

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 1 REVIEW LNAPL Containment Interim Measure Work Plan

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-------|---|---|---|
| Intro | <p>The Work Plan emphasizes that many details of the pump-and-treat system cannot be developed at this time because of the need to first obtain the requisite characterization information described in the Work Plan primarily in Sections 1 through 6. The NMED concurs with the Permittee that collection of characterization data is a necessary precursor to the proposed interim measure, hence the need for a separate characterization plan. The revised Work Plan to be submitted in response to this letter, on the other hand, needs to focus on the design and operations aspects of the pump-and-treat system, and be developed after the characterization data has been obtained. Separating characterization work from the pump-and-treat system design will simplify the objectives of each plan, which is needed due to the complexity of the proposed pump-and-treat system. The characterization plan must include proposed work to conduct the pumping tests and installation of the extraction and injection wells in addition to the other characterization activities proposed in Sections 1 through 6 of the Work Plan. Comments concerning characterization are addressed chiefly in Part 1 of this letter and primarily pertain to Sections 1 through 6 of the Work Plan.</p> | No action | <p>The objective of the work plan was to outline the data needs and design requirements for an interim measure that would contain the LNAPL on the groundwater.</p> |
| 1 | <p>Table 1-1 - Prepare the characterization plan to discuss the type of analyses that are intended for the parameter "NAPL cleaning." Identify the analytical laboratory that will be performing the analysis for hydrocarbon degrading bacteria.</p> | <p>Text will be added to the Characterization Work Plan to discuss the type of analyses planned for each of the parameters listed in Table 1-1. Table 1-1 will be edited to identify the laboratory performing the analysis for hydrocarbon degrading bacteria.</p> | Revise as indicated. |
| 2 | <p>Section 2.3 - NMED approval must be obtained for any changes to previously-approved work plans</p> | <p>Section 2.3 will be revised to clarify that NMED approval is required for any changes to the previously approved work plans.</p> | Revise as indicated. |
| 3 | <p>Section 2.3 - Prepare the characterization plan to indicate where the Field Change Request form is to be found.</p> | <p>The following sentence will be added to Section 2.3: "The FCR can be found in Appendix D of this work plan."</p> | Revise as indicated |
| 4 | <p>Section 4.4.1 - Prepare the characterization plan to indicate where Building 2405, the JP- 8 offloading rack, is located on Figure 3-2.</p> | <p>Figure 3-2 will be revised to clearly label the location of Building 2405, the JP-9 offloading rack.</p> | Revise as indicated. |
| 5 | <p>Section 4.7 - Specific receptor points must be identified, such as the WUA, KAFB, and the Veterans Administration water supply wells.</p> | <p>Section 4.7 will be revised to identify the specific receptors, including the WUA, KAFB, and VA water supply wells.</p> | Revise as indicated. |
| 6 | <p>Figure 5-2 - It is difficult to review data on Figure 5-2 due to the background aerial photograph. Provide an additional figure that leaves only major streets and/or other major features for reference to improve readability of the presented data.</p> | <p>Figure 5-2 will be revised to remove the aerial photograph from the background. This edit will be made to other figures using an aerial photograph as the background image.</p> | Revise as indicated. |
| 7 | <p>Section 5.2.1 - Slug tests are proposed for wells KAFB-1065, KAFB-1066, KAFB- 1068, KAFB- 1069, KAFB- 106 10, and KAFB- 106 14. Additional hydraulic conductivity data for locations closer to the proposed extraction and injection wells are needed to better define the magnitude and spatial variability of hydraulic conductivity within the proposed containment area. At a minimum, conduct additional slug tests at wells KAFB-10613, KAFB-</p> | <p>The work plan will be revised to include the following list of existing groundwater monitoring wells to be slug tested: KAFB-1065, KAFB-1066, KAFB-1068, KAFB-1069, KAFB-10610, KAFB-10613, KAFB-10617, KAFB-10618, KAFB-10619, KAFB-10620,</p> | <p>Slug testing will be conducted on downgradient groundwater monitoring wells, as per the March 6, 2011 meeting with the NMED and subsequent letter. The work plan will be revised as indicated.</p> |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 1 REVIEW LNAPL Containment Interim Measure Work Plan

