New Mexico Environment Department responses to public comments on the draft 2019 Kirtland Air Force Base Fuel Leak Cleanup Strategic Plan

April 25, 2019

The New Mexico Environment Department ("NMED") provides the following responses to public comments received on the draft 2019 Strategic Plan ("Plan") for the Kirtland Air Force Base ("KAFB") aviation fuel leak cleanup.

I. Nancy Bearce comments dated April 6, 2019 (Appendix A)

NMED response:

NMED anticipates a rapid review and implementation of the soil vapor monitoring work plan, as installation of the vapor probes is a prerequisite to the bioventing test. NMED will also expeditiously and carefully review the soil vapor data obtained by the new probes.

The light non-aqueous phase liquid (LNAPL) coring produced more than 3,000 linear feet of core samples and these cores are being subjected to rigorous physical, chemical and biological testing. After test results are available, additional time will be needed to interpret the data, but the timing will be sufficient so that the core data will be used to inform the Corrective Measures Evaluation.

Monthly testing of drinking water wells and quarterly testing of sentinel wells is appropriate for contamination conditions at this site. This testing is being conducted in accordance with standards for sample collection and analytical chemistry.

With regard to plume capture modeling, semiannual simulations are appropriate, and we expect that this modeling will continue for the duration of groundwater extraction and treatment until compliance with standards is attained.

NMED anticipates that both dry and wet bioventing pilot tests are needed. The 12 years of soil vapor extraction dried some areas of the soil to levels where naturally occurring bacteria do not have enough water to effectively biodegrade the fuel contamination. The results of these tests will inform the Corrective Measures Evaluation of what technologies are feasible to achieve soil

remediation. If there is ever a threat of the bioventing test causing contaminant vapors to intrude into homes or businesses, the test will be shut down.

Stakeholder engagement is critical to the success of this project and NMED will continue to engage the community, including schools, neighborhood associations and other community organizations to educate and involve them in this project. We welcome any suggestions from the public on how to improve our public outreach efforts.

II. Charles Gregory comments dated March 31, 2019 (Appendix B)

NMED response:

The New Mexico Environment Department, as the regulatory authority overseeing the cleanup, is fully committed to protecting Albuquerque's drinking water by requiring that the Air Force conduct a comprehensive investigation and clean up soil, soil vapor and groundwater to the most stringent of state and federal standards.

III. Kathryn D. Lynnes, Department of the Air Force, comments dated April 5, 2019 (Appendix C)

NMED response:

Most of the Air Force comments involve technical clarifications which have been incorporated into the final Strategic Plan.

In comment #3, the Air Force states, "[i]t is important to note that concentrations of all monitored volatile fuel related constituents in the 28 soil vapor monitoring points located off Kirtland AFB were below the established background concentration of 20 parts per million by volume (ppmv) at all depths." As shown in Table 1 below, a soil vapor concentration of 20 ppmv of either benzene or EDB would be extremely high, well beyond any concentration that could be considered as a background level, and would cause great concern for vapor intrusion hazards if these concentrations were in shallow soil near residences. For example, a concentration of 20 ppmv of EDB equals a concentration of 153,570 ug/m^3 of EDB at standard pressure and temperature, which is nearly 100,000 times greater than NMED's residential Vapor Intrusion Screening Level (VISL) of 1.56 ug/m^3 EDB.

Contaminant	ppmv	ug/m^3	NMED Residential Soil Vapor VISL ug/m^3
Benzene	20	63,854	120
EDB	20	153,570	1.56

NMED therefore rejects the Air Force assertion that concentrations of 20 ppmv of either benzene or EDB could be considered as background. NMED has required the Air Force to perform shallow soil vapor monitoring in the residential and VA Hospital campus areas for the following reasons:

1. Soil vapor concentrations of benzene and EDB in the soil vapor probes closest to the residential and hospital areas (KAFB-106136-25, -106138-25, -106141-25, and -106142-30) sometimes occurred at high levels in 2012-13.
2. The most recent detection of EDB that was greater than the NMED VISL of 1.56 ug/m^3 occurred in probe KAFB-106138-25 in October 2017.
3. The Air Force did not determine the origins (groundwater versus source area soil) and migration pathways of the vapors detected in probes KAFB-106136-25, -106138-25, -106141-25, and -106142-30.
4. Groundwater concentrations of benzene and EDB are still high enough to generate soil vapor concentrations that, if migration occurred into shallow soil in hospital and residential areas, could cause potential vapor intrusion concerns.
5. Source area vadose zone concentrations of benzene and EDB are still high enough to generate soil vapor concentrations that, if migration occurred into shallow soil in residential and hospital areas, could cause potential vapor intrusion concerns.
6. The Air Force did not define the northernmost extent of soil vapor contamination.
7. While the soil vapor extraction system (SVE) appears to have remediated previously high vapor concentrations in vapor probes KAFB-106136-25, -106138-25, -106141-25, and -106142-30, and contaminants have not rebounded to 2012-13 concentrations at these locations, shallow soil vapor monitoring is needed to provide confirmation that vapor intrusion hazards do not exist in these areas.

In summary, the origin(s) and migration pathways of vapor contamination in vapor probes KAFB-106136-25, -106138-25, -106141-25, and -106142-30 have not been determined, site soil and groundwater contaminants still have the potential to create vapor concentrations of potential concern, the northern extent of vapor contamination has not been determined and the northern extent of SVE remediation has not been determined. Therefore, the Air Force is being required to conduct shallow soil vapor contamination in the residential and VA Hospital areas.

