



**Public Comments and NMED Responses on the
Draft 2015 NMED Strategic Plan for the
Kirtland Air Force Base Fuel Spill
March 23, 2015**

General Responses

The New Mexico Environment Department (NMED) Kirtland Air Force Base Fuel Spill Cleanup Team sincerely thanks everyone who took the time to review and comment on our draft Strategic Plan for 2015. We received many thoughtful, constructive comments that will improve the quality of the final Strategic Plan and of the work that we will accomplish during 2015.

1) Air Force Civil Engineering Center

Technical experts from the Air Force Civil Engineering Center (AFCEC) in San Antonio, TX became heavily involved with this project in July 2014, resulting in an immediate improvement in the technical quality and robustness of the Air Force's approach to investigate and clean up the fuel spill. Within the first month, a plan was developed to begin filling data gaps with 16 new monitoring wells, and to relocate the pilot extraction well to capture and remove EDB from a larger aquifer thickness and at a more strategic location. The work plan for these activities was submitted and approved in August 2014. Then, in September 2014, the Air Force proposed to install up to 7 additional extraction wells, in a logically phased program, designed to collapse the EDB plume and pull it away from the Ridgecrest well field. As of February 2015, up to four drill rigs have been operating simultaneously to install the monitoring and extraction wells. Construction on the infrastructure to convey, treat and disperse the extracted water also is moving ahead at full steam. We are extremely pleased that the first groundwater extraction and treatment system for this site will go online this summer, with three additional extraction wells scheduled to become operational by the end of 2015.

The AFCEC experts are also planning robust and ambitious improvements to clean up the vadose zone and prevent soil contaminants from reaching groundwater. As some of the commenters have noted, soil vapor extraction (SVE) is most effective for light hydrocarbon fuel constituents, such as those in aviation gasoline and in the low range of JP-4 constituents, but less effective for heavier hydrocarbons in JP-8. As experience has shown at many other fuel spill sites, SVE will reach a point of diminishing returns. Bioventing technology will then be needed to destroy the residual heavier hydrocarbons that are in the JP-8 and in the high range of JP-4. Towards this end, the SVE shutdown/rebound testing, and the biorespiration testing, as explained in the Strategic Plan, will be conducted by AFCEC in the late winter and spring of 2015.

Even some of our harshest critics have acknowledged the beneficial changes that AFCEC experts have brought to this project. NMED believes that AFCEC's arrival marks a significant turning point for the investigation and cleanup of the fuel spill. We strongly encourage the residents of Albuquerque to:

- stay informed and involved by attending public meetings, poster sessions, and field trips, and by reviewing regulatory and technical information posted on the NMED and KAFB web sites;
- demand transparency and good science from the Air Force and NMED;

- continue to make sure their voices are heard as the project proceeds; and
- support the Air Force and NMED, as many people have done in their comments on this Strategic Plan, when technically sound actions are proposed to investigate and clean up the fuel spill.

2) Public Participation and Outreach

NMED and the Air Force have been and continue to work within the RCRA requirement and guidelines for public participation. Both entities have made significant improvements to opportunities for public participation since the summer of 2014. These improvements include poster sessions and field trips where the public has unrestricted access to staff experts, revised public meetings, creation of an NMED email listserv, development of NMED's KAFB fuel spill web page, and the request for public comments on NMED's draft Strategic Plan for 2015. Some comments received on the Strategic Plan indicate additional outreach that could be done, and we agree. We are going to explore interest in a facilitated working group and develop additional avenues for communicating about the project.

3) Dissatisfaction with the Slowness and Lack of Completeness in Cleaning Up the Fuel Contamination

NMED appreciates and shares this dissatisfaction. We believe that a turning point occurred in the summer of 2014, however, when experts from the Air Force Civil Engineering Center became involved with the investigation and cleanup. The Strategic Plan proposes an ambitious, but doable, course of action for calendar year 2015 that will make significant progress towards getting the spill cleaned up. In March, the SVE a shutdown-rebound test will begin to identify soil-contamination hot spots, and the vadose zone will be monitored to measure rates of microbial respiration. These test results will be used to locate additional SVE wells, to identify soil vapor contamination hotspots, to design a more robust SVE system, and to identify soil horizons that are suitable for transitioning treatment from SVE to bioventing.

4) Lack of Confidence in the U.S. Air Force and NMED to Clean the Site Up

Given the historical slowness and lack of completeness of cleanup up, NMED can appreciate the skepticism expressed by several commenters on recent commitments by the Air Force and NMED to accelerate cleanup efforts and to make them more robust. Both organizations have the technical expertise, funding, and support structure in place to implement these aggressive plans and fully intend to carry out the actions proposed in the Strategic Plan. By doing so, we hope that by the end of 2015 we will have earned a greater level of confidence and trust in the community.

5) The KAFB Fuel Spill Does Not Constitute an Emergency Situation

NMED staff experts have worked on numerous emergency situations, sometimes serving as Incident Commander. These emergency situations include floods, wildfires, explosive gasoline vapor in buildings, chemical explosions, contaminated drinking water wells, hazmat releases, water outages, water system intrusions and other situations where there is a human exposure pathway or other immediate endangerment of public health and safety.

Monthly testing of public water supply wells in the vicinity of the groundwater contamination plume continues to show no detections of fuel contaminants. As such there is no human exposure pathway at the present time, and, though this is a very serious matter, the KAFB fuel spill does not qualify as an emergency.

6) HJM-13, 2014 N.M. Legislative Session – Independent Scientific Task Force

HJM-13, passed by the 2014 N.M. State Legislature, resolved that “the New Mexico Congressional delegation be requested to fund and assemble an independent task force of experts...” NMED strongly believes in scientific peer review, and has assembled panels of highly qualified experts from the NMED, Air Force Civil Engineering Center, Albuquerque Bernalillo County Water Utility Authority, City of Albuquerque Environmental Health Department, U.S. Environmental Protection Agency, U.S. Geological Survey, N.M. Bureau of Geology, and various private project contractors. Many of these experts have decades of professional experience, and some worked extensively on the middle Rio Grande aquifer system. The mission statements of the working groups are contained in Appendix B of the Strategic Plan.

7) The Strategic Plan is not a Regulatory Document

The New Mexico Environment Department (NMED) developed this Strategic Plan as a communication tool to provide the public with a clear compilation of our vision on how to advance the fuel cleanup during 2015. This reference document is a guide to the various 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.

The guide also contains information NMED and KAFB presented during numerous public presentations in the 2nd half of 2014 and links to current enforceable regulatory documents related to those strategies in progress. NMED values public involvement and comments. A draft of the 2015 Plan was voluntarily issued for public comment in December 2014, and any comments and suggestions were incorporated into the final document. A new draft issued in December 2015.

The Plan also provides links (Appendix A) to current enforceable regulatory documents related to those strategies in progress. As work proceeds, additional regulatory documents will be submitted by the Air Force, subject to NMED approval.

8) Strategic Plan Schedule

Numerous commenters requested that a schedule or timeline for activities be provided in the Strategic Plan. The final Strategic Plan contains a general timeline for strategies outlined in the document. Due to the nature of such clean-up activities, some of which are dependent of the outcomes of others, it is difficult to present a static timeline in the Plan. As the Air Force submits work plans to NMED for the various project activities, enforceable deadlines will be set. The work plans will also include much greater detail and technical specifications for the activities.

Responses to Specific Comments

Comments from Carol Benson

There is no real containment goal here and there is no independent oversight, which seems an obvious necessity to many of the public.

The plan should follow RCRA process at every step, and with transparency.

There is a multiplicity of agencies and air force leaders involved in this emergency, thus it is not getting done.

The data is not there to contain. Without all the facts containment will never happen.

It is most essential to keep EDB from our city wells, but there is no demonstrated strategy we can trust to do that.

Even the faulty and inadequate proposed remediations have not been put in place to date.

PLEASE, act with the passion and efficiency appropriate in an emergency, as that is what we are experiencing.

NMED Response to Carol Benson

Containment of the contamination will be achieved by the pump and treat system that will collapse the EDB plume back towards the base, away from the Water Utility Authority wells. Our strategy is to install one extraction well this summer then test it to measure its performance. Using this test information, 3 additional extraction wells will be installed and tested in 2015. Test data from the first 4 wells will be used to install up to 4 additional extraction wells in 2016, for a total of up to 8 extraction wells. These actions will result in containment and removal of EDB from the aquifer.

The investigation and cleanup are proceeding with increased transparency in accordance with the RCRA process, and with KAFB's RCRA permit, under the regulatory oversight of NMED. Since the U.S. EPA has delegated RCRA authority to NMED, our RCRA program is subject to oversight by EPA.

The multiple agencies involved in the process have interest as stakeholders. NMED is the RCRA regulatory authority over the Air Force. Other agencies have obligations to their constituents.

We appreciate your comment about the adequacy of data to design a containment system. This is why we have required the Air Force to drill probe well KAFB-106212, to find the deepest level in the aquifer at that location where EDB exceeds the drinking water standard, before designing the first extraction well.

Please see our general response above that the KAFB fuel spill does not constitute an emergency situation.

Comments from Edward Birnbaum

I read the information contained on the web link provided in an article in the Albuquerque Journal on Dec. 3, 2014, and have two comments.

First, I was surprised to see nothing about trying to pump contaminated water from the center of the spill. I am not an expert on aquifer remediation, but it seems only logical to pump contaminated water from that location to draw what is the most likely the most contaminated water from the aquifer, followed of course by treatment to remove the EDB and other contaminants contained therein. Is there a reason why pumping of this type can't begin before the total extent of the spill is known via test wells? This process as already dragged on way too long.

Second, I would like to see some requirement placed on Kirtland Air Force base to routinely carry out a mass balance of the fuel delivered to the Air Base vs. the fuel used for planes, with some estimate of losses due to spills and evaporation. Keeping track of the fuel delivered would appear to be the only means of getting a heads-up that another fuel spill is taking place. In fact, had such a mass balance been done in the past, the fuel leak would have been discovered much earlier, making remediation unnecessary, or at least easier and much less costly. One wonders how no one noticed the loss of 6 - 24 million gallons of fuel, and why isn't someone being held accountable for this huge waste of money!!!

NMED Response to Edward Birnbaum

Our Strategic Plan for 2015 proposes to pump out the contaminated groundwater from the most effective location, treat it to drinking water standards, then determine the best non-potable beneficial reuse for the cleaned water. The first of 8 extraction wells should be operating by the middle of 2015.

Your comment on the fuel inventory is excellent. The industry standards for construction and operation of aboveground tanks, fuel delivery systems, and inventory control, have greatly improved since the original facilities were built at KAFB in the 1950s. The current KAFB fueling facilities have much greater oversight, tracking, and safety mechanisms in place than existed decades ago when the fuel leakage occurred.

Comments from Adria Bodour, Ph.D., DAF, Air Force Civil Engineering Center

We looked over the strategic plan and wanted to provide comments that we hope will improve the document. Attached is AF comments on the NMED Draft 2015 Strategic Plan.

See Attachment A.1 for Dr. Bodour's written comments.

NMED Response to Dr. Bodour

All of your suggested language clarifications are very helpful and have been incorporated into the final Strategic Plan. The figures you commented on were prepared by your contractor, and we are working with you and your contractor to revise these graphics.

Comments from Beverly H. Burris, Ph.D.

1. Although I agree with the goals of this plan, I have little confidence that the measures proposed here can achieve these goals before the drinking wells become contaminated by EDB.