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----|---|---|---|
| | 10617, KAFB-10618, KAFB-10619, KAFB-10620, KAFB-10628, and as appropriate, at new wells installed under the Groundwater Investigation Work Plan. | KAFB-10621, KAFB-10625, and KAFB-10628. Additionally, the text will be revised to clarify that slug testing will also be conducted at newly installed groundwater monitoring well clusters located downgradient from the extraction wells: GWM-1, GWM-2, GWM-3, GWM-4, GWM-5, GWM-8, GWM-9, GWM-10, GWM-14, GWM-15, GWM-16, GWM-19, GWM-20, GWM-21, GWM-22, GWM-23, and GWM-28. | |
| 8 | Section 5.2.1 -There is a high likelihood that the presence of LNAPL will affect the outcome of the slug tests. It is therefore critical that the thickness of the LNAPL be measured immediately prior to and after the slug tests are performed, and the results recorded. Specify how the presence of LNAPL will be addressed during field data collection and how it may affect the slug test results. | The text will be revised to clarify that the thickness of NAPL in a well, both prior to and after slug testing, will be measured during field data collection. | Due to the relatively thin thickness of NAPL in the groundwater monitoring wells to be slug tests, the influence of NAPL on the slug test data will be negligible and therefore not corrected for in the data. |
| 9 | Section 5.2.1 - Indicate and explain the method that will be used to evaluate slug test data. | Work plan will be revised to include an explanation of the method that will be used to evaluate the slug test data. | The oscillating slug test method will be used to analyze the slug test data. A paper on this method of analysis was distributed to the NMED. |
| 10 | Section 5.2.1 - Specify the size of slug or slugs that will be used. | The work plan will be revised to clarify that slug tests will be conducting following pneumatic slug testing methods, where possible. Text will be revised to clarify that in wells where pneumatic slug testing cannot be used, a slug of sufficient size to induce a two-foot water level change will be used. | Pneumatic slug tests will be used to the extent practical. If pneumatic tests are not viable for wells screened across the water table a slug of sufficient size to induce a two-foot water level change will be used. |
| 11 | Section 5.2.2 - In addition to the locations specified in Section 5.2.2, collect and analyze LNAPL and groundwater samples from well KAFB-10628, the extraction and injection wells, and any additional observation wells (see Comments #21 and 22 of Part 1 of this letter) installed for conducting the pumping tests. All wells must be properly developed and purged before groundwater samples are collected for analysis in accordance with the KAFB Hazardous Waste Facility Permit (Permit) Parts 6.5.17.10.6 and 6.5.17.4. | The work plan will be revised to clarify that groundwater samples will be collected observation wells (groundwater monitoring wells) as part of the quarterly sampling program. Additionally, text will be revised to clarify that LNAPL samples will be collected from wells with adequate LNAPL volume. | Groundwater samples will be collected from monitoring wells as part of the quarterly monitoring program. Observation wells used during the aquifer testing will be monitoring wells installed as part of the Groundwater Investigation Work Plan and therefore will be included in the sampling program. Clarification is requested on the request for groundwater sampling from the extraction and injection wells. LNAPL samples will be collected from any wells that have adequate NAPL present for sampling. |
| 12 | Section 1.2, Item #2 - This section discusses various analytes for testing but is not consistent with worksheet 18g in Appendix B, UFB-QAPP. Correct the work sheet as appropriate. | The work plan will be revised to be consistent with the analyses listed in the Quality Control Project Plan. | Revise as indicated. The KAFB BFF Quality Assurance Project Plan will incorporate the appropriate analytical parameters as specified in Section 1.2 of the LNAPL Containment Work Plan. The Quality Assurance Project Plan will replace the UFP-QAPP document as discussed with NMED on Jan 6, 2011. |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 1 REVIEW LNAPL Containment Interim Measure Work Plan

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----|---|---|--|
| 13 | Section 5.2.3 - Indicate whether the 3D model incorporates the potential for transient flow from KAFB and Veterans Administration water-supply wells. | The work plan will be revised to clarify that the 3D model incorporates the potential for transient flow. | The 3D model does incorporate the potential for transient flow from the KAFB and VA water supply wells. However, there is no transient data for these wells to put into the model. If this data is made, or comes available, it may be incorporated into the model as appropriate. |
| 14 | Section 5.2.3 - NMED assumes the Permittee has a conceptual geologic model for the capture-zone modeling. It was therefore surprising that a RockWorks™ model for the Bulk Fuels Facility Spill was not provided in the Work Plan. Such a geologic model must be included in both the characterization plan and the revised Work Plan. Update the geologic model for each of the plans to include newly collected geological and geophysical data, as applicable, obtained through implementation of the Vadose Zone and Groundwater Investigation Plans. | The work plan will be revised to include a geologic model. | A conceptual geologic model has been developed and can be included in the revised work plans. Revise as indicated. The model incorporates existing and newly collected boring log and geophysical log data that has been through the internal QC and review process. The model includes boring and geophysical logs for both groundwater and soil vapor monitoring wells installed as part of the Groundwater Investigation and Vadose Zone Investigation Work Plans. |
| 15 | Section 5.3.1 - Clarify if the definition for residual saturation only applies to nonwetting liquids (as indicated in the first sentence), given that annotations for both wetting fluid and nonwetting fluid (S_{rw} and S_{mw}) are provided in the second sentence. | The text will be revised to include the sentence: "This definition of residual saturation only applies to nonwetting fluids." | Revise as indicated. |
| 16 | The Permittee's analysis indicates that two extraction wells will capture the LNAPL plume, assuming the hydraulic parameters used in the analysis are reasonably accurate. However, there is considerable uncertainty regarding these parameters. The last three bullets of Section 5.1 indicate that a feasibility analysis was performed that resulted in the selection of a two-well hydraulic extraction system. NMED agrees that a system with two vertical extraction wells is better than one vertical well for the reasons described. However, the same logic can be used to validate the efficiency of three vertical extraction wells or more. While the Permittee has demonstrated that one extraction well is inadequate, the optimum number is still in question. The proposed two-well system may in fact not provide adequate capture of the LNAPL plume. At least one additional extraction well should be considered to provide system redundancy, enhance system flexibility, and facilitate monitoring during system performance and pumping tests. The suggested location for the well is midway between proposed wells KAFB-106108- NAPL and KAFB-106109-NAPL (see Figure 1 of this letter). This additional extraction well would provide additional benefits, including system back-up for the proposed primary extraction wells during down times, and (if not being pumped) water-level measurements within the capture zone between the active extraction wells. Even if not brought online immediately, it could be activated as a primary extraction in the future well to facilitate adequate capture. | | The objective of the LNAPL Containment Interim Measure Work Plan is to present an interim measure to contain the NAPL plume. A third well may be installed, if needed, either as part of the containment system or as part of the final remedy. It is our understanding based on the April 21, 2011 meeting to discuss the quarterly report, that it is NMED's intention that the characterization plan can include the installation of extraction wells so that pumping tests can be performed. If this is in fact the case, the characterization plan will include these details. |
| 17 | NMED does not approve of a cross-gradient location of the injection well, as specified in Section 6.2 and as shown on Figures 5-1,5-2, and 6-1 of the Work Plan. This objection was first expressed by the NMED in its public meeting held on January 12,201 1, where representatives of KAFB were present. The | | A meeting is requested with the NMED to discuss the placement and impact of an up-gradient injection well. |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 1 REVIEW LNAPL Containment Interim Measure Work Plan