IV. Dave, McCoy, Citizen Action New Mexico, and Eric Nuttall Ph.D. comments (Appendix D)

NMED response:

Stakeholder issues raised by Citizen Action New Mexico and Dr. Nuttall

1. The decision on whether or not to create a Restoration Advisory Board is up to the Air Force, based on their community polling results. The request to provide workshop and deep dive material in advance is a good idea.
2. Monthly testing of drinking water wells in the area has never detected any EDB. This information is contained in the Quarterly Reports published by the Air Force and has been routinely discussed at public meetings. The tap water at the Veteran's Administration Hospital is safe to drink.
3. An integrated and comprehensive plan to clean up all the pollution will be developed after completion of the investigations and Corrective Measures Evaluation, and then after a robust public participation process.
4. As discussed above in issue #2, monthly testing of all drinking water wells in the area has never detected any EDB.
5. As was discussed extensively during 2018, neither the Air Force nor NMED have ever proposed to use monitored natural attenuation only as the remediation pathway.
6. NMED hired an independent panel of experts in 2015 to review options for LNAPL remediation that NMED had identified. The independent panel of experts concluded that "the soil and groundwater remediation methods identified in the spreadsheet appear to represent a complete list of possible technologies that could in principle be applied to remove and/or degrade contaminants in the LNAPL zone at the KAFB BFF site." https://www.env.nm.gov/wp-content/uploads/2018/07/LNAPL-Interim-Measures-Review.pdf
7. NMED has previously provided the public with an organizational chart for the KAFB fuel cleanup project. This chart is being updated for 2019.
8. The amount of administrative records and data for this project is quite voluminous, and sometimes hard to find on the NMED and Air Force websites. NMED is currently working to improve its website accessibility and welcomes any recommendations on how to improve the organization and cross referencing of this information.

Technical issues raised by Citizen Action New Mexico and Dr. Nuttall

1. The Air Force has developed a detailed Conceptual Site Model (CSM) in the September 2018 Phase 1 RCRA Facility Investigation Report (RFI) that includes the vadose zone, source area groundwater and EDB plume. As with any complex site, the CSM is updated as necessary when new data and information become available and this is explicitly stated in Activity #2 in NMED's Strategic Plan.

2. As stated above, an integrated and comprehensive plan to clean up all the pollution will be developed after completion of the investigations and Corrective Measures Evaluation.
3. The 2019 Strategic Plan sets out Secretary Kenney's management plan that includes everything from the application of best available science to the initiation of enforcement activities, if necessary, to ensure the Air Force complies with the corrective action requirements of its Hazardous Waste Permit. NMED has developed and made publicly available organizational charts in the past and the chart is now being updated for 2019.
4. As has been discussed with the public extensively over the past several years, data are insufficient to allow precise calculations of the amount of LNAPL that was released and some of the earlier calculations of the volume of LNAPL in the plume were not conducted in accordance with modern practices and standards. The most current estimate of LNAPL is provided by the Air Force in the Phase 2 RFI. With regard to EDB plume mass, the extensive three-dimensional network of monitoring wells provides good data for estimates to be made. These estimates are published in the Air Force quarterly reports, and include estimates before and after the initiation of the groundwater pump-and-treat interim measure.
5. The RFI is currently incomplete, as work continues to fill data gaps. The final, Phase 2 RFI is expected to be completed in 2020 after the remaining data gaps are filled.
6. There are uncertainties with regard to some of the EDB plume issues identified in your comments, such as discussed above regarding plume mass, but such issues have been addressed. Modelling results have been made available to the public and a public deep dive on plume capture modeling was held last year. As has been stated publicly in the past, the number of years that will be required for cleanup to be completed is currently unknown, especially since the Corrective Measures Evaluation has not been completed and the final remedy has not been selected.

<u>Independent review issues raised by Dave McCoy</u>

- Joint Memorial HJM-13, passed by the 2014 NM Legislature – This memorial asked that the NM Congressional Delegation fund and assemble an independent task of experts to address the KAFB cleanup and report its findings by November 2014. Although discussions were held regarding the possibility that the Air Force could fund the National Academy of Sciences to perform such a review, no federal review was conducted. Recognizing the intent of the NM legislature that an independent review be performed, NMED hired an independent panel of experts in 2015 to review options for LNAPL remediation that NMED had assembled into a detailed spreadsheet. The independent panel of experts concluded that "the soil and groundwater remediation

methods identified in the spreadsheet appear to represent a complete list of possible technologies that could in principle be applied to remove and/or degrade contaminants in the LNAPL zone at the KAFB BFF site." https://www.env.nm.gov/wp-content/uploads/2018/07/LNAPL-Interim-Measures-Review.pdf

- ABCWUA Water Protection Advisory Board Resolution Number WPR-2018-02, requests that NMED hire a contractor to conduct a comprehensive independent evaluation of the project. As discussed above, NMED hired an independent panel of experts in 2015, and may consider doing this again if funding exists.
- As discussed above, the Air Force has developed a detailed conceptual site model that will be updated as necessary in accordance with NMED's Strategic Plan.
- The NMED website for the KAFB cleanup project contains voluminous administrative and technical records. This transparency allows the public to evaluate the scientific project data and review technical workplans and project reports and NMED approval/disapproval letters.
- NMED has provided the public with a project organization chart in the past that is now being updated. NMED agrees that a chart for interagency cooperation between the Kirtland Air Force Base, the Air Force Civil Engineering Center and the Army Corps of Engineers would be helpful.
- As has been discussed repeatedly over the past several years, an integrated and comprehensive plan to clean up all the pollution will be developed after completion of the investigations and Corrective Measures Evaluation, and then after a robust public participation process. A number of interim corrective measures, however, have been approved that are well documented in technical workplans and NMED approval letters. Remediation of the residual LNAPL that now largely exists within the groundwater zone will be one of the most technically challenging aspects of this cleanup project.

V. Don Schrader comments dated March 14, 2018 (Appendix E)

NMED response:

NMED concurs that human exposure to potential carcinogens like EDB should be minimized to the extent practical. State and federal drinking water standards for EDB, however, are both set at 0.05 ug/L and this is the concentration level to which the Air Force is required to clean up groundwater.

VI. Gwen Sun MD, MPH comments dated April 7, 2018 (Appendix F)

NMED response:

NMED is familiar with how myco-remediation technology has been used for remediation of surface spills and soil. The challenge with the Kirtland Air Force Base (KAFB) site is that the aviation fuel has migrated deep into the soil and into groundwater at a depth of approximately 480 feet below the ground surface. An independent panel of experts hired by NMED did not identify myco-remediation as a possible technology that could in principle be applied to remove and/or degrade contaminants at the KAFB site. Interim corrective measures and in-situ pilot tests so far have shown promising results from stimulating native groundwater and soil bacteria with oxygen, lactate and nutrients. During the upcoming Corrective Measures Evaluation, the Air Force may further evaluate the potential applicability of other technologies for the difficult conditions at this site.

