval Comment 12. "The model was provided as a visualization to supplement understanding of the data collected and was not required by the approved work plan. As the model is not necessary to support the data interpretation in this report the model and all associated tables and figures were deleted from the report."

NMED Comment: The figures associated with the model were intended to present the results of the source zone characterization investigation activities. In the second revision of the Report the removed figures must be replaced with relevant figures (i.e., accurate cross sections) which present visual and spatial representation of the subsurface contaminant data. See Comments 5 and 6.

55. NMED Comment 72.a through 72.d, 72.e, and 73.a through 73.e, from August 2020 Disapproval; Figures Depicting Soil Vapor in the Vadose Zone

Permittee Response: "As discussed in comment 21, the model and the associated discussion was removed from the report."

NMED Comment: Despite the model being removed from the report, the correlation between soil concentration data, soil vapor concentration data, LNAPL data, and groundwater concentration data is important for site characterization. While the soil vapor data is not representative of subsurface conditions, it is a qualitative indicator of the locations of vadose zone contamination in the subsurface. COC's in qualitative soil vapor data at the time of the investigation are relevant to source zone characterization. The Permittee must discuss the qualitative soil vapor concentrations in the relevant portions of the Report and include a figure depicting qualitative BTEX in soil vapor in the vadose zone in the second revision of the Report. The text and figure must visibly and clearly state that the soil vapor data is qualitative use. See Comment 40.

56. NMED Comment 74 from August 2020 Disapproval; Analyses for Sample Depths on Table 3-1

Permittee Response: "Table 3-1 was revised to show samples collected from ARCH cuttings in bold. The table notes were revised with the following note: "Samples collected from soil cuttings were analyzed for total petroleum hydrocarbons. All other analyses were performed on samples collected from sonic cores." Figure 5-3 and Table 3-1 have been revised to depict which samples were collected from soil cuttings.

NMED Comment: The row indicating laboratory analyses for TPH and/or volatile organic compounds (VOCs) is confusing as it is unclear which analysis applies to the specific sample depths in that row. Add a row for each analysis type to Table 3-1 in the second revision of the Report. In addition, the Permittee must revise Figure 5-3, Total Petroleum Hydrocarbon Concentrations in Soil, and Figure 5-2, Ethylene Dibromide Concentrations in Soil, to present non-detect analytical results as "less than the LOD" (i.e., <0.05) in the second revision of the Report. See Comment 8.

57. Figure for Benzene Concentrations in Soil

NMED Comment: Because there are numerous instances where benzene exceeded the screening levels in the borings at the site, the Permittee must add a Figure to show benzene concentrations in soil.

58. NMED Comment 76 from August 2020 Disapproval; Well KAFB-106247 Sampling

Permittee Response: "Table 3-1 of the report originally only reported samples collected for TPH and VOC analysis. The table has been revised to include all samples. The sampling intervals for KAFB-106247, the background boring, were revised to better match the site-specific samples that were collected during the field investigation. The revised sample table was approved by NMED in an email dated January 28, 2019 and

required nine sample locations. A copy of the email and the sample table can be found in Appendix A [Regulatory Correspondence]."

NMED Comment: The revised sample table was not found in Appendix A. The relevant emails provided in Appendix A do not include all attachments referred to in the text of the provided emails. The only relevant information in Appendix A is the signed approval for the new boring location for KAFB-106247. All email attachments, including the revised sample table must be provided in Appendix A of the second revision of the Report. See Comment 12.

59. NMED Comment 78 from August 2020 Disapproval; Table 5-1, Analytical Results for Total Petroleum Hydrocarbons and Volatile Organic Compounds in Soil

Permittee Response: "The footnote has been removed from Table 5-1. NMED Soil Screening Levels (SSL) were not added to Table 5-1 because site conditions depart substantially from the conceptual model used to derive the soil leaching to groundwater SSLs. The depth of most soil samples makes the soil leachate pathway the appropriate SSLs; however, limitations in Section 4.5 of NMED's Risk Assessment Guidance for Site Investigations and Remediation (NMED 2019) are not all satisfied, including: 1) the significant vadose zone thickness provides potential significant attenuation for leaching and 2) NAPL is present. For the Corrective Measure Evaluation development of Site-Specific SSLs for protection of groundwater may be developed in accordance with Section 4. 7 (NMED 2019). For the Corrective Measure Evaluation, SSLs for protection of groundwater will be evaluated in accordance NMED's Risk Assessment Guidance for Site Investigations and Remediation (NMED 2019).

