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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

May 23, 2014

Colonel Tom D. Miller
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RE: DISAPPROVAL
QUARTERLY PRE-REMEDY MONITORING AND SITE INVESTIGATION REPORT FOR JANUARY - MARCH 2013, BULK FUELS FACILITY SPILL, SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111, JUNE 2013
KIRTLAND AIR FORCE BASE
EPA ID# NM9570024423, HWB-KAFB-13-011

Dear Colonel Miller and Mr. Pike:

The New Mexico Environment Department (NMED) has reviewed the U. S. Air Force's (Permittee) document *Quarterly Pre-Remedy Monitoring and Site Investigation Report for January –March 2013, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111*, dated June 2013 (Quarterly Report). By letter on June 4, 2010, NMED required quarterly reports to be submitted for the investigation and remediation of the Bulk Fuels Facility Spill. The pertinent part of that letter states:

> *Each quarterly report shall provide detailed information on all characterization and remediation activities that took place during the period covered by the report, including, but not limited to, as applicable for the reporting period, field and laboratory analytical results for groundwater, soil, and soil gas; graphs showing trends of major contaminants versus time, a table of surveyed well locations; descriptions of the installation of groundwater and soil-gas monitoring wells; measurements of light non-aqueous phase liquid (LNAPL); table of water levels; water-level map; plume contaminant maps and*

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> *cross-sections; and geologic and geophysical logs of wells and boreholes. Each quarterly report shall also describe the operation, maintenance, and performance of the four soil-vapor extraction (SVE) systems. Each quarterly report shall also include all field and laboratory quality control data for the reporting period and a discussion of data quality as it relates to accuracy, precision, representativeness, and completeness for each analytical parameter that is to be reported.*

The Quarterly Report is deficient. Existing data are not being utilized to maximum benefit. Also, as with earlier reports, the Quarterly Report does not adequately convey the information that is necessary to facilitate a detailed understanding of the geologic, hydrologic, and contaminated conditions of the vadose zone and groundwater. In particular, an adequate geologic conceptual site model for such a complex investigation has not been prepared based on the figures provided in the Quarterly Report, especially for the source area of the contamination where geologic conditions clearly influence the migration of fuel to the water table.

The following comments are also intended to convey deficiencies in the Quarterly Report that have been identified by the NMED. Comments in Part 1of this letter concern the majority of the Quarterly Report; whereas, comments in Part 2 specifically discuss the Radius of Influence (ROI) testing.

<u>Part 1 Comments</u>

1. The Executive Summary, first bullet states *"Based on the three-dimensional (3D) distribution of soil and vapor concentrations, most of the vadose zone contaminant mass is located within 100 to 150 feet above the present-day water table at depths of 350 to 500 feet below ground surface (bgs)."* In contrast to this statement, Figures 2-2 through 2-4 of the Stage 2 Abatement Work Plan for the Soil Vapor Pilot Test at the Bulk Fuels Facility (ST-106), December 11, 2002, show considerable contamination in the upper 300 feet (ft) of the vadose zone, especially beneath the location of the Former Fuel Offloading Rack. Given that the last known leak was repaired in1999, it seems likely that the upper portion of the vadose zone would still contain considerable fuel contamination. The Permittee must describe how the contaminant mass is distributed throughout the vadose zone, including the uppermost 350 ft, and especially in the vicinity of the Former Fuel Offloading Rack (see also Comment 17).
2. Section 3.2.1 Geophysical Logging, defers to the prior Fourth Quarter CY 2012 Report for geophysical logging information as no geophysical logging was conducted during First Quarter CY 2013. The 2nd paragraph of Section 3.2.1 of the Fourth Quarter CY 2012 Report states "*the goal of the geophysical investigation is to refine the conceptual site model to optimize the placement of SVE, groundwater extraction, and future monitoring wells*." In neither the Fourth Quarter CY 2012 Report nor the First Quarter CY 2013 did NMED find any discussions on how these goals were met. Also, there is no discussion of the results of the geophysical logging either individually (electric, gamma, neutron) or as a whole. The Permittee must describe the results of the geophysical logging and how it was used in the site conceptual model.