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----|--|--|---|
| | <p>injection well must be located upgradient of the LNAPL plume within the area shown on Figure 1 of this letter such that any contaminated water for which treatment fails to achieve clean up goals will be recaptured by the containment system or other future remedial system. The proposed injection well location is not acceptable because detectable levels of contaminants would be introduced into a portion of the aquifer near a water supply well where contamination is not known to exist. Also, this area would not be subject to capture and subsequent treatment, putting the water supply unnecessarily at risk. The combination of a pump-and-treat system with an upgradient injection area provides a circulation cell whereby treated water is drawn into the upgradient portions of the plume in the capture zone. This imparts a flushing effect and serves to enhance hydraulic movement of the plume toward the extraction location, which should accelerate cleanup of the LNAPL and dissolved phase plume. NMED acknowledges the Permittee's March 24,2011 letter and attachment to the Albuquerque Bernalillo County Water Utility Authority (WUA), in which Dr. Gary Hecox opines that upgradient injection would "lead to spreading of the dissolved-phase contaminant plume outside containment area" due to influx of regional groundwater into the capture zone. NMED has not noted this phenomenon at other pump-and-treat systems with upgradient injection in New Mexico, and without supporting data, is not persuaded by this argument.</p> | | |
| 18 | <p>Collect samples for lab measurements of grain size distribution, hydraulic conductivity, specific yield, and porosity at the injection well, extraction wells, and any additional observation wells (see Comments #21 and 22 of Part 1 of this letter).</p> | <p>The following text will be added to the work plan: "Bucket samples will be collected from groundwater monitoring wells, as part of the Groundwater Investigation Work Plan (Shaw, 2011) , and from the extraction and injection wells. These samples will be submitted to a laboratory for reconsolidation and analysis for grain size, hydraulic conductivity, and specific yield. Porosity for the observation wells and the extraction and injection wells will be estimated from the grain size analysis results and the geophysical logs."</p> | <p>As discussed during the March 6, 2011 meeting and subsequent letter, samples are being collected from the screened intervals of the groundwater monitoring wells, as part of the Groundwater Investigation Work Plan. Additionally, bucket samples will be collected from the screened intervals of the extraction and injection wells. These samples will be analyzed for hydraulic conductivity, specific yield and grain size. Grain size data and geophysical logs will be utilized to estimate the porosity of the screened interval. This data will be incorporated into the characterization of the LNAPL containment system.</p> |
| 19 | <p>Sections 6.2.1.3 and 6.2.1.5 and Figures 6.2 and 6.3 -The text of these sections do not agree in all cases with what is shown on Figures 6-2 and 6-3.</p> <p>a) Section 6.2.1.5 states that the thickness of bentonite seal will be a minimum of 5 feet but Figures 6-1 and 6-2 show the thickness as 10 ft.</p> <p>b) Sections 6.2.1.3 and 6.2.1.5 state the estimated depth of the extraction wells as 550 feet, but Figure 6-2 shows the bottom of each well's filter pack to be 600 feet.</p> <p>c) Section 6.2.1.3 states "the injection well boring will be drilled to 100 ft below the first encountered groundwater (approximately 550 feet)." It is unclear if the 550 feet refers to groundwater or well depth, but in any case, the</p> | <p>Sections 6.2.1.3 and 6.2.1.5 and Figures 6-2 and 6-3 will be revised so that they are consistent and correct.</p> | <p>Revise as indicated.</p> |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 1 REVIEW LNAPL Containment Interim Measure Work Plan