NMED Comment: To date, site-specific SSLs have not been submitted to nor approved by NMED. The site is not currently in the CME stage of the RCRA process, therefore the SSLs in the November 2022 NMED RAG apply and must be added to Table 5-1 in the second revision of the Report. See Comment 50 above.

60. NMED Comment 80 from August 2020 Disapproval; Fluid Losses During Core Retrieval

Permittee Response: "It is also likely that the moisture contents of saturated sand and gravel samples collected below the water table have been biased low due to gravity drainage within the sample bags. Coarse-grained samples (sands and gravels) with high permeability collected below the water table may have experienced drainage where water drained to the bottom of plastic sample sleeve and not collected during sample preparation. This would create a low bias towards the moisture content of samples collected below the water table. Water draining from permeable sand and gravel samples is more likely to occur in samples collected below the water table than above

the water table. Above the water table, the moisture is held in capillary tension and did not freely drain upon extrusion from the core barrel."

NMED Comment: While the Permittee's statement that moisture content is likely biased low in samples collected below the water table is accurate, the response is inadequate. In addition to gravity drainage within the core bags, the Permittee must also discuss fluid losses due to gravity drainage out of the core barrel during core retrieval. This is particularly important for cores collected below the water table prior to being put into plastic collection bags at the surface. The Permittee must provide a discussion regarding fluid losses that may have occurred during core retrieval in the second revision of the Report. See Comment 38.

61. NMED Comment 81 from August 2020 Disapproval; Table 5-4, Summary of LNAPL Saturation and Mobility for Select Core Samples

Permittee Response: "The following note was added to the footnotes of Table 5-4: "LNAPL Saturation (%TV) =LNAPL Saturation (%PV) * Porosity/ 100."

NMED Comment: The LNAPL Pore Volume Saturation (%PV) values provided in Table 5-4 indicate the percentage of a sample's pore space volume that is filled with LNAPL. According to Table 5-4 LNAPL was detected in the pore space of every sample analyzed for LNAPL. According to Figure 5-4, LNAPL Pore Volume Saturation Percent and Figure 5-5, LNAPL Total Volume Saturation Percent, LNAPL is present in the pore space of every sample analyzed for LNAPL in every coring location, including those off base. The presence of even very small percentages of LNAPL in the pore space, regardless of its mobility, indicate that the extent of LNAPL in the subsurface has not been defined. See Comments 2 and 3. State that the extent of LNAPL at the site has not been defined in the second revision of the Report.

62. NMED Comment 82.a from August 2020 Disapproval; Table 5-7 Summary of Soil Analytical Moisture Content

Permittee Response: "Added the following footnote: "Soil samples were collected using the sonic drilling method from various depths below ground surface under significant overburden pressures. As a result, the samples should be considered disturbed and may not be representative of the in-situ density of the sample. It is also likely that the moisture contents of saturated sand and gravel samples collected below the water table have been biased low due to gravity drainage within the sample bags."

NMED Comment: The Permittee's response is inadequate. See Comment 56. Expand the note for Table 5.7 to indicate the potential impact fluid loss during core retrieval may have had on soil moisture content in samples in the second revision of the Report.

63. NMED Comment 82.b from August 2020 Disapproval; Table 5-7, Summary of Soil Analytical Moisture Content

Permittee Response: "Column with LNAPL data has been removed for clarity."

NMED Comment: The presentation of LNAPL data on Table 5-7 was useful to see approximate LNAPL percentages at specific depths in each boring. Return the column with LNAPL percentage data to Table 5-7 and address the original comment in the second revision of the Report. See Comment 39.

64. NMED Comment 82.e from August 2020 Disapproval Table 5-7, Summary of Analytical Moisture Content

Permittee Response: "The PTS Laboratory results of 8.2 and 6.9 percent were added for KAFB-106S5 at 488 feet below ground surface and 6.9 was added for KAFB-106S7 at 492 feet below ground surface."