3. Similar to Comment 2 above, Section 3.2.1 Geophysical Logging, 3rd paragraph, Fourth Quarter CY 2012 Report, states "*However, Jet West geophysical logs have been verified as being calibrated and can be used for qualitative analysis, pre- and post-shop calibrations, as well as daily calibrations, have been documented for all Jet West logging events (Appendix M).*" Induction logs that differentiate between clays/silts and sands/gravels by only a few ohm meters are not correctly calibrated. Other induction logs in the area show an order of magnitude difference in resistivity between the finer and coarser units. Furthermore, the Permittee's letter of May 23, 2012, states a baseline shift "*may be an over correction for a cased-hole scenario, thus forcing the resistivity logs to appear anomalously low for all lithologies at the BFF spill site.*" The description of field calibration in the letter also indicates that ASTM 6726 was not completely followed. Although daily calibration records are included for the induction logs, some show slope deviations of greater than 20% with no data quality objective to indicate what slope deviation is allowable or how many wells may show deviations on the order of 20%. NMED does not concur that the induction logs are calibrated logs. The induction logs done by Jet West do not look similar to any other induction logs generated at the BFFS site or other nearby areas at KAFB or adjacent areas off-site from the Air Force Base. The induction logging was not done with correctly calibrated equipment as clearly shown by the poor resolution of the data and the lack of conformity with logs done by other contractors or at other times. Because the induction logs generated by other contractors for the KAFB area are especially useful for mapping subsurface stratigraphy, the Permittee must obtain correctly calibrated induction logs for the BFFS project.

4. Gamma log calibrations erroneously show mmhos/m as the unit of measure on the calibration graphs in Appendix M. They should be reported in API units. Given that quality control documentation forms are erroneous, which casts doubt on the credibility of data, the Permittee must review its quality assurance procedures (See also Comment #23).

5. Geophysical and geologic data are not being fully integrated into the geologic model or cross-sections. Include data from KAFB production wells, the Veteran's Administration well, Ridgecrest #3 and 5, and the ABCWUA Trumbull wells. Because the production wells and the ABCWUA wells in the area are deeper than the monitoring wells, these wells may be the only source for geologic information for deeper parts of the aquifer (geophysical logs are available for many of these wells).

6. Section 4 presents contoured cross-sections showing concentrations for various vapor constituents. At multiple locations, the data related to specific concentration values do not appear to match the color coded ranges. For example, in Figure 4-6, for KAFB-106112, the value of 2400 parts per million by volume (ppmv) at approximate elevation 5,000 feet is placed in the 100-1000 ppmv range (green) and for KAFB-106130 the values of 6.9 and 4.8 ppmv at approximate elevations of 5,200 ft and 5100 ft, respectively, appear within the blue color coded range of 10 to 100 ppmv. All such computer generated cross-sections and maps should be checked and corrected for accuracy. Submit the corrected cross sections.

7. Section 5.2, Liquid-Level Data, first and second sentences state" *Starting with First Quarter CY 2012, liquid levels were measured on a quarterly basis as opposed to monthly basis in all Kirtland AFB BFF Spill site wells (Table 5-2). As stated in the accepted NMED letter dated 27 August 2012 Quality Assurance Project Plan, groundwater level and LNAPL*

measurements will be conducted on a quarterly basis for years 2012 through 2014." While NMED did acknowledge the QA plan was complete in its letter of August 27, 2012, it did not notice the change from monthly to quarterly water level measurements. Any such change in the frequency of water level measurements should have been proposed as a revision to the Groundwater Investigation Work Plan; however NMED does not agree that quarterly groundwater measurements are adequate at this stage of the investigation. Continue monthly groundwater measurements.

8. The shallow groundwater potentiometric surface map (Figure 5-2) does not cover a large enough area. Wells KAFB-510 (see Comment 32), KAFB-0519, KAFB-0118, KAFB-0119, KAFB-0121, KAFD-015, KAFB-016, KAFB-003, the VA Hospital, Ridgecrest 3, Ridgecrest 5 and the ABCWUA Trumbull wells should be added to the map. Groundwater elevations from the water supply wells should be posted on the map. Static groundwater elevations from the water supply wells that are screened much deeper than the monitoring wells also must be posted on the map, even if not used for contouring. The Permittee must submit a map that includes the above mentioned wells and data.