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----|---|--|--|
| | <p>water level is shown on Figure 6.3 at 500 feet and the bottom of the well at 600 feet.</p> <p>d) Figure 6-3 shows 6-inch inside diameter (ID) casing as having an 8-518-inch outside diameter (OD). Correct these specifications as applicable.</p> <p>e) Clarify if the 13-318-inch surface casing shown on Figures 6-2 and 6-3 extends down to approximately 200 feet (the approximate depth of the 13-1/2-inch drive casing mentioned in Section 6.2.1.3). If the latter is true, clarify also in the well installation procedure in Section 6.2.1.5, which does not mention a 13-1/2-inch borehole diameter.</p> | | |
| 20 | <p>Section 6.2.1.4 - Prepare geologic logs for all wells, including any observation wells (see Comments #21 and 22 of Permit Part 1 of this letter).</p> | | <p>Geologic logs will be prepared for the extraction and injection wells, as well as for any observation/groundwater monitoring wells.</p> |
| 21 | <p>Section 6.2.2 –</p> <p>a) The expected drawdowns at wells that are to serve as observation wells for the pumping tests are not discussed. It is unclear which wells are to be used as observation wells, and the closest monitoring well (which has yet to be installed) would be about 200 feet from the nearest extraction well. A pumping test conducted at approximately 50 gpm in nearby well KAFB ST-105 achieved drawdown of only about 0.3 feet in an observation well only 70 feet away. NMED is therefore concerned that the distances between possible observation wells and the extraction injection wells may be too large for the observation wells to serve effectively for pumping tests. To resolve this, an extraction/injection well can be moved closer to an existing well to increase the likelihood of achieving a predicted drawdown scenario, provided the well can still adequately serve its intended purpose for the pump and treat system.</p> <p>b) At a minimum, initially model drawdown for each pumping well at 50, 100, and 250 feet, or the distance between the pumping well and the intended observation wells, using hydraulic conductivities of 131 and 246 ft/day for 24 and 72 hour tests, the hydraulic conductivities reported in Table 3-2 of Appendix B of the Stage 2 Abatement Plan for Nitrate Contaminated Groundwater at Kirtland Air Force Base, dated December 2009. Site-specific gradients and other hydraulic parameters must be used in the modeling to the extent that they are known. All modeling parameters and assumptions must be discussed in detail. Additional monitoring wells may be required for the pumping tests based on initial modeling.</p> <p>c) Specify which wells will be used for observation wells for each of the well pumping tests and their distances from the pumping well, which wells will undergo pumping tests for 24 hours and which for 72 hours, and the minimum drawdown that the Permittee believes can be measured in the field with reasonable certainty that the measurements are accurate. Discuss the potential error in the drawdown measurements and demonstrate that the expected minimum drawdown value can be distinguished from water-level decreases caused by changes in barometric pressure or other possible sources of error.</p> <p>d) Propose a plan to determine specific yield from the pumping tests.</p> <p>e) The NMED recommends that the Permittee consider using at least two observation wells for each pumping test, and also to consider using</p> | <p>a) The text will be revised to clarify which wells will be used as observation wells.</p> <p>b) An appendix will be added to the Characterization Work Plan discussing the model sensitivity to hydraulic conductivity, pumping rates, and extraction well locations.</p> <p>c) The work plan will be revised to indicate which wells will be used as observation wells and their distance from the pumping well.</p> <p>d) The work plan will be revised to include a discussion of how specific yield will be estimated from the results of the aquifer test(s).</p> <p>e) No revision necessary.</p> | <p>a) Revise as indicated; an extraction well may be moved to a location closer to existing groundwater monitoring wells, as suggested.</p> <p>b) A meeting with the NMED is requested for discussion of this comment. The ST-105 pumping well encountered 35 feet of GP gravel. No such gravel thickness has been observed in the vicinity of the proposed LNAPL extraction wells so the applicability of these hydraulic conductivity values is unclear. The slug tests conducted as part of the ST-105 investigation were similar to the values of 50 ft/d used in the initial LNAPL work plan modeling.</p> <p>c) Revise as indicated.</p> <p>d) Revise as indicated.</p> <p>e) During the aquifer testing, all three groundwater wells in a cluster will be monitored. Observation wells will be selected parallel to and perpendicular to the major axis of the LNAPL plume.</p> |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 1 REVIEW LNAPL Containment Interim Measure Work Plan

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----|--|--|---|
| | observation wells oriented parallel to and perpendicular to the major axis of the LNAPL plume. Horizontal anisotropy may be present with greater hydraulic conductivity in a north-south direction compared to that in the east-west direction (see U. S. Geological Survey Water-Resources Investigations Report 02-4200, page 19). | | |
| 22 | If appreciable drawdown is not observed for at least one observation well for a given pumping test, and taking other actions fail to produce appreciable drawdown, at least one observation well closer to the pumping well must be installed, and the pumping test for the well repeated. The location of new observation wells must be approved by NMED prior to their installation. | No revisions required. | Commented noted. |
| 23 | The volume of wastewater expected from the pumping tests could exceed 200,000 gallons. According to Table 2 of Appendix C, the proposed method for treatment/disposal of investigation-derived wastewater is "Discharge to ground surface per approval." Discharge of pumping-test water to the ground may not be acceptable given the expected contaminated nature of the water from the extraction wells, which potentially may be a hazardous waste because of the toxicity of benzene. Even if treated, the wastewater from the pumping tests must be contained, sampled, and disposed of in accordance with Permit Part 6.5.7. Discharge to the ground surface must be approved in advance by NMED's Ground Water Quality Bureau. Discuss in detail in the characterization plan the means by which investigation-derived wastewater and other investigation-derived waste will be managed and disposed of. | Work plan will be revised to clarify treatability test that will be conducted as part of the pumping test and that the decision tree provided by the NMED Groundwater Quality Bureau will be used for handling of non-hazardous waste-water. | As part of the pumping test, Shaw will conduct a treatability test using granular activated carbon. This will consist of a two-bed system with the second bed designed as a guard bed for the primary bed so that all water discharged will be below regulatory concentrations for discharge per the Permit. . As a result, the decision tree provided by the NMED Groundwater Quality Bureau will be used for handling of non-hazardous waste water. |
| 24 | Section 6.3 - This section implies that geophysical logging for the extraction and injection wells will be performed within steel-drive casing after total depth has been reached and before well construction. EM induction logging is generally used for uncased boreholes or polyvinyl chloride (PVC) cased wells, and therefore may not be effective under these circumstances. Describe the effectiveness of each logging tool when employed in steel-drive casing if this is indeed the plan. | The work plan will be revised to clarify that induction logging will not be conducted on the extraction or injection wells due to the steel casing. | Revise as indicated. |
| 25 | Section 6.3.1 - Prepare geophysical logs for all wells, including any observation wells (see Comments #21 and 22 of Permit Part 1 of this letter). | The text will be revised to clarify that geophysical logs will be completed in the extraction and injection wells, as well as the groundwater monitoring wells (as described in the Groundwater Investigation Work Plan). | Geophysical logs will be completed in each well that is installed, including the extraction and injection wells. Induction logging will not be completed in the extraction and injection wells due to the interference of the steel casing. |
| 26 | Section 6.3.1 - This section discusses the use of a caliper tool. Because geophysical logging is presumably planned to be conducted within drive casing having a constant inside diameter, the purpose of the caliper logging in this application is unclear and its use potentially unnecessary. | The text will be revised to delete the reference to caliper tools. | Revise as indicated. |
| 27 | Section 6.3.2 - This section states "The borehole induction system can be used in boreholes that range from 2 to 8 inches in diameter without significant borehole effects." Because the proposed boreholes are larger than 8-inches in diameter, explain what the significant borehole effects are or could be expected, and how these effects will be mitigated or taken into account. | The work plan text will be revised throughout to remove discussion of induction logging. | Induction logging will not be conducted on the extraction and injection wells. |
| 28 | Section 6.3.2 - Prepare the characterization plan to indicate whether the induction logging tool will be centralized. Provide the focusing radii of the | The work plan text will be revised throughout to remove discussion of induction logging. | Induction logging will not be conducted on the extraction and injection wells. |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 1 REVIEW LNAPL Containment Interim Measure Work Plan