2. For instance, it is certainly better to test the drinking wells monthly rather than every three years (p. 3), however the reliability of existing testing procedures is questionable, given the fact that EDB is toxic at such low levels and only small samples from large drinking wells are being tested. Adequacy of testing methodology also needs to be considered.
3. The sentinel wells should also be tested monthly, not quarterly (p. 3).
4. Similarly, it is important to better characterize the parameters of the plume (p. 5). It is remarkable to me that this has not yet been done after more than 15 years. This should have been done first, but at this point, it will need to be done simultaneously with corrective measures, in my opinion.
5. A crucial question, not addressed by this plan, is how long we have before the EDB reaches the drinking wells. Although some analyses (e.g. the 2013 draft EPA report) have reached the conclusion that we have 30 or even 40 years, I have carefully reviewed the EPA report and found it to be undermined by serious data gaps and extremely biased in favor of lengthening this time frame. Given the several types of bias in the EPA report, I consider it to be so misleading as to be worthless. Estimates by independent experts of the number of years before EDB reaches the Ridgecrest wells were in the 6-9 year range last year, so 5-8 years at this point.
6. Starting with one pilot extraction well is insufficiently aggressive; start with several and increase their number based on improved characterization of the plume.
7. Air sparging and bioremediation are unlikely to be effective for EDB removal, based on the evidence that I have seen. In fact, air sparging can spread the contamination and should be considered very carefully by people with experience with EDB removal from large bodies of water.
8. Public involvement is a worthy goal, but to date has been inadequate. NMED and KAFB have tended to construe public involvement as top-down information sessions (with some misinformation). There has not been enough opportunity for informed citizens and local experts to sit down at the table and participate in decision making. Instead, meetings are staged public relations efforts, designed to give the illusion of efficacy when in fact little or nothing is being done. No EDB has been removed from the aquifer to date.
9. Once again, KAFB has missed a critical Dec. 31, 2014 deadline with no fines or repercussions. They should have been fined \$10,000 a day starting Jan. 1. This is why nothing has been done for over 15 years.
10. In my view, NMED should implement HJM 13 from the 2014 NM Legislative Session, which called for bringing in scientific experts from outside the state as consultants. There are experts with experience in cleaning up massive toxic spills and in EDB removal who could be very helpful in designing remediation of this large and serious contamination of our aquifer.
11. With all due respect, I have little confidence in the ability of NMED and KAFB to clean up this spill in time. Too little has been done to date, and there has been too much misleading and even

erroneous information presented to the public. The main emphasis at public meetings is on reassuring the public that “this is not a serious problem and we are taking care of it (so you can forget about it).” In fact, this IS a serious problem and NMED and KAFB’s efforts have been woefully inadequate over a period of many years. It is time to bring in bring in additional expertise so as to address this problem before it is too late.

NMED Response to Dr. Burris

1. Please see our general response above to the lack of confidence among some members of the public.
2. The drinking water wells are being tested using methods approved by the U.S. EPA pursuant to the federal Safe Drinking Water Act. These test methods have detection limits that are lower than EPAs maximum contaminant level of 0.05 µg/L EDB.
3. Monthly testing of sentinel wells is not justified since any contaminants that might break through into the sentinel wells would have to migrate even further to impact a drinking water well. Quarterly testing is the appropriate frequency for sentinel wells for the purpose of providing early detection of any contaminant migration towards the drinking water wells, while still allowing time for intervention to protect the drinking water wells.
4. Much has been learned about the spill site since its discovery in 1999 and this information has been used to implement interim measures. Valuable data from the site is also being used to guide the aggressive strategies currently being pursued. However, NMED fully agrees that the plume needs better characterization. Additional monitoring wells are presently being drilled to define the vertical and horizontal extent of contamination. Additionally, more testing will be done on the chemical composition and physical properties of the drowned LNAPL.
5. Modeling of how many years it will take EDB to reach drinking water wells will become an academic issue once the EDB containment and collapse system goes on line. The EDB will be pulled away from the drinking water wells.
6. We appreciate your desire to see extraction wells installed as soon as possible, but believe that a phased approach is best for this complex site. Our strategy is to install one extraction well this summer, and to test it and measure its performance. Then, using this test information, install and test 3 additional extraction wells. Then, using test data from the first 4 wells, install 4 additional extraction wells, for a total of 8 extraction wells, to collapse the plume.
7. NMED staff and project partner experts have extensive experience in removing EDB from water. Air sparging and other aeration technologies have been used successfully, and without spreading the contamination. With regard to the potential for bioremediation to be successful, we suggest that judgment on this issue be reserved until the results of the laboratory microcosm tests become available.
8. NMED agrees that opportunities for public involvement should be continually improved, and we hope that you will work with us in this regard. Please see our general comment above on the public participation and outreach.
9. On January 15, 2015, NMED issued a Notice of Violation, with daily compounding fines, to the Air Force for failing to meet the December 31, 2014 deadline.
10. Please see or general response above to HJM-13 passed by the 2014 New Mexico State Legislature.
11. Please see our general response above to the lack of confidence among some members of the public.

Comments from Virginia Burris

I, a long-time resident of Albuquerque, strongly support the comments and evaluations on the Kirtland NMED Draft Strategic Plan submitted by the CANM citizens group (Citizens Action New Mexico).

NMED Response to Virginia Burris

Please see our response to the comments submitted by Citizen Action New Mexico.

Comments from Scott Ellinger, U.S. EPA

- Goal 1 says “protect drinking water wells”, but it’s really about monitoring. The goal statement and the strategy statements don’t match up. Monitoring itself wouldn’t stop fuel constituents from migrating into drinking water wells. Re-wording could make this more clear.
- Goal 2 seems like it should be Goal 1, or the most important goal, because it’s the most pressing situation right now. This goal could be called “protecting drinking water wells” because it’s an active method of protection.
- Somewhere on Goal 1, for protecting drinking water wells, a statement could be made about coordination between the Air Force, NMED, and the water utility. This is important because as Kirtland wells and water utility wells sometimes go on/off line, the gradients change that affect plume movement and monitoring. So they need to know what each other is doing.

NMED Response to Scott Ellinger

NMED appreciates your comments on goals and strategies. We have amended the final Strategic Plan to reflect one goal and five strategies that will help to achieve that goal.

We also appreciate your suggestion that the Strategic Plan should provide for coordination between the stakeholders on municipal pumping rates, monitoring and plume movement. The final Strategic Plan will provide for this coordination.

Comments from Janet Greenwald, Co-Coordinator, Citizens for Alternatives to Radioactive Dumping

I am representing The Water Groups (Our Endangered Aquifer Working Group and Agua es Vida Action Team) and Citizens for Alternatives to Radioactive Dumping (CARD). Our groups are in support of Citizen Action's comments on NMED's strategy plan for the Kirtland Air Force Base Jet Fuel Spill with this addition: One of the areas that spans the spill is the International District, New Mexico's most diverse and one of our most economically challenged neighborhoods. Our understanding of Federal and State Environmental Justice mandates is that a special effort must be made to reach out to this neighborhood concerning the spill in a way and in languages that are

understood by this special group of people. There seems no plan to do that and an inadequate plan to include the public in general in the important decision making that must continue concerning this dangerous spill.

Thank you for your consideration.

NMED Response to Janet Greenwald

Please see our response to the comments submitted by Citizen Action New Mexico.

We appreciate your comments and suggestions on the need to reach out to the International District.

Comments from Juliana Hankins, N.M. Veteran's Administration Health Care System

I like your draft. Thank you for the opportunity to comment.

NMED Response to Juliana Hankins

NMED worked with the N.M. Veteran's Administration Health Care System (NMVAHCS) to develop a Source Water Protection Plan for the NMVAHCS water supply well. The Source Water Protection Plan contains a contingency plan in the event that the NMVAHCS well becomes contaminated by the KAFB fuel plume or by any other source.

Comments from John Hawley, Ph.D., Emeritus Senior Environmental Geologist, N.M. Bureau of Geology

You said it would be "a quick read," so I took a chance. Needless to say I'm very impressed, particularly with the schematic (map, cross-section, and block-diagram) graphics. They definitely will communicate very effectively with "the general public."

My only review comment relates to the "Technical Working Group Mission Statement." Even though they aren't directly concerned with regulatory aspects of the Strategic Plan, I would hope that there is some way to formally recognize the importance of entities like the USGS-NM Water Science Center and the NM Bureau of Geology & Mineral Resources, particularly in activities of the "Hydrogeology Working Group."

NMED Response to Dr. Hawley

The USGS and the N.M. Bureau of Geology are participating in the Hydrogeology Working Group, and were major participants in our first field trip last October. The final Strategic Plan will acknowledge their involvement.

Comments from Dan Koning, N.M. Bureau of Geology

Attached is the PDF with my comments. There should be a pop-up next to each highlighted sentence. In appendix B, I did not read beyond the hydrogeologic working group. For the figure at the end of page 3, what do the lighter-shaded red sentinel wells signify (i.e., those north of KAFB-3)?

You did a good job in making this a readable document for lots of different audiences.

(See Attachment B for Mr. Koning's written comments.)

NMED Response to Dan Koning

NMED appreciates your suggestions on language and punctuation, and some of your comments were incorporated into the final Strategic Plan. The remainder of our response addresses the substantive comments that you made.

With regard to not allowing detectable concentrations of fuel constituents to migrate into any drinking water wells, we agree that the EPA Maximum Contaminant Level is the regulatory safety standard. However, we also believe it is technically possible, and would be in the best public interest, to prevent any fuel contaminants from reaching a drinking water well in the first place.

We are re-drafting the map of drinking water wells, monitoring wells and sentinel wells to make it clearer. Sentinel wells are monitoring wells that serve the additional purpose of providing early detection of any contaminant migration towards a drinking water well. Drinking water wells in the vicinity of the plume are tested on a monthly basis. Monthly testing of sentinel wells is not justified, however, since any contaminants that might break through into the sentinel wells would have to migrate even further to impact a drinking water well. Quarterly testing is the appropriate frequency for sentinel wells for the purpose of providing early detection, while still allowing time for intervention to protect the drinking water wells.

We have added language to better explain how surfactants might lower the surface tension between water and LNAPL to mobilize the LNAPL and allow it to be captured.

We have added language to explain the pros and cons of CATOX and ICE vapor treatment systems.

We greatly appreciate the expertise that the NM Bureau of Geology and Mineral Resources has provided on field trips and on the Hydrogeology Working Group, and we have acknowledged your contributions in the final Strategic Plan.

Comments from Dave McCoy, Esq., Executive Director, Citizen Action New Mexico

See Attachment C.1 for Mr. McCoy's written comments.

See Attachment C.2 for NMED's response to Mr. McCoy.

Comments from Jim McKay

See Attachment D.1 for Mr. McKay's written comments.

See Attachment D.2 for NMED's response to Mr. McKay.

Comments from Susan Michie, President, Nob Hill Neighborhood Association

Thank you for providing the opportunity to comment on the NMED strategic plan draft regarding the Kirtland Air Force Base fuel spill cleanup. The Nob Hill Neighborhood Association is deeply concerned about the environmental impacts of this very large spill and urges all efforts possible to clean up and remove the contaminants before it reaches the Albuquerque and Bernalillo County water supply.

We agree with the stance of the Water Authority that zero contamination is the only acceptable level for EDB so we have concerns that NMED has not chosen zero as the acceptable benchmark.

We agree with the various approaches to the clean up as it is clear that only by using all available technologies will the spill be fully removed and cease to be a threat.

However, we are very concerned that there are no clear deadlines for any of the interventions. As a result there are no consequences for KAFB continuing its history of missing deadlines and benchmarks. We believe NMED must exert maximum pressure on KAFB and set firm deadlines and fines for failure to meet established targets.

There is great cynicism in the community regarding KAFB's commitment to clean up this spill and our state government's efforts to hold KAFB accountable. We urge you to revise your plan as we discuss above and make strides in building the confidence we need going forward.

NMED Response to Susan Michie

We want to assure you that we believe the measures described in the Strategic Plan will pull the contamination away from the Ridgecrest drinking water wells before the contaminants migrate into the wells. The sentinel wells will provide an early warning, and time for intervention, if the contamination moves further in the direction of the wells.

The goal of NMED and KAFB is to never allow any EDB at any level reach the drinking water wells, thus achieving the WUA's resolution of zero contamination. Water that will be pulled from the contaminated portion of the aquifer through extraction wells (not clean drinking water wells) will need to be cleaned. This is the water for which a standard of 0.05 µg/L is set. The contaminated water cleaned to this level will be beneficially reused for non-potable purposes.

While the U.S. EPA recommends a public health goal of zero for all potential carcinogens in drinking water, including EDB, they have established numerical maximum contaminant levels for these carcinogens at levels greater than zero. EPA has set the enforceable drinking water standard for EDB at 0.05 µg/L, and this standard is enforced by NMED as we have been delegated primacy by EPA to administer the Safe Drinking Water Act program in New Mexico. As such NMED cannot exceed its authority by required cleanup to a more stringent level.

We appreciate your support of our efforts to put in place a combination of technologies, both simultaneous and sequential, that are required to clean up this complex site. A general timeline has been added to the final Strategic Plan.

Given the historical slowness and lack of completeness of cleanup up, NMED can appreciate your skepticism on recent commitments by the Air Force and NMED to accelerate cleanup efforts and to make them more robust. We fully intend to carry out the actions proposed in the Strategic Plan and hope that, by the end of 2015, we will have earned a greater level of confidence and trust in the Nob Hill community. Please see our general response above to the lack of confidence among some members of the public.