9. There are instances where the contours in cross section figures in Section 7 do not agree with contours in map figures in Section 5. For example, there is an area on Figure 5-13 between the cluster with KAFB-106067 and the cluster with KAFB-106079 that shows a large area of EDB with concentrations greater than 10 μg/L. An area of EDB concentrations does not appear at a similar location on Figure 7-7 (between KAFB-106068 and KAFB-106081). See for example, the location KAFB-10628-510 on Figure 5-13 and the location KAFB-106066 on Figure 7-7. As another example, Figure 7-11, a cross section view of a line south of Randolph Road, shows a 1400 foot wide groundwater EDB plume at the intermediate depth, yet no such plume is shown south of Randolph Road on Figure 5-14, a map view of EDB concentrations in intermediate groundwater. Correct all such discrepancies between cross-sections and map views and submit the corrected figures.

10. Section 5.2.1, Groundwater Levels, third bullet states "*Field technicians measure water levels and field-check to verify that measurements within a given cluster are within plus or minus 0.5 ft, or are similar to previous quarterly measurements. If not, the field team will then re-measure the water level in the well with the discrepancy.*" Previous quarterly reports stated "*Field technicians measure water levels and field-check to verify that measurements within a given cluster are within plus or minus 0.5 ft. If not, they then re-measure each water level in the cluster.*" Explain why the procedure in Section 5.2.1 was changed, and indicate what other procedures, if any, have been changed. Note that procedures cannot be changed without proposing and obtaining approval to revise the Groundwater Investigation Work Plan.

11. Section 5.2.1, Groundwater Levels, fifth bullet states "*Additionally, the Field Sampling Coordinator compares the measurements against the measurements from the preceding quarter. If any measurements fail a plus or minus 1.0-ft check, they are marked and measured again the following day. This QC evaluation is documented on the water level measurement field form.*" The measured depth to water in well KAFB-106065, for example, was 491.59 ft in the fourth quarter 2012 and a depth of 490.33 ft was measured in the first quarter 2013, yet NMED could not find evidence of re-measurement of the water level for this well. Provide documentation of the re-measurement or describe why this well and others like it have not been re-measured in accordance with the procedure referenced above.

12. Explain the process for choosing which groundwater elevation to use when multiple groundwater depths for a well are recorded on the Quarterly Water Level Field Measurements form.

13. Appendix E-2 is presented in pdf format with wells and dates intermixed. Submit the Appendix in spreadsheet format to make it possible for NMED to manipulate the data.

14. The First Quarter CY 2013 Pre-Remedy Quarterly Monitoring Report, pages 5-13, last paragraph of Section 5.3.2 states: "*The effect of microbial degradation on EDB migration rates and extent is much more problematic with no obvious plume pattern of degradation compounds that indicate EDB degradation. Additional compound specific data are required to determine whether microbial degradation is having any effect on EDB*." The report, page 7-8, Section 7.5 further states: "*One outstanding data gap is data related to the EDB degradation and fate and transport mechanisms. This data gap will be addressed using microbial and compound-specific isotope analyses scheduled for Third Quarter CY 2013*." The Second Quarter 2012 Report indicated this data would be collected in 2012. The 4th Quarter Report, in the executive summary, indicates that the data will be collected 1st quarter 2013. Explain the year-long delay in collecting the data to eliminate the data gap.

15. Explain the 30 ft shift in groundwater levels at KAFB-016, Appendix F-1, page F1-3 (about January 2007).

16. The number of graphs in Appendix F-1 may be reduced. Instead of individual plots for each well, graphs showing water level versus time for wells in the same geographic area can be prepared so that changes in water-level for a given well can be assessed relative to that of the other wells shown on the same plot, or for instance, all shallow wells may be shown on the same graph.