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|------------|---|---|--|
| | medium and deep dual induction tool. | | |
| 29 | Section 6.3.5.1 - The Work Plan states that the cable to be used to conduct geophysical logging tool is long enough to log to depths of 600 ft. Section 6.3.2 says "the depth of measurement . . .will be 650 ft." Correct the text of these sections to be consistent in that logging must be conducted from surface to total depth of each well. | The work plan will be revised throughout to clarify that geophysical logging will be conducted from the ground surface to the total depth of each well. | Revise as indicated. |
| 30 | Section 6.4 - Include a proposal to submit quarterly reports to the NMED. | | Clarification is requested. Data will be included in the BFF Quarterly Report. |
| 31 | The thickness of the aquifer is likely greater than 60 ft, and thus, the pumping wells will likely not fully penetrate the aquifer. Provide a detailed discussion in the characterization plan on how the true thickness of the aquifer may affect the results of pumping-test drawdown and how the modeling of drawdown has taken this into account. | | A meeting with the NMED is requested to discuss. |
| 32 | Include a water-level map in the characterization plan (see Comment #2 in Part 2 of this letter). | A figure will be added to the work plan showing a water level map. | Revise as indicated. |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 2 REVIEW

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----|--|--|---|
| | Part 2 of this letter pertains chiefly to the design of the pump-and-treat system, found primarily in Sections 5 and 7 of the Work Plan. The design of the pump-and-treat system in the Work Plan must be revised to take advantage of the information obtained through implementation of the characterization plan, the Vadose Zone and Groundwater Investigation Plans, and the Interim Measures Work Plan. | | |
| 1 | The thickness of the aquifer is likely greater than 60 ft. It is therefore likely that the extraction wells will probably not fully penetrate the aquifer. The revised Work Plan must contain a detailed discussion on how the true thickness of the aquifer may affect the results of drawdown, and thus, the extent of the capture zone and how the modeling of the capture zone has taken this into account. | | A meeting with the NMED is requested to discuss. |
| 2 | Figure 5-2 - Prepare an additional figure showing the water table utilizing data from the wells shown on this figure, new monitoring wells to be installed under the Groundwater Investigation Work Plan, and the following wells: KAFB-0508, KAFB-0510, KAFB-0118, KAFB-0119, KAFB-0121, KAFB-0524, KAFB-3, KAFB- 14, KAFB- 15 and KAFB- 16. | Figure 5-2 will be revised to include the water table levels, using existing and new groundwater monitoring wells. | Clarification is requested regarding the additional wells listed in comment. Water level data are not available from production wells and it is unknown if the wells are even configured to measure water levels. The other wells are ½ to over a mile upgradient from the ST-106/SS-111 area and it is unclear how the water levels in these wells relate to the groundwater flow in the remediation area. |
| 3 | Section 5.2.3 - As indicated in Comment #14 in Part 1 of this letter, include a geologic model in the characterization plan and the revised Work Plan. | The work plan will be revised to include a geologic model. | Revise as indicated. |
| 4 | Section 5.2.4 - Clarify in the revised Work Plan if the vertical capture of contaminants is an objective of this interim action. | No revision required. | The objective of this work plan is to provide an interim measure that contains the LNAPL. Vertical capture of contaminants may be relevant in the final remedy and is not required to design and operate the proposed LNAPL Containment system. |
| 5 | Section 7 - This section of the Work Plan does not provide an adequate discussion of the sampling and analysis of groundwater after it has been treated. Provide in the revised Work Plan details concerning: a) a sampling port for effluent; b) parameters to be tested for; c) laboratory testing methods and detection limits; d) frequency of analysis of effluent; and e) quality assurance quality control. NMED's Ground Water Quality Bureau may direct further sampling and analysis requirements through any permits it may issue regarding reinjection of treated water. | The work plan will be revised to include details on: a) A sampling port for effluent; b) Parameters to be tested for; c) Laboratory testing methods and detection limits; d) Frequency of analysis of effluent; and e) Quality assurance quality control. | Revise as indicated. Additional discussion is requested, regarding the sampling and analysis requirements and permits for reinjection of treated water. |
| 6 | Explain in the revised Work Plan the corrective action procedures that will be conducted if a sample of effluent fails any clean up goals. | | Shaw will comply with permit requirements. The system will be designed with multiple redundancies to be protective of the effluent. In the scenario where the system needs to be shutdown for repairs, it is estimated that it can be shutdown for a duration of 3-6 months. A |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 2 REVIEW