Comments from Eric Nuttall, Ph.D., UNM Civil Engineering Professor, Retired

Thanks for reaching out to the public & taking leadership in this effort. It will be interesting to see the integrated team input result in a comprehensive CSM. Don't forget the need for 3D views & the appropriate mass balances. Also a dynamic Gantt chart would inform the public of progress & schedule.

NMED Response to Dr. Nuttall

NMED greatly appreciates your continuing advice, recommendations, and support on this project and are particularly grateful you agreed to be a speaker during the geologic field trip last October.

We are working on a conceptual site model and mass balances. 3D images of the plume have been generated by EPA and are represented in the final Strategic Plan. The animated model is posted on our website. We have added general deadlines and milestone dates to the Strategic Plan but will not include a Gantt chart as we feel it would not be appropriate for the Plan. More detailed plans, specifications, schedules and Gantt charts, however, are available in the regulatory work plans and other documents that have been approved for various phases of this project. Please see our general comment above that the Strategic Plan is not a regulatory document.

Comments from Rick Shean, Water Quality Hydrologist, Albuquerque Bernalillo County Water Utility Authority

Thank you for opening up NMED's 2015 Strategic Plan (Plan) for the Kirtland Air Force Base (KAFB) Bulk Fuels Facility Spill for public comment. Water Authority staff have reviewed the document and have some comments we ask that you consider during the finalization process.

1. Inclusion of deadlines and unambiguous performance measures for goals and tasks: Please consider adding deadlines to specific tasks identified in the Plan as activities that will support the five proposed goals. The stakeholders and public should be provided the expectations that NMED has for the corrective action activities to occur during the year, so the success or failure of proposed and implementation activities can be easily evaluated by all who depend on these

interim measures to be done. The recent Notice of Violation letter sent to the U.S. Air Force / KAFB includes deadlines that should be included in the final version of the Plan. Also, some of the activities listed do not appear to be achievable in 2015, so distinguishing the projects that will be implemented and or completed this year from those that will be ongoing or started after 2015 will be helpful.

2. **Public Involvement:** Please include how public input will be solicited and utilized, particularly in the working groups mentioned in the Goal 5 strategy discussion. There are technically competent members of the public who, if given an appropriate venue, could provide valuable input in the process.
3. **EDB Plume Collapse:** A series of time-step snapshots of the ethylene dibromide (EDB) plume being extracted would help demonstrate the concept of “collapsing” the dissolved phase plume.

Please let me know if you have any questions about the Water Authority’s comments.

NMED Response to Rick Shean

1. Please see our general response to the issue of the strategic plan schedule.
2. Please see our general response to the issue of how to improve public involvement.
3. Thank you for the recommendation for a series of time-step snapshots of the EDB plume collapse. These graphics have been added to the final Strategic Plan.

Comments from Ray Shortridge, Rio Grande Chapter, Sierra Club

We appreciate your requesting public comment on the 2015 strategic plan for the KAFB fuel spill. Attached is a pdf file containing our comments.

(See Attachment E for Mr. Shortridge’s written comments.)

NMED Response to Ray Shortridge

Please see our general response to the issue of schedule and milestone dates.

We appreciate your comment about resource requirements and budgets, but these issues are beyond NMED’s jurisdiction as they apply to the Air Force. The bottom line is that the Air Force is responsible for obtaining the necessary funding and resources to cleanup up their fuel spill. Please be assured that NMED has the resources and funding to carry out our responsibility to administer and enforce the requirements of the federal Resource Conservation and Recovery Act and the Safe Drinking Water Act.

Sentinel wells are located in the Strategic Plan and the location of the first extraction well has been approved in the August 1, 2014 work plan. Locations of additional extraction wells will be determined sequentially as extraction wells are drilled and pump tested.

Regulatory deadlines and milestone dates for review of LNAPL remediation technologies and soil vapor extraction progress have been included in the final Strategic Plan.

NMED agrees that well maintenance and sustainability are critical issues. Due to the rising water table, a number of the shallow monitoring wells now have their screens completely submerged by groundwater. Standard protocol for shallow wells is for the screen to span above and below the water table. Depending on how much drawdown occurs during purging, and on the vertical distribution of contaminants, these wells may no longer produce data that are representative of the uppermost water table zone. To make matters worse, the water table is still rising. It is ironic that at other sites in New Mexico, NMED has had the problem of monitoring wells drying up due to groundwater depletion and the ongoing drought. Additionally, water samples collected from some wells contain air bubbles that can cause test results to be artificially low. Investigations into whether the air bubbles are an artifact of the well pump, or aquifer geochemistry, or some other factor, have been inconclusive so far. These issues are more significant for wells that are clean or have very low contaminant concentrations than for wells that are heavily contaminated. Most hydrogeologic investigations have one or more issues such as these, and the data for this site will never be perfect. Cleanup actions need to move forward without being delayed by trying to resolve these issues. When the time comes to demonstrate that the aquifer has been cleaned up to standards, however, some of these wells will have to be replaced if needed to demonstrate compliance at those specific locations.

Please see our general comment above that the Strategic Plan is not a regulatory document.

Comments from Jonathan Siegel, AIA, Siegel Design Architects, LLC

I am a member of the North Valley Coalition of Neighborhoods in Albuquerque, and remain concerned about the Kirtland AFB fuel spill. The monitoring is of course important, but at some point I would hope that remediation will be required.

I applaud your recent efforts at Los Alamos and at WIPP and hope that vigorous enforcement will also occur with respect to the KAFB spill, which as you know threatens the drinking water supply and multiple aquifers in Albuquerque.

If you cannot enforce this, perhaps we will need to turn to National EPA enforcement instead - to that end, I will copy my US Congressional delegation.

This goes beyond a small infraction; it threatens the viability of the area, and the health of generations to come along with multiple other organisms and ecosystems who depend on the affected layers of aquifer.

Thank you –

NMED Response to Jonathan Siegel

NMED completely agrees that, while monitoring is important, remediation (corrective action) must occur. Corrective action is, in fact, a requirement of the KAFB Hazardous Waste permit. Remediation activities have been occurring since 2003 and the Strategic Plan cites additional, robust remediation efforts that will take place in 2015.

Vadose zone remediation using soil vapor extraction (SVE) is ongoing and has already removed more than 500,000 gallons of fuel. The SVE system will be made more robust and, after most of the volatile constituents have been vacuumed from the soil, bioventing will likely be employed to destroy the heavier, less-volatile constituents in the soil. In accordance with the Strategic Plan, we anticipate that the first ever groundwater remediation system for this site will become active by June 30, 2015.

Please see our general comment above that the Strategic Plan is not a regulatory document.

Comments from Tom Skibitski, NMED, Department of Energy Oversight Bureau

The plan looks good – comprehensive and understandable. I think it should both help people understand the process, the technology, and be a benchmark for progress. Well done.

NMED Response to Tom Skibitski

We would like to acknowledge that staff of the NMED Department of Energy Oversight Bureau attended and participated in the October 2014 geological field trip.

Comments from Paul van Gulick, PE, PS

I appreciate the level of public involvement and input that you have solicited to date on this important issue. Following are my comments on the Kirtland Air Force Base Fuel Spill Cleanup Draft 2015 Strategic Plan:

1. Five critical goals are identified. In general, I don't find an answer to the natural question, which is: when is the work complete, or when is the goal reached? That is, when can operations and maintenance for each of the treatments cease? Surely this has been discussed - it should be in the plan.
2. Goal 1 - Strategy - Why should review of current hydrogeological conditions wait until action levels are attained at sentinel wells? Elsewhere you identify that predictive models will be run for various scenarios - but I would suggest that the models, once vetted and calibrated, should be run each quarter using newly acquired data in order to monitor conditions. Review of current hydrogeological conditions should be ongoing, in other words.
3. Goal 1 - Drinking Water Standards - Collapsing of the contamination plume and pulling it back towards the boundary of KAFB before it ever reaches a drinking water well is stated as the goal of the plan. What specifically is meant by collapse? How is it measured? Is it collapsed when

the original volume has shrunk a certain percent, or when it's boundary has shrunk a certain distance, or when it is considered to be contained, or become static, or is reduced so that the maximum remaining level is below standards? Specificity is needed otherwise how will you know when you've done it?

4. Goal 2 - Strategy - Develop a robust monitoring and pump and treat system. It appears that up to 8 extraction wells are anticipated. I assume that these would be vertical wells spaced in some manner so that the desired gradient is achieved. But, I suspect that a single horizontal well could be made to intersect the plume more effectively with a significantly higher yield than the combination of vertical wells. Plus, you could then centralize the power, pumping, treatment, and disposal.
5. Goal 2 - Phase 3 - Implement long-term operation, maintenance and optimization of pump-and-treat system to collapse plume and pull it back towards the boundary of KAFB. See my comment 3 above. How long is long term? Until the end of days? Or until some specific metric has been achieved?
6. Goal 3 - Final Corrective Measure Evaluation, Selection, and Implementation - Establish LNAPL metrics to determine when LNAPL remediation is complete. This is commendable, and is the first instance that I found in the Plan. At this stage I, as a member of the public, don't need to know exactly what the metrics will be, only that you're going to establish some.
7. Goal 4 - Final Corrective Measure Evaluation, Selection, and Implementation - Establish soil vapor cleanup concentrations that will not be capable of contaminating groundwater. Again, this is commendable - it would not be much of a plan without a target. So, just to reiterate - the strategy collapsing of the plume would benefit from the establishment of metrics too
8. Goal 5. No comments - Frankly, I think that NMED is doing an excellent job of involving and informing the public.
9. Appendix B - Item 8 of Working Group specific responsibilities. "Review water-level and water-quality monitoring data..." is too general. What are the goals of the review? I would assume that it is first to establish the quality of the data, and then to use it to evaluate the status of the effort, say, by updating a dynamic model.
10. Appendix B - Item 11 of Working Group specific responsibilities. In addition to developing indicator parameter concentrations for sentinel wells - could this working group not also develop indicator parameter concentrations at remediation sites that would signal that remediation has been achieved?
11. Modeling Working Group - Types of simulations. See my comment 2. The focus seems to be on predictive models to design the remediation. This is, of course, essential. However, it shouldn't stop there. Assuming that targets have been set, a dynamic and regularly updated model should be run as new data are gathered. Both the Biogeochemistry/LNAPL and SVE working groups are tasked with maintaining a running quantification of the amounts of EDB and hydrocarbons, respectively, that are extracted - but this is not compelling if you don't really know how much was there to begin with. It's only meaningful when compared to changes in concentration, and volume or areal extent.

This concludes my comments. Thank you again for your proactive stance on this important issue.

NMED Response to Paul van Gulick

We are hoping that completion of soil vapor extraction will occur in the next 2-4 years. Data shows vapor levels are already declining and hopefully this trend will continue and accelerate. Completion of the groundwater extraction "EDB collapse" system will likely take somewhere on the order of 20 years, depending on how soon we can remediate the LNAPL. Since we have not yet determined the

most appropriate LNAPL remediation technology, it is currently uncertain what the time of completion might be.

1. We will clarify the Plan to reflect that definition of hydrogeologic conditions is an ongoing task of the Hydrogeology Working Group. The hydrogeologic review that might get triggered by detections in a sentinel well, would be of localized site specific conditions that are causing the detections. Model simulations are already being run, and more will be run as the project proceeds.
2. Collapsing the plume means reducing the dissolved phase contaminants to levels that comply with standards. We will clarify this in the final Plan.
3. We have had discussions of horizontal versus vertical extraction wells, and these discussions included community acceptance of drilling horizontally below people's homes. The Air Force opted to propose vertical wells. But I would suggest that you come to our next public meeting, scheduled for March 12, 2015, and discuss the issue with the USAF experts in the poster session that evening.
4. Our best estimate is that it will be on the order of 20 years to reduce contaminant levels to comply with standards.
5. The metrics will eventually be proposed by the USAF subject to approval by NMED, and these documents will all be public records.
6. We have numerical standards for groundwater, but not for soil vapor. So we will need to develop metrics for soil vapor.
7. Thank you.
8. We like your suggestion of identifying the goals of this review. QA/QC issues are addressed in task #7. The goals of this review would be to evaluate the effectiveness of the effort, as you suggested, and to make sure that we are not inducing the contamination to migrate towards a drinking water well.
9. Each medium, water, soil and soil vapor, will need to have specific metrics. Some metrics already exist as enforceable standards. Others will have to be developed as the project proceeds, and we have some experience in developing site specific standards from other sites.
10. Visual ModFlow, a finite difference model is being used, and an analytic element model also will be used in parallel with Visual ModFlow. We expect to present a model animation at the March 12 public meeting. The USGS model is more of a regional aquifer system model, than a site specific contamination model, but still useful. Various, and widely ranging, estimates of the amount of fuel spilled have been publicized. However, we don't believe that the data that are complete enough to develop an accurate estimate of the amount spilled. We will nonetheless account for the amounts of fuel removed by engineered extraction systems and destroyed by biodegradation. It's the best we can do.