17. Appendix J2, Figure *Appendix J2-11,* Lithology and TPH Soil, East-West Cross-Sections G-G', provides no soil chemical analytical data from beneath the former fuel offloading rack (FFOR) and indicates the soils in the vicinity of the FFOR exhibit little TPH contamination. Previous reports submitted by the Permittee showed much higher levels of TPH in the soil beneath the FFOR (see for example Figure 2-2 of the Stage 2 Abatement Work Plan for the Soil Vapor Extraction Pilot Test at the Bulk Fuels Facility (ST-106), December 11, 2002). Explain this difference and use all available data for site characterization that isn't rejected for quality control purposes. Also, explain why two separate figures, Figures J2-11 and J2-13, respectively, appear to be the same figure.

18. Appendix J-1, Plate J-10, TPH Soil Concentrations for Geologic Cross Section A-A' indicates the presence of soil contamination about 150 ft beneath the water table at well KAFB-106081. Explain how soil contamination reached that depth below the water table and discuss the ramifications of contamination that deep.

19. Appendix K1, PTS Lab Soil and NAPL Analysis Results, Hyd_Cond_Porosity_ GrainSize_foc, Sieve Analysis, 41516, third page, lists the USCS/ASTM description of the grain-size analysis sample for KAFB-106030 at 475ft depth as gravel. Because more than 50% of the sample is sand, the USCS/ASTM classification would not be gravel. Other such examples exist. Describe the classification system used and why the standard USCS description was not used.

20. The sixth bullet in the Executive Summary states "*The PneuLog® data indicates that the water table was at approximately 350 feet when the NAPL releases started.*" The first bullet of Section 7.4.1 states: "Based on historical analysis of water-level data for water supply well KAFB-3, in the 1940s through most of the 1970s, the groundwater table was at a depth approximately 100 feet higher than the current 2013 water table." The PneuLog wells are at an elevation of approximately 5345 ft and a depth of 350 ft would be at an elevation of approximately 4995 ft. The present water table near KAFB-3, based upon water level elevations at nearby KAFB-106201 is approximately 4854 ft and 100 ft higher would be 4954 ft, a discrepancy between the two statements of about 40 feet. Discuss the reason for the 40 ft difference.

21. The continued submittal of the databases (Appendices E-1 and E-2) is the mechanism to correct earlier mistakes in data. Mistakes have previously been pointed out to the Permittee (see for example comment 30 in the August 17, 2011, letter from NMED). Each quarterly report must contain a table listing or text describing what data have been changed, if any.

22. The stiff diagrams (Figures 5-56 through 5-64) must be posted on a map(s) at the sample locations (wells) each diagram represents so the reader can see the spatial distribution of constituents. Provide such a map(s).

23. In Appendix M1, *Geophysical Calibration Logs*, the standard unit of calibration for the induction logs should be mmhos/m and not mmhos/cm. (See also Comment #4).

24. To make Figure 2-2 more meaningful, add total hours of units operation by period so that, for example, periods of down time such as turning off the units for ROI testing and mechanical breakdown/maintenance are not erroneously interpreted as a decrease in mass recovery efficiency.

25. In Appendix E-1, describe the column headings.

26. In Appendix E-1 certain columns contain cells with no entry. This is appropriate in certain columns, such as qualifiers, but in other columns, such as lab sample type or QC level it is inappropriate. Explain why the cells are blank that would normally be expected to contain an entry, or add the missing information.

27. Appendix E-1 lists many soil samples as collected from a 50-ft interval (for example, benzene from KAFB-106130 at 351-ft start depth and 400-ft end depth). State if samples are composites taken from 50 ft of the soil column or be more specific as to the depths the samples were collected.

28. For Appendix N, PneuLog Evaluation Report, the level of resolution of the technique must be described. For example, Figure 6 seems to indicate the level of resolution on the order of one foot at certain depths, but for most depths the resolution appears to be a larger interval.

29. In Appendix N, Figure 7, explain why there are gaps in the log where the screened intervals end. For example at the 200- and 350-ft depths, the graphed lines do not seem to approach closure.

30. Appendix N, Figure 7, explain why the majority of the results are classified as clayey or silty, which is in contrast to the geologic logs for the site which indicate mostly sands and gravels at depths below about 135 ft.

31. Correct Figure 4-10 as necessary to describe if it is supposed to represent Total VOC Vapor as in the figure title, or TPH Vapor, as in the legend,

32. There is confusion about well KAFB-510 (KAFB-510MW, KAFB0510MW, KAFB-0510-MW). The multiple names and survey coordinate problems with this well were documented by NMED in comments on the Fourth Quarter CY 2012 Report. Provide accurate location and elevation data and why groundwater elevation data taken from it are not used.