Appendix A
Nancy Bearce Comments
Dated April 6, 2019

Nancy Bearce
600 San Pablo St NE
Albuquerque NM 87108
nancymbearce@gmail.com

April 6, 2018

Secretary James Kenney
NM Department of the Environment
Harold Runnels Building, Suite N4050
1190 St. Francis Drive
Santa Fe, NM 87505

RE: KAFB Bulk Fuels Remediation Project – 2019 Strategic Plan

Dear Secretary Kenney:

First, my congratulations on your new position as Secretary of New Mexico's Department of Environment. I look forward to meeting and working with you and your team for the above project.

I am writing to provide my comments and feedback regarding the KAFB Bulk Fuels Remediation Project – 2019 Strategic Plan. I am a resident in the area of the project and have attended public meetings since 2000 to the present. I have been in community leadership roles since that time and continue my advocacy in the project.

As stated in 2015's Strategic Plan, the strategic plan is a communication tool to the public and is a guide to the *"…strategies currently in place, being actively implemented, or being considered as potential options by the technical working groups. Strategies presented in this document (some of which are in process) represent the continuation of an accelerated remediation process initiated by NMED and the Air Force in the summer of 2014."* I do understand the remediation is overseen and enforced by NMED. The US Air Force has been the entity implementing and completing at the public's urging, interim corrective projects, as stated in the strategic plan's Background and Status section.

In reading over the 2019 activities, 4 activities are outlines as follows with my comments noted:

1. Implement a robust site monitoring and wellhead program
   a) Groundwater
   b) Soil-vapor
   c) LNAPL
   d) USAF continued wells testing

Comments: The rise in the water table, attributed to the effects of city and county conservation programs, were seen as a set back a year and a half ago since new wells for the EDP and LNAPL monitoring had to be drilled. However, the new wells went in quickly and I'm relieved to read that there has been 'recycling' of the former dry wells to wet monitoring wells. Not all was lost or wasted which appears to coincide with NMED's guiding principles of innovation.

Soil-vapor was another program that NMED had to oversee filing in of data gaps and is requiring more with a USAF work plan due by May 30th. How long will NMED anticipate the verification, review and reporting out to the public of this 'vapor monitoring work plan' will take?

In the 2018 plan, the public heard about the LNAPL coring and this year the project is on track to have findings by November 1, 2019 to NMED. These findings will inform a course of action I assume, or will the findings have included some trial actions and their outcomes? Again, how long will NMED anticipate the verification, review and reporting out to the public of this project will take? Clearly, this project will continue into the next year, 2020.

The drinking water well testing monthly by USAF is imperative in the public's eye. It is good to see the plan to continue the testing. Does NMED and the ABCWUA agree with the testing frequency and the to date no EDB detection data?

2. Update the Conceptual Site Model
    a. USAF updates the model as necessary
    b. Model is a critical tool

Comments: I believe the model has been touted in public meetings as being a key tool in the remediation project. What is NMED's opinion on the frequency of updating the model? Will the model be used in KAFB's upcoming RCRA review next year?

3. Deploy multiple engineered technologies
    a. EDB biodegradation test
    b. Bioventing test
    c. Pump and Treat system

Comments: The biodegradation pilot is continuing and will have submit a progress report by May 1 with completion this year. The public will look forward to receiving the progress report by the second quarterly public meeting, if feasible or an explanation as to when it will be communicated out. The pilot looked promising last year.

At first thought, the moist bioventing is mistake. After all, KAFB spent 12 years doing just the opposite. However, if we partner this idea with the biodegradation pilot, using nature's own soil biology to further degrade fuel spill constituents could be the innovative science we need. I would request further explanation of the mentioned 'vapor intrusion hazards'. If such hazards became real, would NMED stop the bioventing?

The pump and treat system is marvelous. I do wish we could have this become drinking water for ABCWUA or KAFB residents. Watering the KAFB golf course or re-injection into the aquifer seems to be a waste of the expensively cleaned water in our high desert climate.

4. Continue to involve, provide information to and collaborate with the public
    a. Public meetings
    b. A public involvement plan
    c. Engage students in science

Comments: Very excited and pleased that NMED continues public engagement as the State's Regulator over KAFB's fuel skill clean up project. I am not sure why the Public Involvement Plan is separate from this strategic plan. Additionally, the one sentence on engaging students seems to be passive engagement and no targeted active goals. I would have also expected to see NMED engaging ABCWUA, Albuquerque Bernalillo County Government Commission (ABCGC), Albuquerque City Council, neighborhood coalitions, etc.

Thank you for the public comment time to read and comment on this year's strategic plan.

Sincerely,

Nancy Bearce/e-signature

Nancy Bearce

Cc: Dennis McQuillan, NMED
Kathryn Lynnes, KAFB
Gov. Lujan Grisham/Marianna Padilla
Sen. Heinrich/Alex Eubank
Sen. Udall/Bill Woldman
Rep. Haaland/Brenda McKenna
Sen. Mimi Stewart
Sen. Antoinette Sedillo Lopez
Rep. Sheryl Williams-Stapleton
Rep. Debbie Sarinana
Commissioner Maggie Stebbins
Councilor Pat Davis
District 6 Coalition of NA, Gina Dennis
West Side Coalition, Jerry Worrall

Appendix B
Charles Gregory comments
Dated March 31, 2019

Dear NMED:

Thank you for taking public comments on the department's 2019 Strategic Plan for the Kirtland Air Force Base Fuel Leak.

I've read the plan and, frankly, don't have the expertise to comment intelligently on it.

However, I've been following the leak since 2012. My greatest concern is the attitude and attendant behaviors of the Air Force from the time the leak was first brought to its attention. It may be that they are doing all they can now to clean up the spill, but their past history leaves me deeply skeptical of their honesty. That extends to the degree of the cleanup they say they have accomplished.

My comment is a request to please monitor the Air Force as thoroughly and as doggedly as possible. I have great faith in the current governor's commitment to protecting our drinking water, and in her appointments to the NMED to make sure the job is done well. Now that the EPA is in dubious hands, there is no one else capable of holding the Air Force as accountable as it needs to be held. Please do that.