NMED Comment: There is a typographical error in the Permittee's response to comment. Correct the error in the second revision of the Report. See Comments 11.c and 12 above.

65. NMED Comment 82.f from August 2020 Disapproval Table 5-7, Summary of Soil Analytical Moisture Content

Permittee Response: "The TestAmerica moisture content results in Table 5-7 are associated with TPH results. The 14% moisture content result is associated with the TPH analysis. The 16.3% moisture content is associated with the EDB analysis. The TPH results were used because TPH was collected for every hydrocarbon sample and represented the most complete moisture content data set."

NMED Comment: Add a footnote to Table 5-7 of the second revision of the Report clarifying which laboratory soil moisture content data set was used and the rationale for its use.

66. NMED Comment 84 from August 2020 Disapproval; Sample Integrity

Permittee Response: "The following text has been added to Section 4.3, "During the drilling process, there were occasions when the sample was unable to be retained within the core barrel. When this occurred, the driller would make another attempt at collecting the sample. When this occurred, the sample was reported on the core temperature log as disturbed and the driller made another attempt at sample collection.

This occurred during the collection of the following samples: .... and KAFB-10654 at a depth of 366ft bgs. All of these samples were submitted because they indicated the highest heated headspace concentration of their sample interval. These samples were submitted for analysis of TPH, the results of which were non-detect. These samples were collected within the vadose at wells that are located outside of the BFF. Due to this it is unlikely that these samples would contain significant concentrations of TPH and little to no impact from the disturbance is expected for these samples. Sample disturbance for these samples will be indicated on the appropriate tables and figures."

NMED Comment: The lithologic logs and Table 3-1, Coring Intervals and Soil Sample Locations, do not indicate that analytical samples were collected from boring KAFB-106S4 at 366 ft bgs; however, Figure 5-3, Total Petroleum Hydrocarbon Concentrations in Soil, indicates that samples were collected from this interval. Resolve the discrepancy in the second revision of the Report.

The Permittee's statement that the samples were collected within the vadose at wells that are located outside of the BFF and were therefore unlikely to have significant concentrations of TPH has no bearing on the representativeness of the data due to sample disturbance. No response is necessary.

Some samples for TPH and VOCs analyses were collected from disturbed core. Analytical samples collected from disturbed core would potentially have a greater impact on VOC samples than TPH samples through volatilization of samples while falling from the core barrel and while being recollected in a core barrel that may have had an elevated temperature. The Permittee must have separate rows for presenting TPH and VOC sample collection depths data on Table 3-1, Coring Intervals and Soil Sample Depths. See Comment 61.

In addition, the added text indicated by the RTC was either not added to or worded differently in the revised Report. The RLSO version indicates that the text was not added to the revised Report. The Permittee must review their response and either correct the RTC or add the correct text to the second revision of the Report. See Comments 11 and 12.

The Permittee must submit a revised Report (two hard copies and two electronic copies) that corrects all deficiencies noted in this Disapproval. The revised Report must be accompanied with a response letter (also included as an appendix) that details where the NMED's comments were addressed and cross-references NMED's numbered comments. In addition, the Permittee must submit an electronic redline-strikeout version of the revised Report that shows where all changes were made to the Report. The Permittee may opt to submit a Phase II RCRA Facility Investigation Report (Phase II RFI Report) instead of a revised Report; however, the required accompaniments of the revised Report (i.e., the response letter to comments and redline-

strikeout of the Report) must be submitted with the Phase II RFI Report. The revised Report or the Phase II RFI Report must be submitted no later than **September 30, 2024**.

If you have any questions regarding this letter, please contact Neelam Dhawan at 505-690-5469.

Sincerely,

Ricardo Maestas Digitally signed by Ricardo Maestas
Date: 2024.04.10 16:30:05 -06'00'

Ricardo Maestas
Acting Chief
Hazardous Waste Bureau

cc: N. Dhawan, NMED HWB
C. Eads, NMED HWB
N. Davidson, NMED HWB
L. King, EPA Region 6 (6LCRRC)
R. Wortman, KAFB
K. Bicknell, ABCWUA
A. Tafoya, VA

File: KAFB 2024 Bulk Fuels Facility Spill and Reading