33. The *Executive Summary*, p. ES-2, second bullet, states "*based on the data collected to-date and the soil concentration footprints at various depths, the soil concentrations indicate that the non-aqueous phase liquid (NAPL) migrated in a predominantly vertical direction along relatively narrow pathways until it reached the capillary fringe above the water table where it spread out in horizontal directions. The PneuLog testing has further delineated these pathways.*" Provide profiles that depict the "relatively narrow pathway" (width and/or location) and the capillary fringe spreading, supported by NAPL concentration data from soil samples. Also, explain how the PneuLog testing "further defined these pathways."

34. Figure 3-10 implies that the connector pipe is smaller in diameter than the individual well casing. It also does not indicate any shut-off valves for individual wells. Improve this figure by labeling, at least, the diameters of all pipes and locations of shut-off valves.

35. Figure 4-3, Total VOC Vapor Plume Footprints By Elevation and Cross-Section Lines March 2013, has some dubious contouring. For example, at the 250 foot depth level values of 11,000 and 19,000 ppmv concentrations are shown within the 1,100 to 10,000 color coded area. Also, the color coded contouring intervals appearing in the Legend are not complete. For example, the 10,100 ppmv value for SVMW-09 along cross-section G-G' at the 250 ft depth does not fit within the 1,100-10,000 color coded area or the 11,000 – 36,000 color coded area. Correct all such errors.

36. Table A-1, *Calculation of NAPL Mass Degraded by Bioventing,* lists mass degraded (gal/period) as 3,106 for the SVE System (Wells KAFB-106160 and KAFB-106161) and 8,562 for *Total Mass Degraded* (gal/period) for all units for the period *Total 1/2013 to 3/2013.* Since the ICE units were taken off line, and mass degraded (gal/period) are listed as 0 for each ICE unit, explain how the other 5,456 gallons were degraded.

37. Section 2.1 1, *Description of SVE System*, states the system is designed to extract over 2,200 pounds per day of hydrocarbon from the soil. Table A-1 lists the mass degraded (lbs/period) as 19,259. This equates to about 9 days of optimum extraction in a 90 day period. While acknowledging that the system was not in operation for all the period and testing was going on that may have precluded optimum performance, it is unclear how well the system is operating compared to its design parameters. Add a column in Appendix A-1 listing total hours of operation to help show how well the system is performing. That number is listed in Table 2-4 as 408 hours. That implies (19,259 lbs/period divided by 408 hours/period) that the system is removing about 47 lbs per hour, or about one half of the design capacity.

38. Figure 2-3, *Total BTEX Removed by the SVE System* implies that approximately 530 pounds of BTEX was removed in the 2 1/2 week period from 3/14/2013 to 3/31/13. Table 2-4 lists the total NAPL mass degraded for the period of 3/15/13 through 3/31/13 as 19,259 lbs. This would imply about 2.7% of the mass removed is BTEX. Explain why 2.7% of the Total Mass Recovery is considered to be BTEX. Indicate the constituents that comprise the remaining 97.3% of the Total Mass Recovery.

39. Table 2-4 implies that SVE Total Mass Recovery was 19,259 lbs/period and Calculated Quarterly Biodegradation removed 24,899 lbs/period of total mass, or about 130% of SVE Total Mass Recovery. (It is unclear why Calculated Quarterly Biodegradation (lbs) Q1 2013 value is in the Total Mass Recovery (gal/period column). Table 2-4 of the Quarterly Pre-Remedy Monitoring and Site Investigation Report October – December 2012 (4th quarter 2012) values for Total Mass Recovery by Unit 249 was 18,455 lbs/period and the Calculated Quarterly Biodegradation value was 629.8 (unknown unit). It is not clear if the units should be lbs/period as in Table 2-4 of the First Quarter 2013 Report or gal/period, as in the column heading of the 4th Quarter 2012 report. In any case, the same comparison of values for Calculated Quarterly Biodegradation divided by Total Mass Recovery (lbs/period) is about 3.5%. Explain why there is such a large discrepancy in the ratio of bioremediation and SVE mass removal in the 1st quarter 2013 versus the 4th quarter 2012: 130% and 3.5 %, respectively. Also submit information to clarify data indicated in this comment as unclear, including the unit of measurement for the Calculated Quarterly Biodegradation value of 629.8.