Thank you.

Sincerely,

Charles Gregory

Appendix C
Department of the Air Force Comments
Dated April 5, 2019

DEPARTMENT OF THE AIR FORCE
377TH AIR BASE WING (AFGSC)

Submitted via Email

April 5, 2019

Ms. Kathryn D. Lynnes, Senior Advisor
SAF/IEE
2000 Wyoming Blvd. SE
Kirtland AFB NM 87117

Ms. Maddy Hayden, Public Information Officer
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe NM 87505-6303

RE: U. S. Air Force Comments on the New Mexico Environment Department's draft 2019 Strategic Plan for the Kirtland Air Force Base Fuel Leak

Dear Ms. Hayden

Thank you for the opportunity to submit comments on the New Mexico Environment Department (NMED) Draft 2019 Strategic Plan for the Bulk Fuels Facility (BFF) remediation project at Kirtland Air Force Base (AFB). The Air Force agrees with the NMED that the Strategic Plan, while not an enforceable element required by the Resource Conservation and Recovery Act (RCRA) corrective action process or Kirtland AFB's RCRA permit, is a useful reference and planning document to provide information to project stakeholders.

The NMED's comments to the Draft 2019 Strategic Plan have been reviewed by the U.S. Air Force (USAF) and submits the following comments and recommendations:

1. 'Background' Section:
   - "*…had seeped into groundwater and a plume of EDB had spread off-base to the north, threatening public drinking water supplies.*"
     - Replace text as follows: "…a plume of EDB had spread off-base to the north potentially threatening public drinking water supplies."
     - Rationale: As the data collected from the beginning of this investigation continues to confirm, none of the three nearby community water supply systems (i.e.: the Albuquerque Bernalillo County Water Utility Authority, the Veterans Administration Medical Center, and Kirtland AFB) have been impacted.
   - "*To stop the plume from spreading further north of the base and toward drinking water supply wells…*"
     - Replace text as follows: "…further north of the base and potentially toward drinking water supply wells."
     - Rationale: As the data collected from the beginning of this investigation continues to confirm, none of the three nearby community water supply systems (i.e.: the Albuquerque Bernalillo County Water Utility Authority, the Veterans Administration Medical Center, and Kirtland AFB) have been impacted.

- "*…the USAF installed a "pump-and-treat" system in 2015 to pull the northern extent of the plume back toward the source area.*"
    - Replace text as follows: "…the USAF installed ~~a~~ an interim measure "pump-and-treat" system…"
    - Rationale: The pump and treat system was installed pursuant to the interim measure corrective action provisions in Part 6.2.2.2.12 of the Kirtland AFB RCRA Permit. An interim measure is an important tool for protecting human health and the environment because the iterative, data-driven RCRA Facility Investigation (RFI), Corrective Measures Evaluation (CME) and Corrective Measure Implementation (CMI) processes are often lengthy.
- "*The Air Force has implemented and completed a number of interim corrective measures throughout the years…*"
    - Replace text as follows: "The USAF has ~~implemented and~~ completed a number of additional interim ~~corrective~~ measures throughout the years…"
    - Rationale: These interim measures were in addition to the pump and treat interim measure.

2. 'Status' Section:
    - "*However, the rising water table has flooded 61 of the monitoring wells, causing a need for more monitoring wells to be installed. Work to drill and complete additional monitoring wells began in 2018 and was completed earlier this year.*"
        - Replace text as follows: "Work to drill and complete additional monitoring wells ~~began in 2018 and~~ was completed ~~earlier this year~~ in 2018. The coring project added an additional nine shallow wells, which were completed in March 2019".
        - Rationale: The data gap wells to address this concern were installed in the third and fourth quarters of 2018. Eleven of the newly added wells, including the six new well nests, had baseline sampling completed in the Quarterly Report for October - December 2018, Bulk Fuels Facility Spill, Solid Waste Management Unit ST-106/SS-111 dated March 2019. There are now 43 functional water table wells in the BFF monitoring network. The nested wells consist of one monitoring well screened across (partially above and below) the groundwater table and a second well (contingency well) constructed with the well screen above the current water table elevation. The contingency well will be available to monitor the upper zone of the plume in the future as the water table continues to rise.
    - "*The enhanced in-situ anaerobic groundwater biodegradation pilot test that began in 2017 continues.*"
        - Replace text as follows: "…groundwater EDB biodegradation pilot test…"
        - Rationale: This pilot test is designed only to treat Ethylene Dibromide (EDB), and not the other constituents in the groundwater.
    - "*Amendments introduced have successfully stimulated groundwater bacteria.*"
        - Replace text as follows: "Amendments introduced have successfully stimulated groundwater bacteria and significantly reduced EDB concentrations."
        - Rationale: The data from this pilot test have shown marked reductions in EDB concentrations in groundwater.
    - "*Both the pilot test and "pump-and-treat" system are interim corrective measures intended to decontaminate groundwater.*"
        - Delete this sentence in its entirety or clearly define the purpose of pilot tests.
        - Rationale: Interim measures and pilot tests are not the same thing. Part 6.2.2.2.12 of the Kirtland AFB RCRA Permit provides for the implementation of interim measures if the NMED or the Permittee determines that "such measures are necessary to reduce

or prevent migration of hazardous wastes or hazardous constituents that have, or may result in, an unacceptable human or environmental receptor exposure to hazardous waste or hazardous constituents while long- term corrective action remedies are being evaluated and implemented." The EDB plume pump and treat system, soil removal, bioslurping and soil vapor extraction system are interim measures. The enhanced in-situ anaerobic groundwater EDB biodegradation project is pilot test not an interim measure. "Pilot Test" means a study that is focused, limited-scale test of a technology to determine its potential effectiveness under field conditions. The Air Force implemented the enhanced in-situ anaerobic groundwater EDB biodegradation pilot and will implement the upcoming bioventing pilot to inform the evaluation of feasible technologies in the CME.