Comments from Holly Wilkie

(See Attachment F for Ms. Wilkie's written comments.)

NMED Response to Holly Wilkie

Thank you for acknowledging the on-going source control actions, as well as the studies of other technologies that also may help to control the source of contamination. With regard to your recommendation to utilize pump-and-treat technology, we are pleased to inform you that the first extraction well for a pump-and-treat system should become operational by the end of June 2015.

Three additional extraction wells should become operational by the end of 2015. Up to 4 additional extraction wells, for a total of up to 8 extraction wells, should be installed in 2016. Your comments about regional snow packs, surface water, the tremendous value of the Middle Rio Grande aquifer system, and the need to clean up EDB and hydrocarbons in groundwater are spot-on. With regard to the site conceptual model and a pump and treat strategy, NMED enthusiastically agrees with your suggestion that we, “get it right!”

Comments from David Wood, C.P.A., Vice President, North Valley Coalition of Neighborhoods

I am vice president of the North Valley Coalition of Neighborhoods in Albuquerque, and remain concerned about the Kirtland AFB fuel spill. The monitoring is of course important, but at some point I would hope that remediation will be required.

I applaud your recent efforts at Los Alamos and at WIPP and hope that vigorous enforcement will also occur with respect to the KAFB spill, which as you know threatens the drinking water supply and multiple aquifers in Albuquerque.

If you cannot enforce this, perhaps we will need to turn to National EPA enforcement instead - to that end, I will copy my US Congressional delegation.

This goes beyond a small infraction; it threatens the viability of the area, and the health of generations to come along with multiple other organisms and ecosystems who depend on the affected layers of aquifer.

Thank you -

David Wood
NORTH VALLEY COALITION

NMED Response to David Wood

NMED completely agrees that, while monitoring is important, remediation must be required. Vadose zone remediation using soil vapor extraction (SVE) is ongoing and has already removed more than 500,000 gallons of fuel. The SVE system will be made more robust and, after most of the volatile constituents have been vacuumed from the soil, bioventing will likely be employed to destroy the heavier, less-volatile constituents in the soil. In accordance with the Strategic Plan, we anticipate that the first ever groundwater remediation system for this site will become active by June 30, 2015.

- Attachments Follow -

Attachment A

Commenter	Section	Page	Comment
AFCEC	Whole document	i-16	<p>Please change throughout the document the following:</p> <ul style="list-style-type: none"> • AFCEC acronym. It is Air Force Civil Engineer Center. • Use correct name for NMED Ground Water Quality Bureau. • Acronym use and consistency (i.e., spell out first time then use the acronym throughout the document). • Page numbering ends after page 12 but there are more pages. • Periods are missed placed. • Spell out ORP. • Use consistent language for EDB (i.e., remove 1,2-dibromoethane) because they are the same thing.
AFCEC	A Message from NMED Cabinet Secretary Ryan Flynn	i	<p>Please revise the statement “The vadose zone remediation strategy will be optimized to effectively reduce fuel contamination to be protective of groundwater and the environment existing soil vapor extraction system will be expanded to increase the hydrocarbon removal capacity from 90 pounds per hour to 1,500 pounds per hour.” This is more current in the remediation efforts in the vadose zone.</p>
AFCEC	Introduction	1	<p>Please revise these bullet as such: “Light non-aqueous phase liquid (LNAPL), residual jet fuel that has migrated through the vadose to reach the groundwater liquid fuel); “Soil vapor (lighter jet fuel constituents that have volatized to the vapor phase in soil);”</p>
AFCEC	Introduction	1	<p>Add drinking to the following statement “Dissolved ethylene dibromide (EDB, an additive of aviation gasoline) has migrated in groundwater about 6,000 feet away from the source area, but has not contaminated any drinking water supply well.”</p>
AFCEC	Critical Goals	2	<p>Clarify goal 2 by adding drinking “Collapse the dissolved-phase EDB plume and pull it back towards the boundary of KAFB, away from the seven drinking supply wells in the area”</p>
AFCEC	Critical Goals	2	<p>Revise goal 4 to represent where the technical team is “Remediate residual vacuum-fuel and fuel vapor from the soil to prevent it from migrating into and contaminating groundwater.”</p>
AFCEC	Figure Pump and Treat System	6	<p>This figure doesn’t agree with the figure on page 3 regarding the well location in the downgradient dissolved phase EDB plume.</p>
AFCEC	Pilot Tests	7	<p>Change the following sentence to “NMED will oversee evaluations performed by the Air Force and their contractors to explore the feasibility and effectiveness of variety of interim measures. Remediation technologies under consideration include but are not limited to the following remediation technologies:”</p>

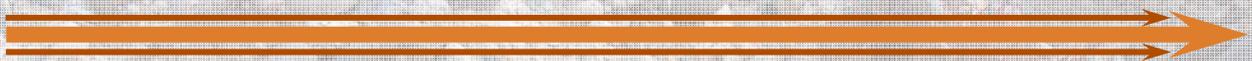
			Add the following sentence after the bullet list: “A final list of technologies to be evaluated as interim measures will be developed using groundwater geochemistry and contaminant data, and data collected from soil cores as described under Goal 4.”
AFCEC	Final Corrective Measure Evaluation, Selection, and Implementation	7	Revise this sentence to the following “In accordance with the requirements of the federal Resource Recovery and Conservation Act, evaluate, interim measures will be evaluated to select and implement a final corrective measure for LNAPL remediation. This may include a combination of different treatments.”
AFCEC	Figure Air Sparge/SVE Pilot Test System	8	This figure should not include recirculation equipment. Replace the recirculation equipment label with vacuum and air injection equipment.
AFCEC	Goal 4	9	Revise sentence to “Remediate residual vacuum-fuel and fuel vapor from the soil to prevent it from migrating into and contaminating groundwater.”
AFCEC	Interim Measures	9	<p>Revise the Bullets list to the following to represent where we are technically:</p> <ul style="list-style-type: none"> • “Shut down SVE for an appropriate period of time to observe rebound of contaminant levels to locate areas where residual contamination exists and to design and place additional SVE wells if needed. • Conduct in-situ microbiological respiration tests during the SVE shutdown period to evaluate the biodegradation capacity of the vadose zone. • Drill additional SVE wells into identified suspected LNAPL and hotspot areas, and collect soil cores to locate, quantify and characterize residual LNAPL in the subsurface. • Terminate the current air quality permit, and apply to the Albuquerque Environmental Health Department (AEHD) for a new permit for pilot testing of the new SVE wells. • Install temporary internal combustion engine (ICE) treatment systems, in accordance with the new permit, for pilot testing of new SVE wells. • Conduct pilot testing using both the current catalytic oxidation (CATOX) and/or internal combustion engine (ICE) treatment systems at identified hot spots areas. • After pilot testing, dismantle the CATOX system use ICE treatment to vacuum hotspots. • After completion of all pilot testing and hot spot treatment, remove the ICE systems. • Use the results of the pilot testing to design a new robust SVE system that optimizes the extraction and treatment of the remaining vadose zone contamination, capable of treating up to 1,500 pounds per hour of hydrocarbons

			<p>extracted in soil vapor; apply for an AEHD air permit for the system.</p> <ul style="list-style-type: none"> • Construct the new robust SVE system, operate, maintain and optimize as necessary in accordance with the permit. • Treat soil vapor extracted from the LNAPL air sparging pilot test as treatment capacity allows. • Evaluate the potential benefits of a bioventing pilot test to remediate the remaining vadose zone contamination. If justified, conduct a bioventing pilot test will be performed after all pilot testing and hotspot treatment are complete.
AFCEC	Final Corrective Measure Evaluation, Selection, and Implementation	9	Revise this sentence to the following “In accordance with the requirements of the federal Resource Recovery and Conservation Act evaluate , interim measures will be evaluated to select and implement a final corrective measure for the vadose zone.”
AFCEC	Appendix B - The hydrogeology group will have the following specific responsibilities:	13	Add #13 to say the following: “13. Optimize the current groundwater monitoring program including the wells sampled and the laboratory analyses.”
AFCEC	Appendix B – Soil Vapor Extraction Working Group	14	Please revise the name of this working group because it is now the Vadose Zone Working Group.
AFCEC	Appendix B - Soil Vapor Extraction Working Group Under The SVE group will have the following specific responsibilities:	14	<p>Make #3 the following sentence: “3. Identify areas where biodegradation is ongoing and would benefit from active bioventing.”</p> <p>Make #3, #4 and make #4, #5.</p>



New Mexico Environment Department

2015 STRATEGIC PLAN



Kirtland Air Force Base Fuel Spill

DRAFT 12/19/14 - open for public comment

Written comments due to NMED by close of business, January 30, 2015.

Mail or Email comments to:

Dennis McQuillan
New Mexico Environment Department
Environmental Health Division
PO Box 5469; Santa Fe, NM 87502

dennis.mcquillan@state.nm.us

Project Collaborators:

Albuquerque-Bernalillo County Water Utility Authority,
City of Albuquerque, Environmental Health Department

U.S. Air Force, Kirtland Air Force Base

U.S. Air Force Civil Engineering Center

U.S. Environmental Protection Agency

A Message from NMED Cabinet Secretary Ryan Flynn:



Cleaning up the Kirtland Air Force Base fuel spill is one of the highest priorities of the New Mexico Environment Department (NMED) and I am certain we will be able to prevent the spill from threatening the health and safety of Albuquerque's citizens. As Cabinet Secretary, I have committed to working with the City of Albuquerque and the Albuquerque-Bernalillo County Water Utility Authority to ensure Albuquerque's drinking water supply is not endangered by the fuel spill. Designing and implementing a successful cleanup is an ongoing process and this 2015 Strategic Plan is an important part of that process.

Over the past year, NMED has worked closely with the Air Force, the Albuquerque-Bernalillo County Water Utility Authority, the City of Albuquerque and the U.S. Environmental Protection Agency to design effective measures for cleaning up the fuel spill based on sound science and engineering. We developed productive working groups with top technical experts from our project partner organizations and other entities and are beginning to see meaningful progress. Although I will not be satisfied until we have successfully cleaned up the entire spill, I am very pleased with the progress we are making and feel confident that we are on the right path.

In 2014, NMED and the technical working groups made progress to identify and fill data gaps, and increase the robustness of interim corrective measures. I am pleased to report the following progress that was accomplished in 2014:

- The soil vapor extraction system, which has already removed more than 500,000 gallons of fuel from the subsurface, was upgraded.
- An air sparging pilot test well was drilled and put into operation.
- A work plan to drill an additional 16 monitoring wells to fill data gaps in the horizontal and vertical plume definition was approved, and drilling commenced in early December.
- A work plan to drill the first groundwater extraction well and treatment system, which will begin to collapse the dissolved phase contamination plume and pull it away from the City of Albuquerque's water supply wells, was recently approved.
- An e-mail Listserv to keep the public better informed of site developments and opportunities for involvement was created.
- Quarterly public meetings were modified to include poster sessions that allow members of the public to speak directly with NMED and Air Force technical experts.
- A geological field trip was held to discuss the hydrogeology and geochemistry of the site with members of the public.

The measures outlined above are expected to remove significant amounts of contamination and may be incorporated in a larger-scale final remedy. The following pages describe remediation activities we expect the Air Force to complete in 2015. These include:

- Installing 16 new monitoring wells.

- Making up to 4 extraction wells operational. The extracted groundwater will be treated to drinking water standards and re-injected back into the aquifer or used for irrigation.
- The existing soil vapor extraction system will be expanded to increase the hydrocarbon removal capacity from 90 pounds per hour to 1,500 pounds per hour.
- Laboratory and field tests of various technologies that might be used to clean up the light non-aqueous phase liquid (LNAPL) fuel will continue **and, in some cases be scaled up.**

We hope that many of you will continue to participate in the quarterly public meetings and periodic field trips to stay informed of site developments and to make sure your voice is heard as we continue to make progress on this important project.