40. Explain the difference between the *Average Influent Vapor Concentration* (ppmv) column and *Influent Vapor Concentration* column (ppmv) on Table 2-4. Also explain the need for many of the notes and abbreviations that do not appear in the table, or remove the unnecessary notes and abbreviations.

41. The last bullet in section 7.4.1 indicates that "*The EDB migration is therefore occurring at a rate of between 80 and 200 feet per year*" and the sixth bullet on page ES-3 states the groundwater velocity ranges between "18 to greater than 300 feet per year." Explain the difference between the two.

42. In Table 2-3 explain why there is a higher concentration of Total Lab VOC (for both rows "C5-C12 GRO" and "no C8-C12 GRO") at CATOX- than the total of KAFB-106160-in and KAFB-106161-in. In addition, explain why the Lab VOC measurements are much lower than the Field VOC results.

43. In Appendix G-1, 2012 Data and Purge Logs, for KAFB-106001, for example, explain why Tubing Diameter, Tubing Length, Pump Placement from TOC, Final Pumping Rate and Stabilized Drawdown are listed as zero, or provide the appropriate values. Also, for Calculated Sample Rate and Sample Rate, the data are listed in units of time, which is not a rate. Correct as appropriate. The Calculated Sample Rate is listed as 18,000 sec (5 hours) – explain what this represents.

Part 2 Comments

44. A key provision of the ROI (radius of influence) assessment is the use of 0.2 inches of water column (inWC) as the "edge" or perimeter of the ROI. This is subjective and results in a rather large ROI of 300 feet. ROI should be calculated based on air movement in the subsurface rather than measured vacuums (see comment 45 below). In addition, 0.2 inWC is a value well within the range of barometric pressure fluctuations.

    Furthermore, the last sentence of Section 2.1.2 (New SVE System Installation) states: "The ROI of the system was determined to be isotropic and approximately 300 feet in all directions." Yet, in the previous Quarterly Report, other ROI tests were reported. The 5DKAFB106121-450 test is described as having an interpreted ROI of about 75-95 ft (p. 3-43), and the results section for test SDTSVEW-05 stated "No meaningful conclusions about the ROI of extraction well SVEW-05 can be made from this analysis of the data." (pp. 3-44). Given the disparity between the earlier ROI test results from the 4th Quarter 2012 and the more recent ROI test described in the 1st Quarter 2013 Quarterly Reports, justify and elaborate on the conclusion that the ROI is isotropic and approximately 300 feet in all directions (see also Comment #47).
45. The radius of vacuum influence should not be used directly as a basis for full scale design. ROI as defined in this report is not the same as the effective radius of treatment, because measurable vacuum does not imply effective air flow. Consequently, the ROI of 300 feet should not be used for system design. Calculation of the air permeability of soil, and establishing minimum soil gas flow parameters (such as air flow velocities) must be used for full-scale design.
46. The following guidance documents (obtained from http://www.clu-in.org/techfocus/default.focus/sec/Soil_Vapor_Extraction/cat/Guidance) should be consulted during SVE system design:

    a. U.S. Army Corps of Engineers, 2002, Soil Vapor Extraction and Bioventing, Engineering Manual (EM) 1110-1-4001. Pg. 4-21, above eq. 4-2, refers to the "zone of effective air exchange," which indicates that adequate exchange of air (i.e., multiple soil pore volumes) is more important than just pressure influence. Pg. 4-26, (2) indicates that the observed vacuum distribution should not be used as the basis for the well field design. Instead, a specific air permeability value should be estimated, and estimates of pore gas velocity (specific discharge) made for a given SVE extraction flow rate. Pg. 4-33 text in bold indicates that the radius of pressure influence is not appropriate as a basis for selecting vent spacing. Pg. 4-34, Paragraph 18, indicates the radius of vacuum/pressure influence does not provide an adequate estimate of the zone of effective air exchange of the vent, which is often much smaller than the radius of pressure influence.