3. '2019 Activities' Section:
   - "*While the Risk Assessment Report stated that contaminant exposure via vapor intrusion into indoor air in buildings located off-base was an incomplete pathway…*"
     - Comment: The Air Force will meet the May 30, 2019 deadline set in the February 25, 2019 letter from the NMED to the Kirtland AFB Installation Commander, Colonel Richard W. Gibbs for the submittal of a shallow vapor monitoring work plan. It is important to note that concentrations of all monitored volatile fuel-related constituents in the 28 soil vapor monitoring points located off Kirtland AFB were below the established background concentration of 20 parts per million by volume (ppmv) at all depths. In addition, the Risk Assessment, which was submitted to the NMED on July 21, 2017, compared maximum detected concentrations of volatile fuel-related constituents in off-Base soil gas compared to residential soil gas vapor intrusion screening levels (VISLs). The maximum detected concentrations of volatile fuel-related constituents in off-Base soil gas did not exceed residential soil gas VISLs. Although these data show that it is unlikely that there is any vapor intrusion risk in off-base buildings the Air Force agrees with the NMED that it is important to confirm this though sampling prior to the CME.
   - "…*USAF will complete LNAPL coring in March.*"
     - Replace text as follows: "…USAF completed the LNAPL coring in March"
     - Rationale: The liquid non-aqueous phase liquid (LNAPL) field activities were completed in early March.
   - "*Neither have had any EDB detections to date.*"
     - Replace text as follows: "Neither have had any EDB or other fuel-leak related contaminant detections to date."
     - Rationale: No fuel-leak related constituents have been detected in drinking water wells.
   - "*The Air Force will begin a bioventing pilot test intended to deliver moisture to soil bacteria desiccated by 12 years of soil vapor extraction.*"
     - Replace text as follows: The USAF will begin a bioventing pilot test intended to deliver oxygen and moisture to soil bacteria desiccated by 12 years of soil vapor extraction."
     - Rationale: The bioventing pilot will deliver ambient air (i.e.: oxygen) and moisture to the vadose zone.
   - "*These bacteria may help in degrading fuel constituents in the soil.*"
     - Replace text as follows: "The objective is to see if adding the oxygen and moisture will revitalize the bacteria so that they will continue to ~~These bacteria may~~ help in degrading fuel constituents in the soil".

- Rationale: The soil vapor extraction system demonstrated that aerobic bacteria are helping to degrade fuel constituents in the soil.

- "*The 'pump-and-treat' system will continue to operate.*"
  - Add a new sentence after the above sentence as follows: "Additionally, in 2019 the USAF will be adding a second injection well and has received a draft National Pollutant Discharge Elimination System (NPDES) permit from the U.S. Environmental Protection Agency to construct and operate a surface water discharge point to ensure that there are redundant means to manage the treated water, thereby ensuring that the treatment system continues to operate at full capacity."
  - Rationale: The additional well and surface water discharge is a significant investment, which was made in response to a request from the NMED and in collaboration with stakeholders.
- Photo of the groundwater treatment plant
  - Comment: The photo is out of date and not an accurate representation of the current system setup. The Air Force added catalyzed sand filters in early 2018. A more recent photo is attached for your use.

4. 'Looking Forward' Section:
   - "*All interim corrective measures are intended to inform the selection of a final remedy*".
     - Replace text as follows: "All interim ~~corrective~~ measures and pilot tests are intended to inform…"
     - Rationale: See the comment #4 (Status Section) about the difference between interim measures and pilot tests.
   - "*The Corrective Measures Evaluation required by RCRA is expected to begin in 2020 after completion of the Phase 2 RCRA Facility Investigation Report and Final Risk Assessment.*"
     - Comment: The February 25, 2019 letter from the NMED to the Kirtland AFB Installation Commander Colonel Richard W. Gibbs set a date of November 1, 2019 for the submittal of a report summarizing the findings of LNAPL coring activities. The Air Force will begin work on the Phase II RFI Report as soon as we receive approval of the Phase I RFI Report, which was submitted to the NMED on August 30, 2018, and will attempt to expedite the submittal of the LNAPL coring report. However, the NMED's concurrence on the sufficiency of the coring data is a condition precedent to the completion of the Phase II RFI Report. As a result, the RFI Phase II Report will likely not be submitted until mid-2020. State rules allow the NMED 360 days for review of an RFI report with a risk assessment. The drafting of CME report cannot begin until the NMED approves the Phase II RFI Report and authorizes the Air Force to begin drafting the CME. Therefore, the 2020 timeframe for beginning the CME does not appear to be feasible.

5. 'Glossary of Terms' Section:
   - Delete "KAFB" and replace the acronym with "Kirtland AFB." KAFB is not used in the document.
   - Add BFF to the list
   - Add NPDES

6. 'Key Dates' Section:
   - The July 25, 2019 public meeting will be held at Kirtland AFB and not the African American Performing Arts Center.

Kirtland AFB appreciates the NMED's consideration of the above comments and looks forward to working together in finalizing the 2019 Strategic Plan for the Bulk Fuels Facility remediation project. If you would like any additional information to support Kirtland AFB's comments and recommendations, please contact myself at (505) 846-8703 or at kathryn.lynnes@us.af.mil or Mr. Scott Clark (505) 846-9017 or at scott.clark@us.af.mil.

Sincerely,

Kathryn D Lynnes

Ms. Kathryn D. Lynnes, HQE
Senior Advisor, SAF/IEE

Attachment:
Updated photo of the groundwater treatment plant

Appendix D
Dave McCoy, Citizen Action New Mexico, and Dr. Eric Nuttall Comments
Dated April 6, 2019

Summary of Stakeholder Concerns and Recommendations
Kirtland AFB BFF Jet Fuel Spill

Citizen Action New Mexico and Dr. Eric Nuttall, Ph.D., Emeritus
Comment for 2019 Strategy Plan

Stakeholder issues

1. Need for collaboration with stakeholders. More than just information sharing. Stakeholders need to feel they can participate in the decisions. Not just lectures with questions!
    a. RAB? Need for a more formal and regular two-way communication channel with stakeholders.
    b. Workshops? Need information/material prior to workshops so one can ask questions.
2. Stakeholders etc. don't believe the water is safe to drink (Veterans Administration)!
3. Not convinced that there is an integrated and comprehensive plan to clean up all the pollution.
4. Not assured that the drinking water wells will be safe and free from contamination.
5. **Not sure that the AF is fully committed to this very long term and expensive cleanup! Need to have a commitment statement on the AFB website. MNA ONLY is not an acceptable remediation pathway nor is it supported by stakeholders.**
6. ***Strong need for an independent review and continuous oversight! Supporting statements below.***
7. Need to provide a management plan and structure.
8. Technical data and modeling information not fully available to the public. Need to improve websites. Very difficult to navigate and they need to be kept up to date.