Sincerely,

Ryan Flynn

Ryan Flynn

NMED Cabinet Secretary

Commonly used acronyms and abbreviations:

AFCEC	Air Force Civil Engineering Center
EDB	Ethylene dibromide
EPA	U.S. Environmental Protection Agency
KAFB	Kirtland Air Force Base
LNAPL	Light Non-Aqueous Phase Liquid (in this case, aviation gasoline & jet fuel)
MCL	Maximum Contaminant Level
NMED	New Mexico Environment Department
RCRA	Resource Conservation and Recovery Act (federal)
SDWA	Safe Drinking Water Act (federal)
SVE	Soil Vapor Extraction

Leakage of aviation gasoline and jet fuel from the Kirtland Air Force Base (KAFB) bulk fuel facility migrated through ~500 feet of vadose-zone sediment, and into the underlying aquifer.

The fuel has partitioned into four phases in the soil and groundwater:

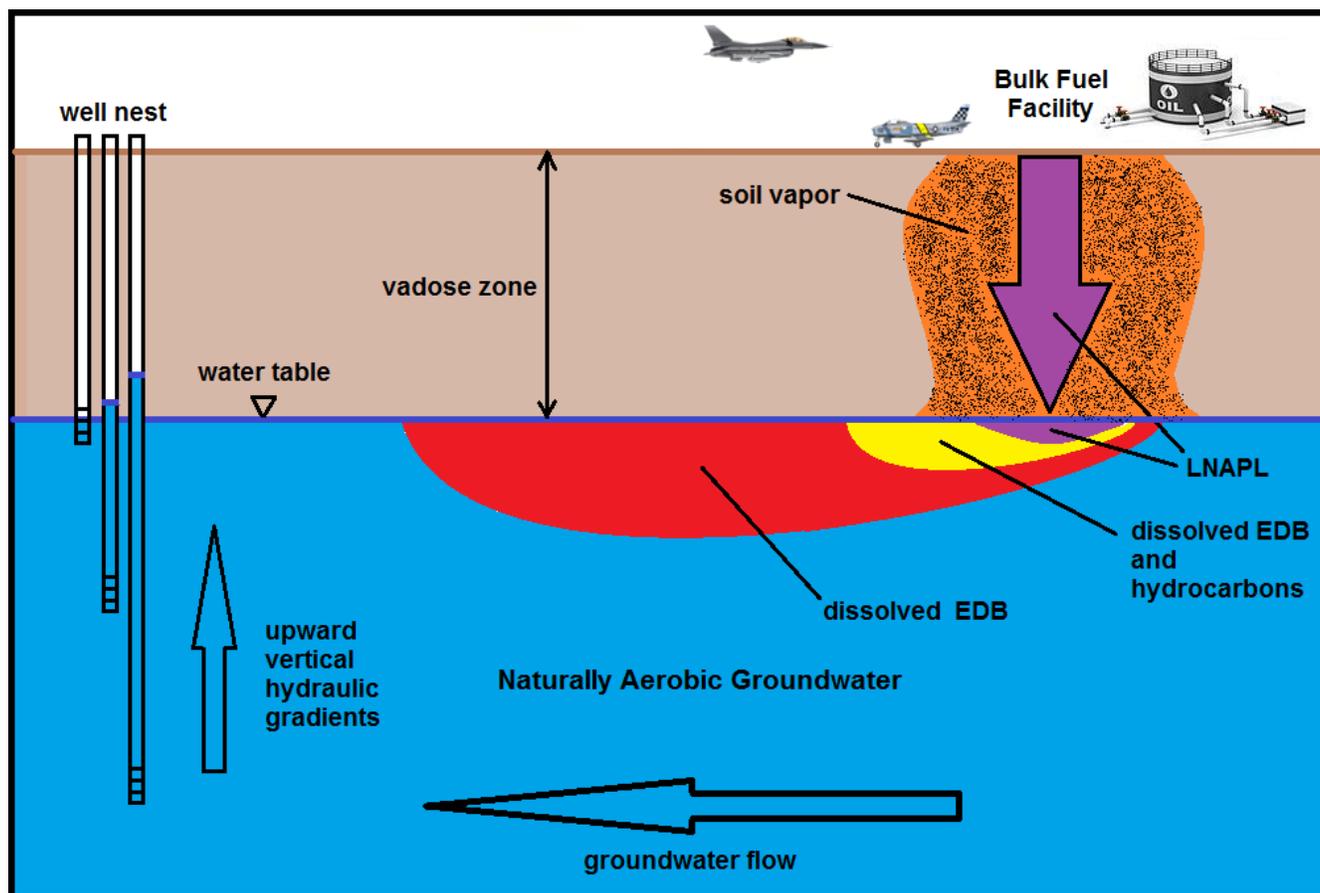
- Light non-aqueous phase liquid (LNAPL, liquid fuel);
- Soil vapor;
- Adsorbed contaminants (attached to soil particles and aquifer matrix);
- Dissolved contaminants (fuel constituents dissolved in groundwater).

LNAPL initially floating on top of the aquifer has become submerged in groundwater by a rising water table.

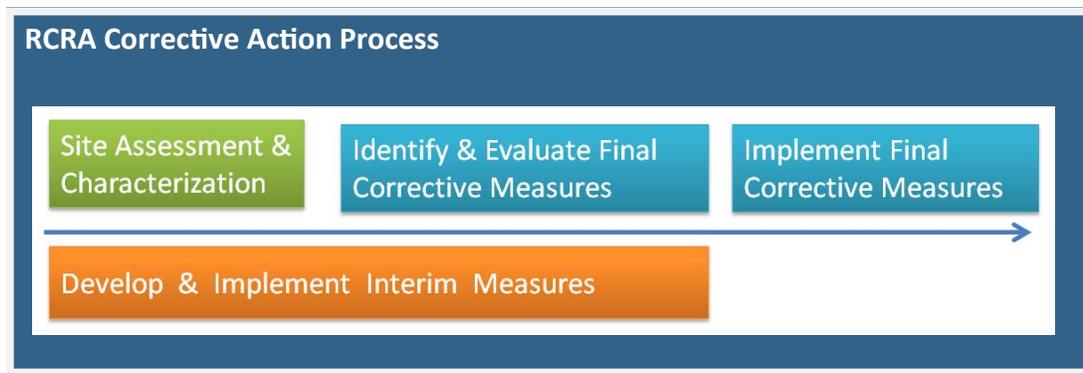
Dissolved ethylene dibromide (EDB, an additive of aviation gasoline) has migrated in groundwater about 6,000 feet away from the source area, but has not contaminated any water supply well.

References for additional technical information are attached in Appendix A.

Schematic Diagram of the KAFB Fuel Spill



New Mexico has primacy granted by the U.S. Environmental Protection Agency (EPA) to administer the federal Resource Conservation and Recovery Act (RCRA) hazardous waste program. The New Mexico Environment Department (NMED) implements the program. Kirtland Air Force Base (KAFB) must comply with their RCRA Hazardous Waste Permit, including the Corrective Action Process.



Some interim measures have been put into place and additional measures are scheduled. Site assessment and characterization activities are ongoing and, upon completion, RCRA Facilities Investigation (RFI) reports will be submitted to NMED. The RFI reports, after approval by NMED, will be used to support the Corrective Measures Evaluation. Teams of multi-disciplinary technical experts (Appendix B) have been created to provide the following support for the corrective action process:

- Identify, and make recommendations to fill data gaps;
- Identify and resolve data quality issues;
- Define and evaluate the physical, chemical, and biological processes that affect the migration and fate of fuel constituents in the vadose zone and groundwater;
- Establish mass balance equations to calculate the amounts of fuel recovered by engineered cleanup actions, destroyed by biodegradation, and remaining in the aquifer and vadose zone.
- Develop a conceptual site model;
- Develop recommendations for cleanup technologies and strategies.

CRITICAL GOALS

1. Protect drinking water wells - do not allow fuel constituents to migrate into any drinking water well at detectable concentrations.
2. Collapse the dissolved-phase EDB plume and pull it back towards the boundary of KAFB, away from the seven supply wells in the area;
3. Remediate fuel (LNAPL) floating on top and submerged in groundwater;
4. Vacuum fuel vapor from the soil to prevent it from migrating into and contaminating groundwater;
5. Maintain a high level of project transparency that exceeds statutory RCRA requirements for public information and involvement.

Each of these goals require a different strategy and course of action which are outlined in the following pages.

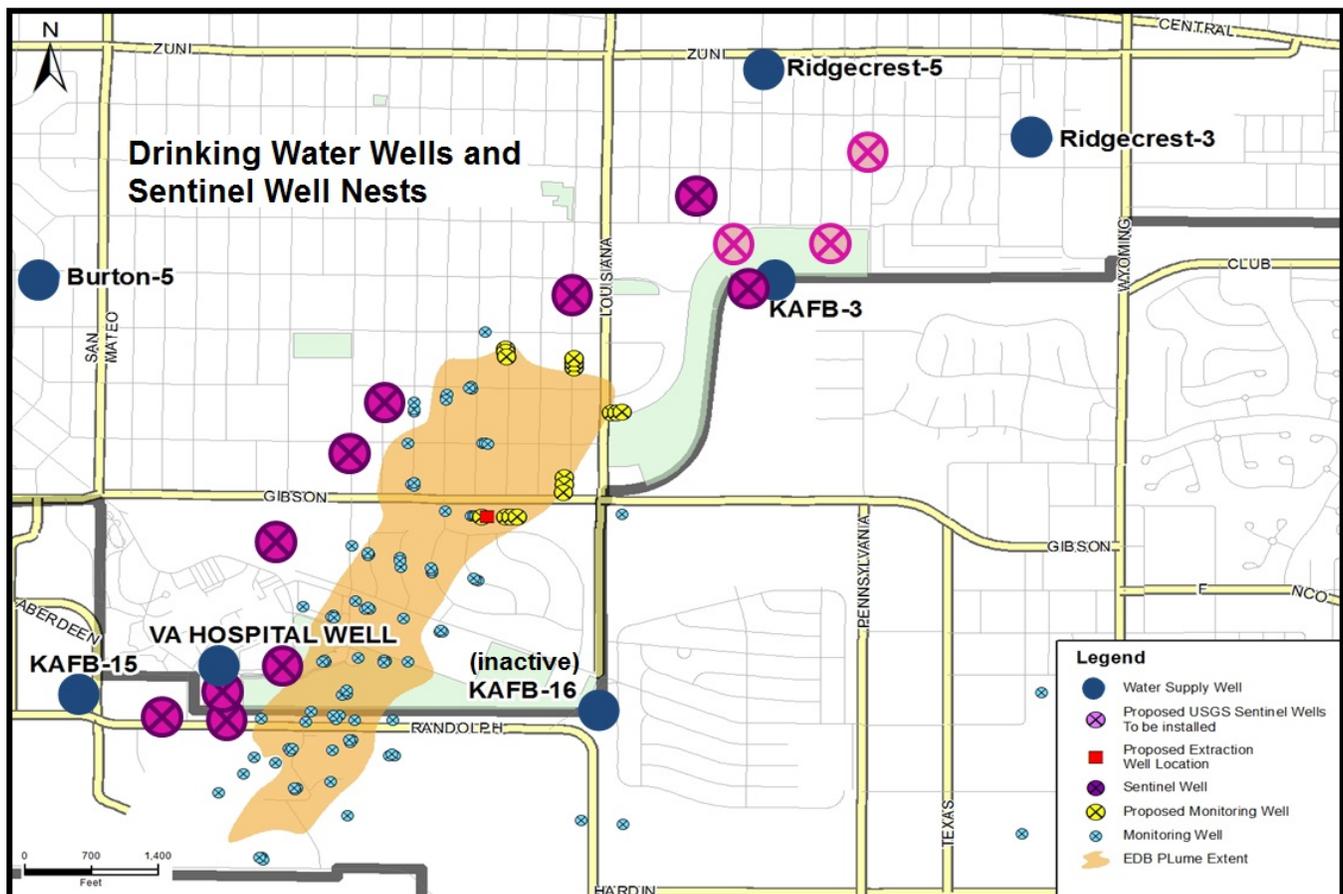
GOAL 1

Protect Drinking water wells - do not allow fuel constituents to migrate into any drinking water well at detectable concentrations.

Strategy

As fuel plume cleanup proceeds, the following plan is being implemented to protect drinking water wells:

- Test for fuel contaminants at drinking water wellheads **monthly**, (current requirements are for testing every 3 years).
- Drill nests of sentinel wells (minimum of 3 wells per nest) located between the fuel plume and drinking water supply wells.
- **Test sentinel wells quarterly** to provide early detection of any contaminant migration towards the drinking water wells.
- Establish geochemical indicator parameters and action levels for sentinel wells, attainment of which would trigger a review of current hydrogeological conditions, increased monitoring, or intervention.