    b. EPA, 1992 Ground Water Issue, Evaluation of Soil Venting Application, EPA/540/S-92/004. Pg. 5, text indicates that the ROI is not an effective parameter for locating extraction wells.

c. EPA, 1998, Innovative Site Remediation Technology, Volume 7: Vacuum Extraction and Air Sparging, 542-B-97-01. Pg. 3.35, last two paragraphs, indicate that vacuum ROI is not adequate, but rather air flow predictions should be used to design the well field. "Historically, radius of influence has been determined by plotting the log of subsurface pressure with distance from the extraction well, regression, and interpolating the regression line to an arbitrary pressure value, typically ranging from 0.01 to 1 inch water column… The radius of influence evaluated in this way is arbitrary, because the vacuum cutoff level is arbitrary….Many alternative approaches have been developed that focus on air flow."

47. **Pg. 2-3, last sentence.** Provide additional justification of the statement: "The ROI of the system was determined to be isotropic and approximately 300 feet in all directions." There is no justification for the statement of isotropy, as there was no specific assessment of this characteristic.

48. **Pg. 3-20, 2nd paragraph, last two sentences.** Text indicates that 0.2 inWC represents the edge of the ROI. Text also states that wells with 2 inWC appeared to be within or outside of the ROI; clarify if the latter text is correct as written (2 inWC instead of 2 inWC).

49. **Figure 3-5.** Since barometric pressure varied from -5 to +3 inWC over about 4 days during Test 1, there is not adequate justification for using a number as low as 0.2 inWC as the lower edge of vacuum affect ROI criteria. The statement at the bottom of Pg. 3-16 that reads "the barometric pressure had a much stronger effect on vacuum pressure in wells being monitored than did the SVE System used during ROI testing (Figure 3-5)" confirms NMED's position.

50. **Pg. 3-21, last paragraph.** For background monitoring results, given that "the average difference from null ranged from -0.9 to 0.17 inWC, with standard deviations ranging from 0.03 to 0.60 inWC," there is not sufficient justification for using 0.2 inWC as the lower edge of vacuum effect ROI criteria. An edge criterion greater than 0.5 inWC would allow more discernment from background monitoring results.

51. **Table 3-5:**

    a. Columns 2, 3, and 4: Some shallower wells seem to have significantly different distances from the extraction wells than the associated deeper wells. For example, KAFB-106155-484 is 271 and 534 ft from the extraction wells, but shallower well KAFB-106155-200 is 331 and 567 ft from the extraction wells. Correct the data as necessary or explain why the data are correct as written. See also KAFB-106152-484 and -194, and KAFB-106115-450 and -150.

    b. For the KAFB-106160 and KAFB-106161 extraction wells, clarify whether the pressure readings are corrected for extraction well efficiency. This parameter will need to be considered during future system design.

    c. Also for the KAFB-106160 and KAFB-106161 extraction wells, the applied pressures for Weeks 1, 2 in the second to last column seem unusually low (0.4 to 0.5 inWC, versus over 2inWC for most other test scenarios). Correct the data as necessary or discuss the variation in the data.

d. Regarding the Test 1, Test 2, and Test 3 Differences from Null Pressure results, explain the differences in well pressures with changing flow between the shallow and deep observation well pressures with increasing flow from the extraction wells. For example, compare the mean results from KAFB-106150-350 corresponding to Test 1, Test 2, and Test 3, which generally show decreasing pressures with increasing extraction flow velocities. In contrast, the deep interval (KAFB-106150-484) shows increasing pressure with increasing extraction flow velocities. This also applies to 106149-349, 106154-350, and others.

The Permittee must respond in writing to this letter and correct the deficiencies noted herein by **September 30, 2014**. As part of the response, include a table that details where all revisions have been made to the Quarterly Report and that cross-references NMED's numbered comments in this letter.

Should you have any questions, please contact me at (505) 827-2855.

Sincerely,

Tom Blaine, P.E.
Director
Environmental Health Division

cc: J. Kieling, NMED HWB
D. Cobrain, NMED HWB
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File: KAFB 2013 Bulk Fuels Facility Spill and Reading