Technical Issues

1. No comprehensive CSM (needs to include vadose, source area in groundwater and EDB plume.
2. No integrated comprehensive cleanup plan.
3. No clear management plan nor organizational chart.
4. Only rough estimate of LNAPL and EDB plume mass.
5. Uncompleted RFI
6. EDB Plume issues
    a. Mass?
    b. Velocity?
    c. Issues of back diffusion and EDB levels within the rock matrix
    d. Pump and treat duration and efficacy
    e. Release to the public modeling results
    f. Estimate cleanup time?
    g. Discuss plume movement and the vertical hydrological flow in light of plume sinking to 100 ft below groundwater level. Also concern about effect to rising water table.

5. An independent evaluation of the site should be completed prior to initiation of the CME. A complex site such as the BFF with the volume of data collected to date would be well served by a comprehensive technical review. The evaluation could be completed by a contractor to the NMED or could potentially follow a model similar to the Independent External Peer Review. The NMED's hiring of a contractor to review the plume capture model and the Water Authority's work on the RCRA Facility Investigation (RFI) report and modeling are examples of how an external evaluation can benefit the project. The goal would be to assess existing data and determine data quality, usability, and completeness along with a review of the site conceptual model. Engagement of this independent peer review prior to the start of the CME would provide the NMED, the USAF, stakeholders, and the public a chance to proactively address any potential data concerns or issues resulting in a more complete and confident starting point for evaluating remedies.

INDEPENDENT REVIEW NECESSARY FOR KIRTLAND AFB JET FUEL AND AVIATION GAS CONTAMINATION OF ALBUQUERQUE DRINKING WATER AQUIFER.

Dave McCoy, dave@radfreenm.org

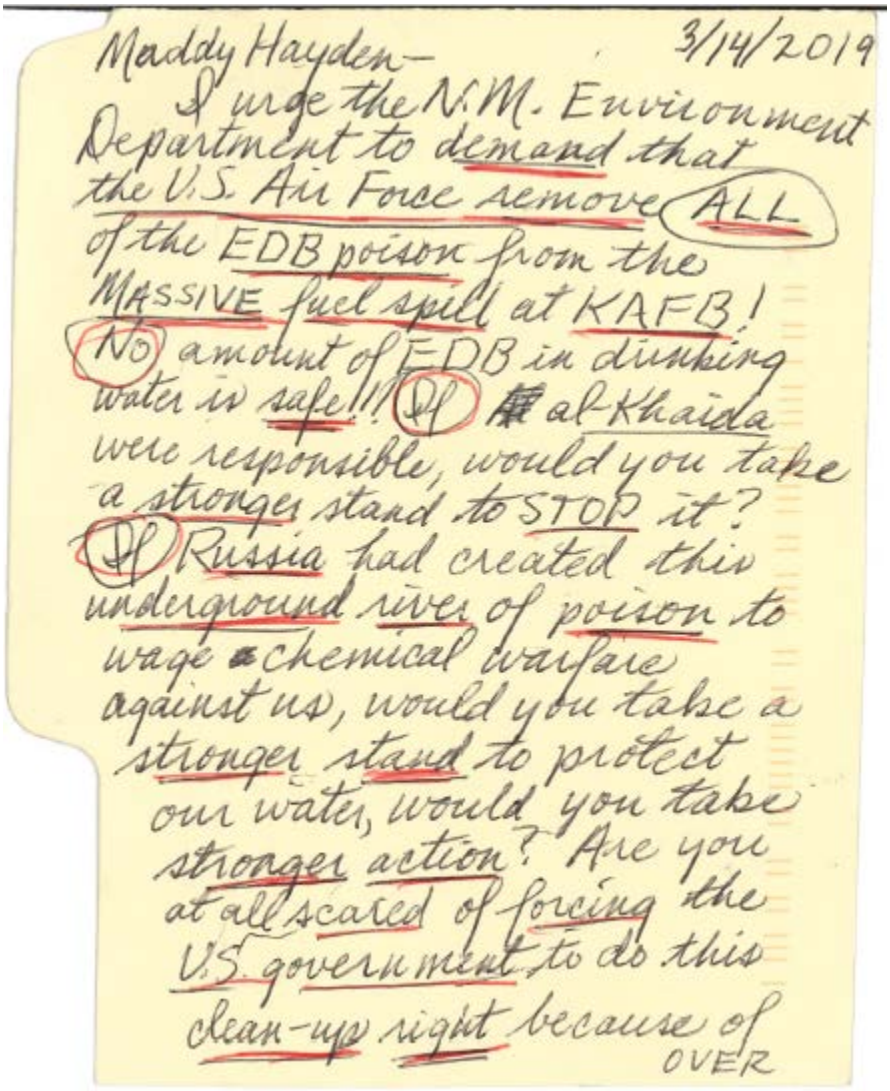
The Albuquerque aquifer that supplies a large percentage of drinking water is contaminated with LNAPL and Ethylene Dibromide from decades of pipeline leakage from the KAFB Bulk Fuels Facility. A plume of from 6 to 24 million gallons that extends more than a mile long and a half mile wide threatens Albuquerque municipal wells, the Veterans Administration and KAFB supply wells. Eighty percent of the toxic plume is off-base within the City of Albuquerque.

- Efforts to fully characterize and create a comprehensive site model of this complex site for purpose of short- and long-term remediation have not been completed and lack coordination.
- Technical information is withheld from the public although taxpayers have paid more than $130,000,000.
- No organization chart for inter-agency co-operation exists. Turnover of regulatory agency, Air Force, contractors, and technical personnel has been high.
- There is no approved containment plan, no remediation plan, or ongoing effort to remove the liquid portion of the jet fuel (LNAPL) that is allowing the dissolved plume of EDB to increasingly enter Albuquerque's aquifer.
- There is a great need at present for an independent review of the planning and operations to implement technology for remediation for the short- and long-term cleanup of the contamination of soils and the aquifer.