Drinking Water Standards

NMED has primacy granted by the U.S. EPA to administer the federal Safe Drinking Water Act (SDWA) program. One of NMED's SDWA responsibilities is to require that public water systems supply drinking water to consumers that complies with the EPA Primary (human health based) Maximum Contaminant Levels (MCLs).

Constituent	Primary MCL* (µg/L)
Ethylene dibromide (EDB)	0.05
Ethylene dichloride (EDC)	5
Benzene	5
Toluene	1,000
Ethylbenzene	700
Xylenes (total)	10,000

*EPA Maximum Contaminant Levels (MCLs) adopted by NM as part of our primacy.
(<http://water.epa.gov/drink/contaminants/>)

To date, fuel constituents have never been detected in any of the public water supply wells.

The goal of this strategic plan is to collapse the contamination plume and pull it back towards the boundary of KAFB before it ever reaches a drinking water well.

GOAL 2

Collapse the dissolved-phase EDB plume and pull it back towards the boundary of KAFB, away from the seven drinking water wells in the area.

Strategy

Develop a robust monitoring and pump and treat system. NMED will oversee the following actions to be performed by the Air Force and their contractors:

Phase 1 (Interim measures)

- Define the horizontal and vertical extent of EDB contamination in groundwater by the drilling of at least 16 additional monitoring wells.
- Install a pilot extraction well at the KAFB-106035 well nest location.
- Construct a pipeline to convey water from the KAFB-106035 well nest location.
- Construct a granular activated carbon filtration system to treat the approximately 100 gallons per minute of extracted water to at least the EPA drinking water MCL of 0.05 µg/L.
- Construct an infiltration gallery, permitted by the NMED Groundwater Bureau, to disperse the treated water into the subsurface and allow it to recharge groundwater.
- Explore other options for the beneficial use of treated water such as landscape irrigation and dust control.

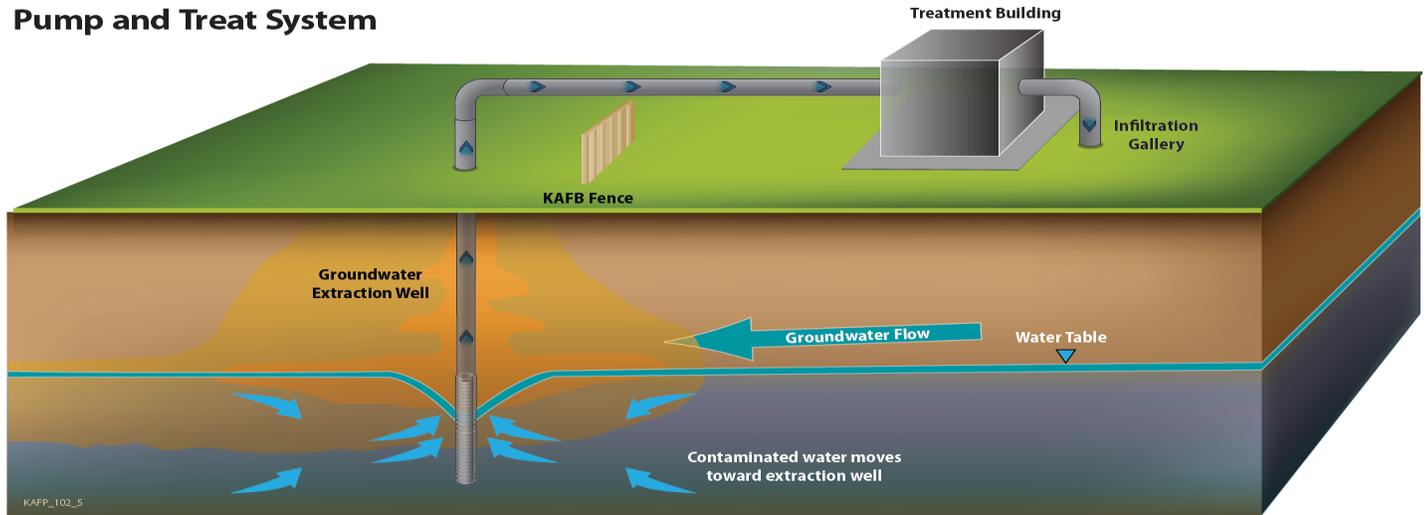
Phase 2 (Interim measures)

- Use hydrogeological data and numerical modeling simulations, as appropriate, to locate and design up to 7 additional extraction wells located throughout the dissolved-phase EDB plume.
- Drill up to 7 additional extraction wells.
- Upgrade conveyance, treatment and infiltration systems, as necessary, to accommodate up to approximately 600-800 gallons per minute of extracted water.

Phase 3 (Final measures)

- In accordance with the requirements of the federal Resource Recovery and Conservation Act, evaluate, select and implement a final corrective measure for dissolved-phase EDB.
- Implement long-term operation, maintenance and optimization of pump-and-treat system to collapse plume and pull it back towards the boundary of KAFB.

Pump and Treat System



GOAL 3

Remediate the fuel (LNAPL) floating on top and submerged in the groundwater (above and below the aquifer water table). *LNAPL = light non-aqueous phase liquid

Strategy

Pilot Tests

NMED will oversee evaluations performed by the Air Force and their contractors to explore the feasibility and effectiveness of the following remediation technologies:

- Air sparging (blowing air into the groundwater to strip out contaminants, followed by vacuuming the stripped contaminants from soil);
- Steam sparging (blowing steam into the groundwater to strip out contaminants, followed by vacuuming the stripped contaminants from soil);
- **Surfactant** flushing (injection of surfactant into the LNAPL zone to mobilize the LNAPL to facilitate fuel recovery);
- Bio-stimulation (introducing amendments to stimulate native aquifer bacteria into doing a better job of biodegrading contaminants);
- Bio-augmentation (introducing specialized bacteria into the aquifer to biodegrade the contaminants even faster).

Scaled-up laboratory and field pilot tests will be conducted for critical evaluation of remediation technologies that are deemed to be potentially feasible. Numerical modeling simulations will be performed, as needed, to assist with the evaluation of these technologies.

LNAPL Measurement Techniques

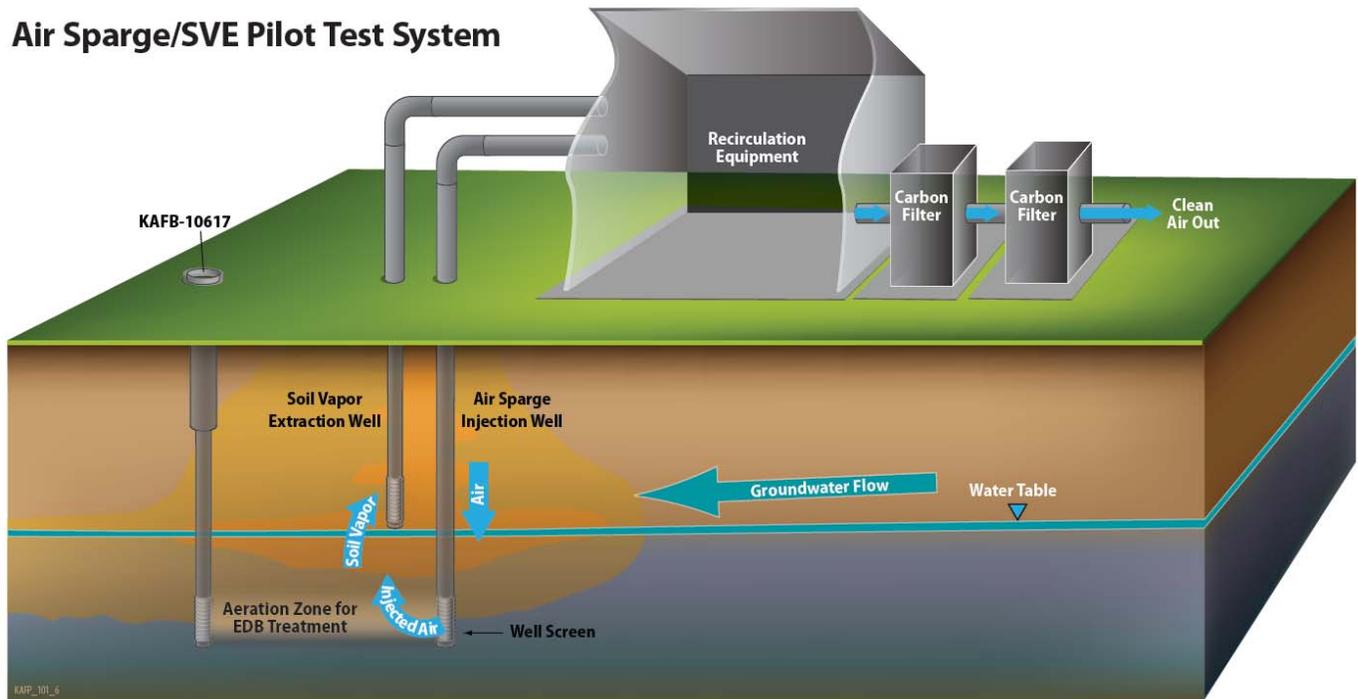
Evaluations and tests of non-invasive methods of detecting and measuring submerged LNAPL will be conducted in parallel with the remediation pilot tests. Techniques to be considered include, but are not necessarily limited to:

- Borehole geophysics;
- **Contaminant concentration gradients;**
- **Environmental Tracers.**

Final Corrective Measure Evaluation, Selection, and Implementation

- In accordance with the requirements of the federal Resource Recovery and Conservation Act, evaluate, select and implement a final corrective measure for LNAPL remediation. This may include a combination of different treatments.
- Establish LNAPL metrics to determine when LNAPL remediation is complete.
- Operation, maintenance, and optimization of the remediation system until LNAPL metrics approved by NMED are met.

Air Sparge/SVE Pilot Test System



GOAL 4

Vacuum fuel vapor from the soil to prevent it from migrating into and contaminating groundwater.

Strategy

Interim Measures

Soil vapor extraction (SVE) has been operating since 2003 and has removed more than 500,000 gallons of fuel from the vadose zone.

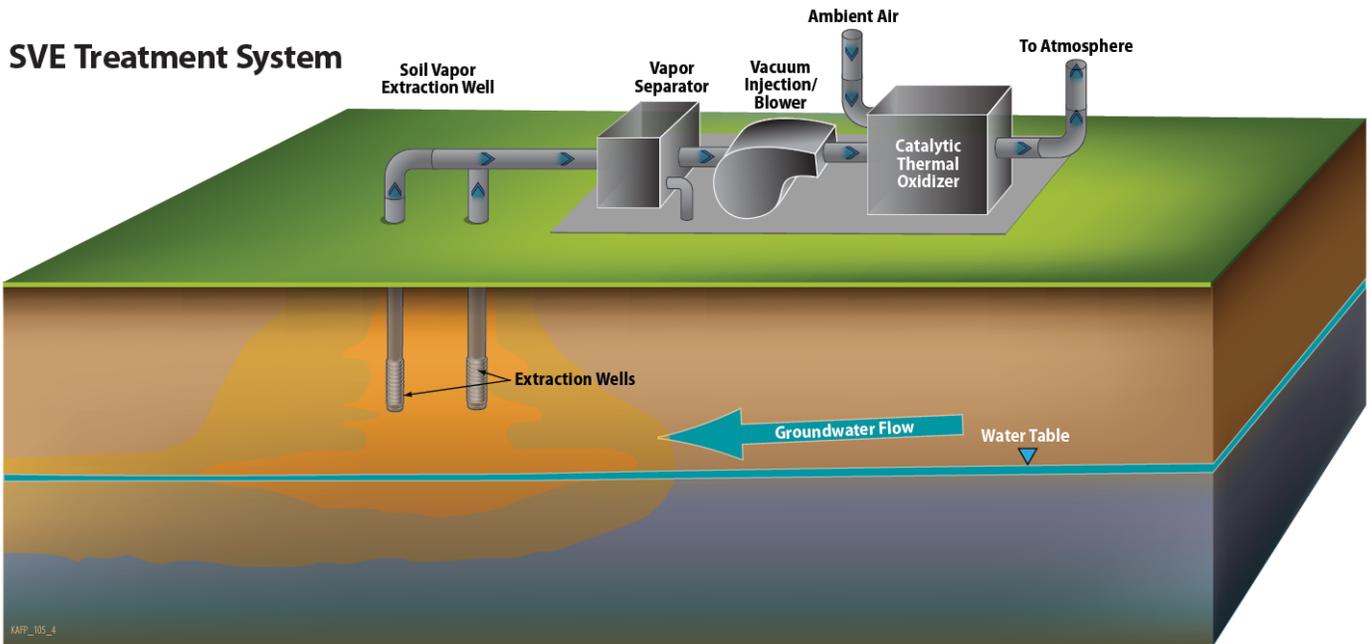
NMED will oversee the following additional actions by the Air Force to increase the robustness of SVE:

- Shut down SVE for an appropriate period of time to observe rebound of contaminant levels.
- Conduct *in-situ* microbiological respiration tests during the SVE shutdown period.
- Drill additional SVE wells into suspected LNAPL and hotspot areas.
- Terminate the current air quality permit, and apply to the Albuquerque Environmental Health Department (AEHD) for a new permit for pilot testing of the new SVE wells.
- Install temporary internal combustion engine (ICE) treatment systems, in accordance with the new permit, for pilot testing of new SVE wells.
- Conduct pilot testing using both the current catalytic oxidation (CATOX) and ICE treatment systems.
- After pilot testing, dismantle the CATOX system use ICE treatment to vacuum hotspots.
- After completion of all pilot testing and hot spot treatment, remove the ICE systems.
- Evaluate the potential benefits of a bioventing pilot test. If justified, conduct a bioventing test after all pilot testing and hotspot treatment are complete.
- Design a new robust SVE system, capable of treating up to 1,500 pounds per hour of hydrocarbons extracted in soil vapor; apply for an AEHD air permit for the system.
- Construct the new robust SVE system, operate, maintain and optimize as necessary in accordance with the permit.
- Treat soil vapor extracted from the LNAPL air-sparging pilot test as treatment capacity allows.