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----|---|--|---|
| | | | meeting to discuss is requested. |
| 7 | Figure 7-1 - Explain in the revised Work Plan with notes added to the figure all acronyms used on the figure. | Figure 7-1 will be revised with acronym definitions. | Revise as indicated. |
| 8 | Section 7.2.2 - This section discusses discharge limits established under 20.6.2.3103 NMAC. The Permittee must also abide by the clean up goals established in Permit Part 6.2.3. | | A meeting with the NMED is requested to discuss and clarify. |
| 9 | Section 7.3.1 -Indicate in the revised Work Plan what pre-design data will be collected to refine the design of the treatment process. | The work plan will be revised to indicate that pre-design data used for the final design is from the Characterization Report summarizing the results and findings of the Characterization Work Plan. | Revise as indicated. |
| 10 | Section 7.4 - This section does not discuss the vapor GAC unit seen on Figure7-1. Discuss in the revised Work Plan if there are any air emissions from this GAC unit (or anywhere else in the system) and discuss if an air quality permit will be or may be necessary. Discuss if there will be a sampling port for vapor at the unit. | The work plan will be revised to add the following language to Section 7.1 (Permitting): "The oil water separator (OWS), the NAPL storage tank and the vapor GAC will have emissions of volatile organic compounds and hazardous air pollutant constituents of the NAPL, though the emissions are expected to be insignificant. Shaw will estimate the emissions and obtain air permits if the emissions are above insignificant level per NMED." Figure 7-1 will also be revised to show an air line from the Vapor GAC unit to the atmosphere. | Revise as indicate. The oil water separator (OWS), the NAPL storage tank and the vapor GAC will have emissions of volatile organic compounds and hazardous air pollutant constituents of the NAPL, though the emissions are expected to be insignificant. Shaw will estimate the emissions and obtain air permits if the emissions are above insignificant level per NMED." |
| 11 | Section 7.4 - Indicate in the revised Work Plan if the piping to and from the treatment building is to be located above ground or below ground. Indicate also if cathodic protection or freeze protection is necessary. | The work plan will be revised to clarify that the piping to and from the treatment building will be located below ground, as well as any protections or precautions that are built into the design to protect the piping.. | Revise as indicated. |
| 12 | Appendix B: Uniform Federal Policy - Quality Assurance Project Plan (UFP-QAPP) (labeled as Pending Review) - The plan appears to be a combination of many types of plans, such as project management, training, data validation, quality assurance, and sampling and analysis plans. Much of the information presented appears to be overly burdensome and not particularly useful in the present format. Revise Appendix E into multiple appendices to separate the various types of plans (e.g. project management, training, data validation, quality assurance, and sampling and analysis). As expressed in our meeting on January 6,201 1, NMED is expecting a Quality Assurance (QA) Plan that contains quality assurance and quality control activities specific to the project. The QA plan is to integrate all technical and quality aspects of the project to ensure that the necessary type and quality of data are obtained. Explain also what is meant by "Pending Review." If the document is considered a draft document because it is labeled "Pending Review," it must be finalized before re-submitting it to the | | The KAFB BFF Quality Assurance Project Plan will replace the UFP-QAPP document in Appendix B and will incorporate project-specific QA/QC activities as discussed with NMED on Jan 6, 2011. |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 2 REVIEW