A JOINT MEMORIAL-HJM 13

REQUESTING THE NEW MEXICO CONGRESSIONAL DELEGATION TO FUND AND ASSEMBLE AN INDEPENDENT TASK FORCE OF EXPERTS TO ADDRESS THE KIRTLAND AIR FORCE BASE BULK FUELS SPILL CLEANUP AND TO REPORT ITS FINDINGS BY NOVEMBER 2014.

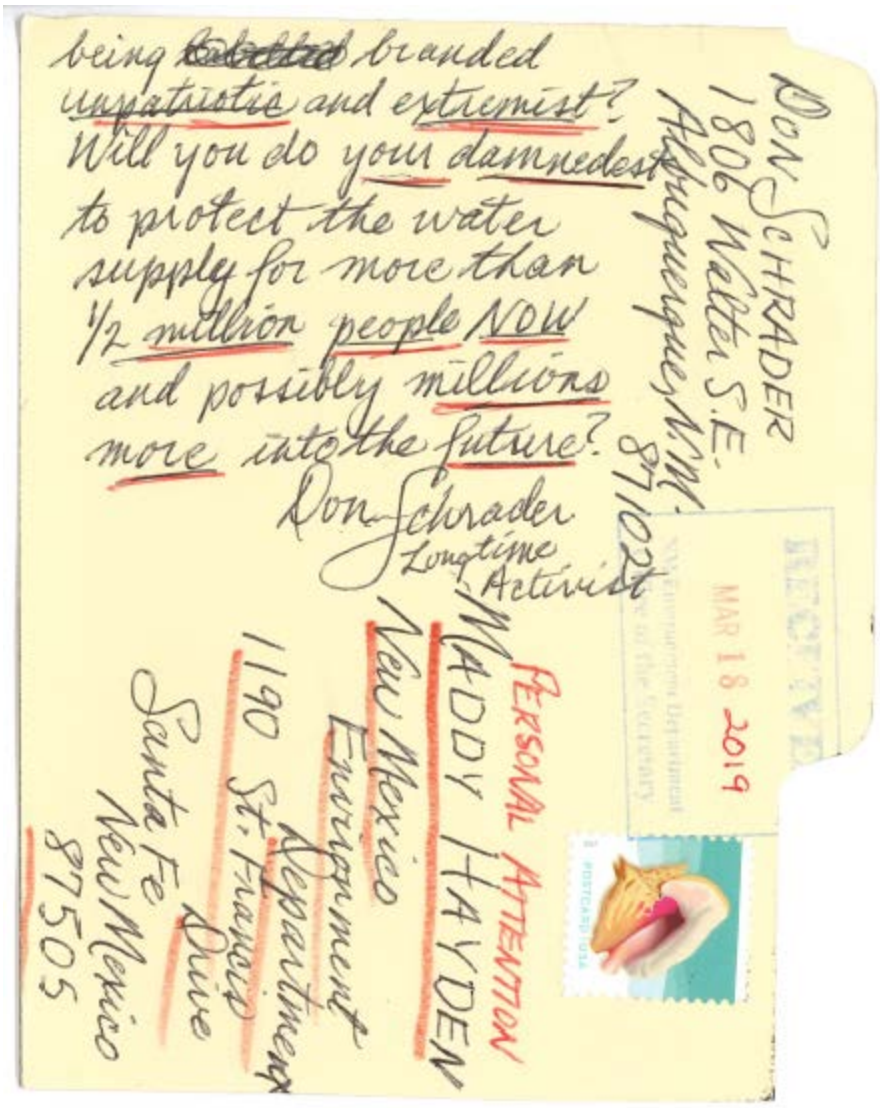
Appendix E
Don Schrader Comments
Dated March 14, 2019



Maddy Hayden— 3/14/2019

I urge the N.M. Environment Department to demand that the U.S. Air Force remove ALL of the EDB poison from the MASSIVE fuel spill at KAFB! NO amount of EDB in drinking water is safe!!! If al-Khaida were responsible, would you take a stronger stand to STOP it? If Russia had created this underground river of poison to wage chemical warfare against us, would you take a stronger stand to protect our water, would you take stronger action? Are you at all scared of forcing the U.S. government to do this clean-up right because of

OVER



being ~~labeled~~ branded
unpatriotic and extremist?
Will you do your damnedest
to protect the water
supply for more than
½ million people NOW
and possibly millions
more into the future?
Don Schrader
Longtime Activist

PERSONAL ATTENTION
MADDY HAYDEN
New Mexico
Environment Department
1190 St. Francis Drive
Santa Fe
New Mexico
87505

Don Schrader
1806 Walter S.E.
Albuquerque, N.M.
87102

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MAR 18 2019

Appendix F
Gwen Sun, MD, MHP Comments
Dated April 7, 2019

Maddy Hayden, NMED public information officer: maddy.hayden@state.nm.us

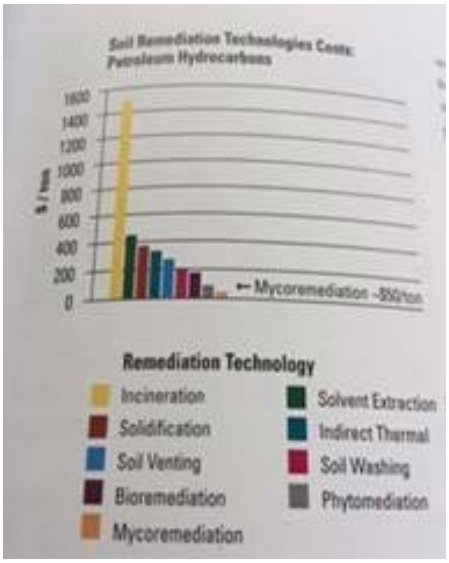
Regarding KAFB ground water jet fuel contamination 4/7/2019

In the iconic book, Mycelium Running, how mushrooms can help save the world, Paul Stamets laid out using a variety of mushrooms to clean up environmental pollution from a variety of pollutants, including many heavy metals and petroleum products.