Final Corrective Measure Evaluation, Selection and Implementation

- In accordance with the requirements of the federal Resource Recovery and Conservation Act, evaluate, select, and implement a final corrective measure for the vadose zone.
- Establish soil vapor cleanup concentrations that will not be capable of contaminating groundwater.
- Operation, maintenance, and optimization of the SVE system until soil vapor cleanup concentrations approved by NMED are met.

Soil Vapor Extraction



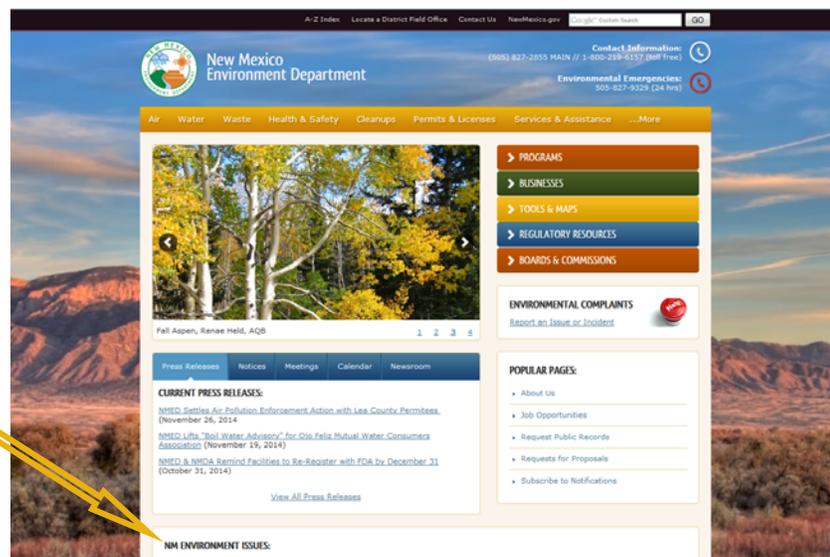
GOAL 5

Maintain a high level of project transparency that exceeds statutory RCRA requirements for public information and involvement.

Strategy

- Maintain a KAFB fuel spill cleanup website on the NMED server to make correspondence and technical information readily available to the public. Documents to be posted include, but will not necessarily be limited to, proposed and final work plans, quarterly reports, technical working group meeting minutes, RFI reports, and NMED approval letters.
- Maintain a KAFB fuel spill cleanup Listserv to send out periodic messages informing the public of important news and opportunities for involvement.
- Participate in quarterly public meetings hosted by the Air Force, to include poster sessions and presentations.
- Make presentations, as requested, to neighborhood associations, city and county governmental agencies, legislative committees, and to other organizations interested in the KAFB fuel cleanup.
- Host occasional field trips, in coordination with other stakeholders, to inform the public about site geology, hydrology, geochemistry, and cleanup actions.
- Explore public interest in participating in working groups to address various components of site investigation and cleanup. Host working group sessions, in coordination with other stakeholders, if public interest exists.
- Conduct a robust public outreach and involvement program for evaluation and selection of final corrective measures in compliance with statutory RCRA requirements.
- Update this Strategic Plan on an annual basis.

KAFB Fuel Spill
Updates on NMED
homepage



Also see: Kirtland Air Force Base Bulk Fuels Facility - Jet Fuel Plume Remediation Web Page at....

<http://www.nmenv.state.nm.us/NMED/Issues/KirtlandFuelPlume/index.html>

References for Additional Technical Information

Groundwater Extraction Pilot and Additional Characterization

KAFB workplan, August 1, 2014

http://www.nmenv.state.nm.us/NMED/Issues/KAFB_docs/KAFB_EDB%20IM%20Work%20Plan_2014Aug1_Rev1+figures+letter.pdf

NMED approval letter, August 20, 2014

http://www.nmenv.state.nm.us/NMED/Issues/KAFB_docs/NMED%20Approval%20Letter%208-20-14%20Signed.pdf

Quarterly Monitoring and Site Investigation Reports (full text, figures and tables)

http://www.kirtlandjetfuelremediation.com/projdocs/projdocs_ov.htm

- 2014, April-June
- 2014, January-March
- 2013, October-December
- 2013, July-September
- 2013, April-June

Public Meeting Presentations and Field Trip Handouts

<http://www.nmenv.state.nm.us/NMED/Issues/KirtlandFuelPlume/PublicOutreach.html>

Historical Reports and Correspondence (dating back to 1999)

- NMED <http://www.nmenv.state.nm.us/HWB/kafbperm.htm#KAFBBulkFuelsFacSpill>
- KAFB <http://www.kirtlandjetfuelremediation.com/>

KAFB Technical Working Group Mission Statements

Multidisciplinary working groups have been established to provide detailed review and analysis of highly technical issues pertaining to the investigation and cleanup of the Kirtland Air Force Base fuel spill. The groups consist of staff scientists and engineers from the New Mexico Environment Department, Kirtland Air Force Base, the Air Force Civil Engineering Center, Air Force consultant CB&I, the Albuquerque Bernalillo County Water Utility Authority (ABCWUA), ABCWUA consultant INTERA, the City of Albuquerque Environmental Health Department, and U.S. Environmental Protection Agency (EPA). Each working group shall prepare minutes documenting the attendance, discussion, and homework assignments from each meeting, and the minutes shall be posted on the NMED web site.

Hydrogeology Working Group

The hydrogeology working group will review published maps and reports, lithologic logs, well records, core samples, drill cuttings, airborne, surface and borehole geophysical data, water level data and other information. The hydrogeology group will use this information to define stratigraphy, structural features, and aquifer hydraulics in the vicinity of the fuel contamination. The hydrogeology group also will define background aquifer geochemistry, but will not address geochemical alterations caused by fuel contamination as that subject will be addressed by the biogeochemistry/LNAPL working group.

The hydrogeology group will have the following specific responsibilities:

1. Assembly or, if necessary, preparation of maps, cross sections, fence diagrams, graphs, Stiff diagrams, trilinear plots, time trends, interpretations and other material as appropriate to document site hydrogeologic conditions.
2. Provide detailed stratigraphic and other geotechnical information to the SVE, biogeochemistry/LNAPL and modeling work groups for their consideration and use in their areas of responsibility.
3. Field oversight of drilling operations, including review and approval of lithologic logs and proposed well completions.
4. Oversee borehole geophysical logging; analysis of logging data.
5. Oversee the design, implementation and interpretation of aquifer performance testing.
6. Develop a conceptual site model in coordination with other technical work groups.
7. Identify and resolve field and laboratory QA/QC issues.
8. Review water-level and water-quality monitoring data from the hydrodynamic dissolved-phase EDB extraction system.
9. Coordinate with ABCWUA, KAFB and NMVAHCS on protection of public drinking water wells.
10. Define background conditions for dissolved oxygen, nitrate, alkalinity, bromide and other parameters of concern.
11. Develop indicator parameter concentrations for sentinel wells that, if observed, would trigger additional review, increased monitoring, or intervention.
12. Plan and host occasional geological field trips for the general public, in coordination with other working groups.

Biogeochemistry/LNAPL Working Group

The biogeochemistry/LNAPL working group will investigate and define the physical, microbial, geochemical, and hydrogeological processes that control the fate and transport of dissolved, non-aqueous liquid, gaseous and adsorbed phase contaminants, and evaluate potential remediation options. Dissolved phase contaminants of concern include 1,2-dibromoethane (ethylene dibromide, EDB), benzene, toluene, ethylbenzene, and xylene isomers (BTEX), polynuclear aromatic and aliphatic hydrocarbons, and 1,2-dichloroethane. Parameters of interest regarding natural and engineered degradation processes include dissolved oxygen, ORP, nitrate, manganese, iron, sulfate, methane, carbon dioxide, alkalinity, bromide, chloride, and stable isotopes of various elements.

The biogeochemistry/LNAPL group will have the following specific responsibilities:

1. Characterize the physical and chemical properties of light non-aqueous phase liquids (LNAPLs) that are submerged within or floating atop groundwater.
2. Identify specific chemical and biological mechanisms that have transformed or degraded contaminants, along with reaction rates and byproducts.
3. Make recommendations for additional sampling and analysis as needed.
4. Use stoichiometric equations to calculate the amounts of contaminants that have been transformed or degraded in the vadose zone and in groundwater.
5. Maintain a running quantification of the amount of EDB that has been removed by the pump-and-treat system.
6. Evaluate potential remediation options for additional removal or destruction of fuel contaminants. Such options may include, but may not necessarily be limited to, pump and treat, air or steam sparging, soil vapor extraction, biostimulation, bioaugmentation, bioventing, surfactant flooding, and monitored natural attenuation.
7. Make recommendations for scaled up laboratory and field-scale pilot tests of potentially viable remediation technologies.

Soil Vapor Extraction Working Group

The soil vapor extraction (SVE) working group will review lithologic data, soil vapor concentrations, and performance data from historical and ongoing SVE operations to make recommendations on increasing the robustness of SVE activities.

The SVE group will have the following specific responsibilities:

1. Identify soil vapor hotspots needing additional treatment.
2. Recommend locations and completion specifications for additional extraction wells.
3. Oversee pilot testing, shutdown/rebound periods, and the ongoing performance of SVE activities.
4. In coordination with the biogeochemistry/LNAPL group, maintain a running quantification of the amounts of hydrocarbons that have been removed by SVE and by biodegradation in the vadose zone.

Modeling Working Group

The modeling working group will design, run and calibrate numerical simulations of contaminant transport and fate.

The modeling group will be responsible for the following types of simulations:

1. EDB transport times to drinking water wells in the area under various scenarios.
2. Hydrodynamic capture zones for various configurations of extraction wells for pump-and-treat remediation.

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Dan Koning Comments from PDF (copied from PDF comment boxes)

Pg i: Many elements of this sentence are repetitive with the earlier highlighted sentence.

Pg ii: Either delete the comma after "and" or add a comma after "cases,"

Pg 1: comma is not needed

Pg 2, #1: Comma is not needed

Pg 2, #2: From a scientific standpoint, I don't object to detectable levels of contaminant going into a well if it can be diluted/mixed below the safety standard. Also, there might be cases where abandoning a drinking supply well and drilling a new one elsewhere might be more economical and rational.

Pg 3, # 1: Delete this period but keep the period after the parentheses.

Pg 3, #2: Since the sentinel wells are closer to the plume, they should be tested at the same frequency as the supply wells. What is the testing frequency of the other monitoring wells?

Pg 3, #3: Why are some of the proposed USGS Sentinel Wells shaded in a lighter shade of red/purple (esp those near KAFB-3).

Pg 4: This sentence is not needed, as the wording is repeated almost verbatim at the beginning of the next page (goal 2).

Pg 5, #1: Are these the sentinel wells? There are 13 proposed sentinel locations, not 16, but if you count 3 wells per nest then there are 39 proposed wells. Anyways, I'm confused about the monitoring well numbers and how monitoring wells relate to sentinel wells.

Pg 5, #2: I suggest putting a comma between "water" and "such".