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----|--|--|---|
| | NMED. | | |
| 13 | <p>Provide more detail and clarification of the criteria to be used to demonstrate adequate capture of the LNAPL plume by the extraction wells. Refer to the "Six Steps for Systematic Evaluation of Capture Zones" provided in Environmental Protection Agency (EPA), 2008a, available at http://www.epa.gov/nrmrl/ubs/600RO8003/600R0800T3h.eo each must include, but not be limited to:</p> <p>a) Documentation of pumping performance over time (e.g., were there any down times);</p> <p>b) Water-level measurements and interpreted flow paths that demonstrate drawdown at or near the extraction wells, and reverse gradients north of the extraction wells;</p> <p>c) Modeled water-level contours, particle tracks, and drawdown/buildup contours; and</p> <p>d) Analytical monitoring data from downgradient wells.</p> <p>Adequate capture of the plume must be demonstrated with empirical data derived from water level measurements showing the presence of a groundwater divide at or beyond the leading edge of the LNAPL plume. Additional groundwater monitoring wells may be necessary to make this demonstration.</p> | The work plan will be revised to clarify the process used to demonstrate capture of the LNAPL plume. | A meeting with the NMED to discuss this comment is requested. The proposed system is for LNAPL capture and therefore, the EPA guidance will be followed because it is measureable. The EPA guidance for LNAPL management will also be evaluated for applicability to the proposed system. |
| 14 | Section 5.2.4 lists the hydraulic gradient used as input for the capture zone model as 0.004 ft/ft. Because gradient has a significant influence on the predicted capture zone, explain why measured hydraulic gradient ranges from about 0.001 to 0.0015 ft/ft (based on water levels observed at existing wells) were not used. | | A meeting with the NMED to discuss this comment is requested. |
| 15 | In both the revised Work Plan and the characterization plan, evaluate and discuss the results of the existing step drawdown tests of nearby WUA or KAFB wells as they may relate to the capture zone model results and the proposed pumping tests. For example, the specific capacity of Ridgecrest #3 (on the order of 75 gpm/ft) and the specific capacities of wells KAFB- 3, KAFB- 15, KAFB-16 (60-80 gpm/ft) imply that a pumping rate of 50- 100 gpm at the extraction wells may not yield the 5 ft of predicted drawdown shown on Figure 5-2 of the Work Plan. The pumping test conducted at ST-105 also suggests that the expected drawdown may not be achieved. | | A meeting with the NMED to discuss this comment is requested. Note that the specific wells mentioned have screened intervals much deeper than is being evaluated at ST-106/SS-111 and so the applicability of these specific capacity values is uncertain. |
| 16 | Section 5.2.4 does not seem to use representative site-specific water-level elevations. The fifth bullet of in Section 5.2.4 indicates "groundwater elevation 4900 used as reference head from measured water table elevations." However, the document Kirtland Air Force Base, New Mexico, Quarterly Remediation and Site Investigation Report for the Bulk Fuels Facility Spill, July 2010 through September 2010 (dated November 2010) presents actual measured water-level elevations ranging from approximately 4,852 to 4,857 ft amsl, which are approximately 20 to 40 ft lower than those used in the model (see Figure 5-2, which shows groundwater elevations of 4,874 to 4,894). Explain the differences in water-level elevations or correct as appropriate, using site-specific data when available. | | A meeting with the NMED is requested to discuss this comment. |
| 17 | Section 5.2.4 - In the second full paragraph, first sentence, indicate whether the intent is to span the entire width of the dissolved plume for the target capture | The work plan will be revised to clarify that the intention of the system is containment of | Revise as indicated. |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 2 REVIEW

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----|--|---|---|
| | zone or just the width of the LNAPL plume. | the LNAPL. | |
| 18 | <p>Section 5.2.4 - This section contains the sentence: "The actual hydraulic capture zone will be determined using conventional capture-zone methods, including the Darcy Flow GIS [geographic information system] method (e.g., EPA, 2008a)." The "Darcy Flow GIS method" is not discussed in the reference given. Include in the revised Work Plan the Six Steps for Systematic Evaluation of Capture Zones, as discussed in Exhibit 1, Section A of the given reference and as included below.</p> <p>Step 1: Review site data, site conceptual model, and remedy objectives; Step 2: Define site-specific target capture zone(s); Step 3: Interpret water levels (from potentiometric surface maps and water level pairs); Step 4: Perform calculations (capture zone width calculations, and numerical modeling); Step 5: Evaluate concentration trends; and Step 6: Interpret actual capture based on Steps 1-5. See also Comment #13 of Part 2 of this letter.</p> | The work plan will be revised to clarify the process used to demonstrate capture of the LNAPL plume. | A meeting with the NMED to discuss this comment is requested. The proposed system is for LNAPL capture and therefore, the EPA guidance will be followed because it is measureable. The EPA guidance for LNAPL management will also be evaluated for applicability to the proposed system. |
| 19 | Section 5.4 - Provide a description of the pump system planned for the extraction wells to recover LNAPL. Although the proposed extraction wells are to be located in an area with thin LNAPL, it is reasonable to expect that LNAPL will eventually accumulate in the resulting cones of depression. LNAPL removal and inducing the formation of a cone of depression appear to be contradictory goals for a single pump in an extraction well. Indicate if a two pump system will be used, and if not, explain how the accumulated LNAPL will be removed and total fluids treated. | No revisions required. | The Characterization Report will account for the pump system design for the extraction well(s). If NAPL accumulates, a skimmer pump may be installed. Pump design will be finalized after the implementation of the Characterization Work Plan. |
| 20 | Section 5.4, Bullet 7 - Indicate specifically which wells are to be used to assess the performance of the remediation system. Also, define the term "liquid level measurement." | The work plan will be revised to clarify that all monitoring wells will be used to assess the performance of the remediation system. The text will be revised to define the term "liquid level measurement." | Revise as indicated. |
| 21 | <p>Section 6.1 - This section discusses permitting, which does not clearly indicate that a discharge permit for the injection well must be obtained from the NMED Ground Water Quality Bureau, which typically takes a minimum of four to six months to obtain (or more time if a public hearing is held). Furthermore, Section 6.1 does not mention if a treatment permit is or may be required under the New Mexico Hazardous Waste Management Regulations, 20.4.1 NMAC. Indicate in the revised Work Plan and the characterization plan that a discharge permit will be acquired from the NMED Ground Water Quality Bureau, and evaluate the need for a treatment permit under the New Mexico Hazardous Waste Act. Additionally, permits may be required from the Office of the State Engineer. Indicate in the characterization plan and the revised Work Plan if permits must be obtained from the Office of the State Engineer to conduct the pumping tests or to operate the pump-and-treat system, Also indicate if water rights will need to be procured to conduct any of the proposed extraction. The schedule in Appendix E implies a discharge permit would be obtained in about 3 months. The schedule should be revised to include a more realistic time frame for the acquisition of a</p> | The work plan will be revised to clarify that a discharge permit for the injection well must be obtained from the NMED Ground Water Quality Bureau. Text will be revised to clarify and specify any additional permitting requirements identified for the system. | Revise as indicated. Permitting will be done in accordance with NMED requirements. Permits have been submitted to the Office of the State Engineer and are pending approval; approval of the permits is dependent on work plan approvals. |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 2 REVIEW