In chapter 7, myco remediation is the use of fungi to degrade or remove toxins from the environment. Fungi are adept as molecular disassemblers, breaking down many recalcitrant, long chain toxins into simpler, less toxic chemicals. There are many different strategies to manage cleaning up contaminated soil. Stamets touched on using straw mats infiltrate with the mycelium spores, can be layered among other natural materials to leave them out and do their magic. In time, depending on the degree of contamination, petroleum products, as well as toxic metals, would be sequestered into the fungi body itself, for removal at the proper time. The practice involves mixing mycelium into the soil by placing mycelium mats over toxic sites or mixing mycelium with water that can be sprayed over contaminated sites.

For water contamination, this method was tested and proved to be most effective in the Exxon Valdez Oil spill. Another opportunity came up when the State of Washington Department of Transportation maintenance yard was looking for suggestions to clean up a diesel fuel spill. He was granted a special permit to experiment and the results were most impressive. Along with his team of researchers, they reported that total petroleum hydrocarbons had plummeted from 20,000 ppm to less than 200 ppm in eight weeks, making the soil acceptable for freeway landscaping. There the mycelium had degraded the larger, more toxic petroleum hydrocarbons into smaller less toxic molecules.

The researchers concluded to have succeeded in remediation with natural means, using oyster mushrooms and other primary decomposer mushrooms to clean up hydrocarbon



contamination, while dramatically decreasing the cost of the environmental clean up. See the attached cost analysis chart.

When it comes to man-made contaminations, Paul Stamets said it best, “our job is to set a natural stage, and nature will finish the act”.

Thank you for your consideration and am happy to assist with any questions or concerns that you might have.

Respectfully,

Gwen Sun, MD, MPH

Mushrooms with Activity against Chemical Toxins

More species and toxins will be added over time. Several of the species probably act upon more toxins than the ones listed above. I will update this chart on www.fungi.com as more research is published.

	Anthracenes	Benzopyrenes	Chromated Copper Arsenate	Chlorine	Dimethyl methyl phosphonate (VX, Soman, Sarin)	Dioxin	Persistent Organophosphates	Polycyclic Aromatic Hydrocarbons (PAHs)	Polychlorinated Biphenyls (PCBs)	Pentachlorophenols (PENTAs)	Trinitrotoluene (TNT)	Brown (B) or White (W) Rot?
Antrodia radiculosa			X							X		B
Armillaria ostoyae					X							W
Bjerkandera adusta		X						X				W
Gloeophyllum trabeum			X			X						B
Grifola frondosa									X			W
Irpex lacteus								X				W
Leotinula edodes								X	X	X		W
Meruliporia incrassata			X							X		B
Mycena alcalina				X								?
Naematoloma frowardii (=*Hypholoma*)								X			X	W
Phanerochaete chrysosporium		X								X	X	W
Pleurotus eryngii						X						W
Pleurotus ostreatus		X			X	X		X	X		X	W
Plewrotos palmonarius						X					X	W
Psilocybe spp.					X		X					W
Serpula lacrymans			X					X				B
Trametes hirsuta										X		W
Trametes versicolor	X		X		X	X	X			X	X	W

Mushrooms versus Heavy Metals

This chart gives a general, preliminary guide to the bioaccumulation coefficients—concentration factors—of a mushroom species' ability to upchannel heavy metals from its myceliated habitat. This chart is a work in progress. Please consult the scientific literature cited in the text for more information.

	Arsenic	Cadmium	Radioactive Cesium	Lead	Mercury	Copper
Agaricus arvensis		X			150X	
Agaricus bisporus		X			X	
Agaricus bitorquis		X		23X	165X	
Agaricus braziliensis		X			X	
Agaricus brunnescens	X	X			X	
Agaricus campestris		X		10X	10X	
Amanita muscaria		X			X	
Amanita rubescens		X				
Boletus badius			X			
Boletus edulis		10X	X	X	250X	X
Cantharellus cibarius			2X			
Cantharellus tubaeformis (Craterellus tubaeformis)			X			
Chlorophyllum rachodes	X			X	X	X
Clitocybe inversa	X	X				
Coprinus comatus	21X	8X			27X	
Coprinus spp.		X				
Flammulina velutipes	X					
Gomphidius glutinosus			10000X			
Laccaria amethystina	X		X			
Lactarius helvus			X			
Lactarius turpis			X			
Leccinum scabrum			X		X	
Lepista nebularis	X					
Lepista nuda					100+X	X
Lycoperdon perlatum			X	2X	100X	X
Marasmius oreades					X	
Macrolepiota procera					230X	
Morchella spp.				70–100X		
Morchella atretomentosa				X	X	
Paxillus atrotomentosus			1180X			
Pleurotus ostreatus		X			65–140X	
Pleurotus pulmonarius		X			X	X
Rozites caperata			X			
Suillus tomentosus				67X	6X	
Trametes versicolor					X	
Tricholoma magnivelare	22X					

Contaminated Habitat Scenarios, Their Toxins, and the Mushrooms That May Heal Them

Contaminated Habitat Scenario	Recommended mushrooms
Petroleum products (oil, diesel, gasoline, petrochemicals)	*Pleurotus ostreatus*
Chemical dyes	*Ganoderma* and *Trametes* species
Industrial metals (lead, cadmium, arsenic, mercury, selenium, radioactive cesium-137 and cesium-134)	Large *Agaricus*, *Lepiota*, and mycorrhizal species
Munitions (TNT)	*Hypholoma* and *Flammulinas* species
Organophosphates, chemical weapons (VX, sarin)	Polypores, oysters, and *Psilocybe* species
Biologicals (*Escherichia coli*, *Bacillus* sp.)	*Calvatia gigantea*, *Coprinus comatus*, *Fomes fomentarius*, *Ganoderma* species, *Piptoporus betulinus*, *Pleurotus* species, *Polyporus umbellatus*, and *Stropharia rugoso annulata*
Nitrates and phosphorus-bound toxins	*Agaricus bernardii*, *Agaricus silvicola* and allies, *Coprinus comatus*, and *Psilocybe* species