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|-----------------|--|---|--|
| | discharge and any other required permits. | | |
| 22 | Section 6.2.1.5 - This section discusses a 60-foot length of screen for the extraction wells. Describe in the revised Work Plan the expected depths at which the pumps will be set in the extraction wells. | The work plan will be revised to include final design details discussed in the Characterization Plan, following implementation of the Characterization Work Plan. | Screen length for the production wells is part of final system design and will be included in the Characterization Plan. |
| 23 | Quarterly reports must be prepared and combined with other quarterly reporting as specified in NMED's letter of June 4,2010. The quarterly reports must document the construction, maintenance, and operation of the pump and treat system, and must summarize the analytical water-quality data for both treated and untreated groundwater. | | Data will be included in the current quarterly reports. |
| 24 | Final Report (Interim Measures Report) - Appendix E, Project Schedule, indicates that an Interim Measures Report will be submitted after construction of the pump and treatment system. Provide additional details of the planned content of this report. At a minimum this report must meet the requirements of Permit Parts 6.2.2.2.12.5 and 6.2.4.10. | The work plan will be revised to clarify the planned content of the Interim Measures Report. | Revise as indicated. |
| Final Direction | The Permittee's letter of December 3,2010 states that the certification that accompanies documents like the revised Work Plan and the characterization plan must be signed by the commander of KAFB (currently Col. Maness). NMED notes that the certification that was submitted with the Work Plan was signed by Mr. Wayne Bitner, who does not appear to be authorized to sign for the Permittee in these matters. Submit the certification with the appropriate signature for the characterization plan and the revised Work Plan. | | Document certifications will be signed by the commander of the KAFB. |
| Final Direction | The characterization plan and the revised Work Plan must address the comments noted herein and incorporate the requirements set forth in this letter as they apply to each plan. The characterization plan must be submitted to the NMED no later than June 15,2011. The characterization plan must also contain a schedule of the work to be completed under the plan, including the submittal of a report of the results to the NMED. The report must be submitted to the NMED by no later than February 1,2012. The revised Work Plan must include sufficient detail that the pump-and-treat system could be constructed and operated under provisions of the plan with a reasonable expectation that its operation will be successful in stopping the migration of the LNAPL plume. The revised Work Plan must be submitted to the NMED no later than April 1,2012. A certification must be included in the revised Work Plan, signed and stamped by a professional engineer registered in New Mexico, stating that the design and specifications of the pump and treat system have been reviewed by him/her, and a reasonable standard of care was used in designing the pump-and-treat system to meet the stated goal of stopping the migration of the LNAPL plume. The Permittee cannot construct or operate the pump-and-treat system until such time that it obtains NMED approval. | | No work plan revisions required. |
| Final Direction | This corrective action is being conducted under the aegis of the Permit. Specifically, all field activities must be completed in accordance with Permit Part 6.5.2. All equipment that is not disposable must be decontaminated pursuant to Permit Part 6.5.3. All equipment that requires calibration must be calibrated as required under Permit Part 6.5.4. Sample handling, shipping, and custody procedures must comply with Permit Part 6.5.5. The collection and management | | No work plan revisions required. |

377 AFNWC/JA RESEARCHING VALIDITY OF ALL JULY 2010 PERMIT REFERENCES AND REQUIREMENTS

PART 2 REVIEW

| No. | NMED COMMENT | PROPOSED WORK PLAN ACTION | PROPOSED RESPONSE TO COMMENT |
|----------------------------|--|----------------------------------|---|
| | <p>of investigation-derived waste must conform to Permit Part 6.5.7. Well locations must be surveyed in accordance with Permit Part 6.5.8. Field quality control samples must be collected and analyzed for all environmental media pursuant to Permit Parts 6.5.14 and 6.5.17.6. Laboratory analyses, including laboratory quality control samples, must be conducted as required under Permit Part 6.5.18. Field and laboratory quality control data must be reviewed and validated in accordance with Permit Part 6.5.18.3. Reporting of field activities, including sampling and analysis results, completion of geologic and geophysical logging, and well installations, must be as directed by NMED's letter of June 4,2010, for quarterly reporting.</p> | | |
| <p>Final Direction</p> | <p>As part of the response letters that accompany the characterization plan and the revised Work Plan, include a table that details where all revisions have been made to the plans and that cross-references NMED's numbered comments. Submittals (including maps and tables) must be in the form of two paper copies and one electronic copy in accordance with Permit Part 1.36.</p> | | <p>No work plan revisions required.</p> |