Pg 7, #1: I had to look up "surfactant" to remind myself of the definition." You may want to define that in the text, since you do a good job of explaining other technical terms.

Pg 7, #2: Vague. I suggest saying something like: "take ground water samples, measure the LNALP using standard laboratory procedures, and define contaminant concentration gradients."

Pg 7, #3: Vague. I suggest saying something like: "take ground water samples, measure the LNALP using standard laboratory procedures, and define contaminant concentration gradients."

Pg 9, #1; Lots of proposals, but I would like a little more detail about the rational. For example, explain why the ICE system is better than the CATOX system. Why the progression from CATOX, ICE, and then a new and better SVE system?

Pg 9, #2; "and" is needed here

Appendix B

#1 Add the NM Bureau of Geology and Mineral Resources if we end up playing a meaningful role.

#2 I would delete "interpretations" and add on a new sentence that says something like: "Strive to reach a consensus on hydrogeologic interpretations involving these datasets."

#3 Replace ";" with "and"

**CITIZEN ACTION NEW MEXICO COMMENTS FOR THE
NEW MEXICO ENVIRONMENT DEPARTMENT'S
2015 STRATEGY PLAN FOR THE KIRTLAND AIR FORCE BASE JET FUEL SPILL
JANUARY 30, 2015**

Citizen Action New Mexico submits the following comments for the NMED 2015 Strategy Plan.

NEED FOR INDEPENDENT SCIENTIFIC TASK FORCE

The New Mexico Legislature passed House/Senate Joint Memorial (HJM) 13 in the 2014 Legislative Session. HJM 13 asked for an independent task force to examine scientific measures that could be taken for emergency short term and long term strategies for cleaning up the Kirtland Air Force Base (KAFB) jet fuel spill. The spill threatens Albuquerque municipal wells and is contaminating billions of gallons of water in the aquifer. There is the need for all group inputs to be integrated through an engineering analysis process and oversight review. CB&I has not shown leadership nor has to date the AF. The use of the expertise offered by the National Research Council of the National Academies of Science could provide a much needed review of the situation.

EMERGENCY STATUS OF JET FUEL SPILL

Unfortunately, the KAFB jet fuel spill is still not recognized as an emergency although estimates of the fuel spilled range as high as 24,000,000 gallons. Such an independent task force has not been put into place and NMED has opposed its formation arguing that delay would be imposed. There is no independent review process for the 2015 Strategy Plan (Plan). The Plan promise to be “robust” and “aggressive” is short on real action that will actually “collapse” the plume. The term “collapse” is inappropriate and the term “containment” or “removal” should be used. There is not a containment goal set forth by the 2015 Plan and suggested strategies do not support that goal.

In 2012 Citizen Action requested an emergency response to the jet fuel spill either under CERCLA or Resource Conservation and Recovery Act (RCRA) to be carried out by either NMED or the US Environmental Protection Agency (EPA). NMED continues to argue that no emergency exists. Yet three years later, not a gallon of jet fuel submerged and dissolved in the aquifer has been removed.

PLAN SHOULD FOLLOW RCRA PROCEDURES

While the strategies are welcome from the standpoint of characterization of the plume, the 2015 Plan is not part of a formal RCRA process. There is the need to complete the RFI and move on to the Corrective Measures Study (CMS) and a Corrective Measures Implementation Plan (CMI) with full public input at each stage.

It is not clear who is making the decisions due to the large number of participants. Consistency in leadership is absent. The NMED has shifted the problem from the Groundwater Protection Bureau to the Hazardous Waste Bureau (HWB) in 2010, then the HWB was put under the Health Division. The leadership for the KAFB spill has shown a lack of sustained consistency caused by the multiple turnover of leaders in the Air Force and NMED. The line of authority for the charge of the RCRA process should be publicly clarified.

A major concern is that no site conceptual plan has been designed to guide the investigation to obtain full knowledge of the full length, width, depth of the plume and the rate the plume is moving. An appropriate remediation plan for dissolved EDB removal cannot be designed due to “data gaps” and lack of a site conceptual model.

The RCRA Facility Investigation (RFI) that was to accomplish the fact finding, prior to remedy design, has not been accomplished. The KAFB RFI was so flawed by “data gaps,” while claiming that none existed, that thousands of pages constituting the entire RFI were withdrawn by the Air Force.

While NMED has the authority under RCRA to require full characterization of the EDB plume, it has not exercised that authority. The necessary number of monitoring wells have not been installed for full characterization. The leading edge of the EDB plume remains unknown. Many of the existing monitoring wells have flawed sampling due to the presence of air bubbles that destroy knowledge of Volatile Organic Compounds (VOCs). Well screens that were supposed to monitor at the water table are submerged. While 15 well screens are proposed to be installed at the computer generated, suspected edge of the EDB plume, the hydrostratigraphy between the municipal wells and assumed EDB front is not well characterized. The regional hydraulic gradient was

used for hydraulic conductivity but is required to be site specific. There is no proof that the 6500 ft long by 1000 ft wide EDB plume can be contained or captured by the technologies proposed in the 2015 Plan.

STRATEGIES DO NOT FIT THE GOALS

When the admirable goals of the 2015 Plan are considered against the actual strategies for achieving the plan's goals, it is evident that the strategies do little if anything to prevent the further advance or containment of the carcinogenic plume of Ethylene Dibromide (EDB) from reaching Albuquerque's municipal wells. Gantt Charts for the scheduled projects and time completion dates are needed. The absence of coordination and enforcement of deadlines has resulted in years of delay. The recent plan to fine KAFB for missing a December 2014 deadline with an extension for another six months and the possibility of fine reduction is an example. The 2015 Plan has the appearance of a public relations document designed more to quell the fire of public apprehension about contamination of the water supply than to accomplish removal of the dissolved plume of EDB.

1. **Goal 1.** The goal for the strategy plan aimed at prevention of the plume of Ethylene Dibromide (EDB) from reaching the municipal wells is appropriate. However, the goal does not identify the protection of the supply well for the Veteran's Administration well or KAFB supply well #3. Monthly monitoring of the municipal wells does not halt the movement of the EDB plume. Sentinel wells do not stop the EDB plume movement. Quarterly testing of monitoring wells will not stop the EDB movement. Measuring geochemical parameters will not terminate the plume's forward movement.
2. **Goal 2.** Collapse of the plume and pull back to KAFB boundary. The period of the operation of a pilot well is not described. The timeline for an indefinite number of extraction wells is not defined and no number is provided. No obligation is imposed upon the Air Force. The strategies of additional monitoring wells, pipeline granular carbon filtration system, and an infiltration pit will not contain the EDB plume or pull it back. It is unknown how many extraction wells would actually be necessary to accomplish the goal. Rate of travel and the extent of the plume is unknown. The

geohydrology is not adequately known. The efficacy of the pumping of the extraction wells for containment of the plume is unknown. How large would the treatment facility need to be? The “exploration of other options” is vague and without description. To consider that a decades old 120 acre plume of contamination will be “collapsed” aggressively by “robust” installation of a pilot extraction well and possibly no others is not credible.

3. **Goal 3.** Treatment of the floating and submerged LNAPL. Use of air sparging will create an even larger dissolved plume. The introduction of unknown surfactants, amendments and bacteria are not described and may be counter to the Safe Drinking Water Act. Laboratory tests and field pilot tests are not described in any time frame.
4. **Goal 4.** Soil Vapor Extraction. SVE will not stop the dissolved phase plume from spreading.
5. **Goal 5.** Public involvement. The public is not included in any of the working groups. The assumption seems to be that no members of the public would be able to comprehend the highly technical issues. Information needs to be summarized and interpreted before it goes to the public. Too much scattered information.

RISK -- MOBILIZATION OF CONTAMINATION

All proposed remedies can result in remobilization unless the remedial strategy is carefully designed to prevent that. More data is needed to ascertain the costs and the ability to achieve treatment of EDB to the level of 50 parts per trillion.

Air sparging and SVE systems are not effectual for the removal of dissolved EDB. Air sparging may further mobilize EDB in the aquifer. Air sparging will have no immediate effect outside the immediate radius of the wells. Injection of air may stimulate bioremediation of VOCs but will not induce bioremediation of EDB. EDB does not respond to natural attenuation and is less responsive to most remediation methods compared with BTEX or MTBE.

According to the EPA, “*Air sparging* is generally more applicable to the lighter gasoline constituents (i.e., benzene, ethylbenzene, toluene, and xylene [BTEX]), because they

readily transfer from the dissolved to the gaseous phase. Air sparging is less applicable to diesel fuel and kerosene.” From Exhibit VII-2 -- Air sparging “Cannot be used if free product exists (i.e., any free product must be removed).”

http://www.epa.gov/oust/pubs/tum_ch7.pdf

Air sparging is a technology that has been used successfully for VOCs, but while it can break up liquid product it can cause greater mobilization of contaminants. Clean up strategies commonly used for BTEX don't work well for EDB and DCA. There is a lack of research on how to clean up EDB and DCA on a field scale. Treatment of BTEX may expand EDB and DCA plumes resulting in more area to treat.

http://www.astswmo.org/Files/Meetings/2008/2008-State_Fund_Admin/Read_Minor-EDB_Lead_Scavengers.pdf

Pump and Treat Extraction Wells

Note that the plan states “up to” eight Pump and Treat (P&T) extraction wells but provides no actual agreed number, time period for installation or locations. Installation of one or even up to eight pump and treat extraction wells will not be adequate to contain the EDB plume movement. A single P&T extraction well will remove perhaps 100 gallons per minute of contaminated water that would amount to 800 gallons per minute. The draw for a single Ridgecrest well can be 3000 gallons per minute. Monitoring wells across the width of the EDB plume are insufficient in number to determine where P&T wells should be placed.

Soil Vapor Extraction

Although NMED claims 500,000 gallons of jet fuel removal through Soil Vapor Extraction (SVE), it should be noted that 400,000 gallons of that amount was removed considerably prior to the installation of the new SVE system that has repeatedly malfunctioned and failed to deliver what the Air Force and its contractor claimed. No mass balance for what has been removed or for what remains in the vadose zone is accounted for in the 2015 strategy. Environmental Protection Agency (EPA) manuals clearly describe that SVE technology is not usable for diesel type fuels in the aquifer. SVE technology cannot clean up the jet fuel trapped beneath the water table.

PUBLIC PARTICIPATION

The RCRA requirements for participation of the public in technical discussions or for updates regarding technical issues and possible solutions has been largely absent. 63 Fed Reg. 56710. While the NMED, Water Utility Authority, KAFB and contractor CB&I hold meetings amongst themselves, there are no minutes or documents recording those discussions that the public may review. The Citizens Advisory Board, while severely compromised by the way it was managed, no longer exists. Public concerns have been raised for the misinformation provided at the CAB meetings. As a result of this, the public has lost confidence and feels the leadership lacks credibility.

SAFETY OF MUNICIPAL WATER STILL NOT VERIFIABLE

The claims by Kirtland and NMED that the municipal water is not contaminated cannot be verified. The well screen lengths for the Ridgecrest supply wells are 800 ft long and pumping is at a rate of nearly 3000 gallons per minute. So there is tremendous dilution of a one liter sample taken from a municipal well when one is looking for contamination in parts per trillion. The municipal wells do not have an annular ring in their boreholes to protect contaminated groundwater flowing in from any level. Monitoring wells have a screen not more than 15 ft long and take very discreet samples. Kirtland has not provided monitoring wells at the location of the supply wells called for by the Water Utility Authority in Resolution 2012-14.

After 15 years since notification of the fuel spill at the fuel off-loading racks, the only actual technologies now proposed, primarily for study purposes, to address the removal of the jet fuel and containment of the fuel spill, still remain to be accomplished:

- The installation of one (1) pilot extraction well to study pump and treat technology;
- The installation of air sparging;
- The installation of a more “robust” soil vapor extraction (SVE) system.
- Bioremediation studies.

CORRECTION OF DEFICIENCIES IN THE 2015 PLAN.

1. The 2015 Plan does not provide a comprehensive roadmap for protection of human health and the environment. It does not provide a strategy that has a demonstrated basis to prevent the EDB from moving to the municipal wells.

2. The goals are not achieved in any cognizable time period by the strategies.
3. The plan appears to lock in remediation for sparging, SVE and P&T in a fashion that is not technically justifiable or coordinated.
4. The plan does not follow RCRA procedures for characterizing the fuel spill, conducting an adequate RFI, CMS and CMI.
5. Only one (1) P&T extraction well is obligated under the plan after 15 years, hardly an aggressive strategy.
6. It is illegal to further contaminate the aquifer. KAFB has already contaminated the aquifer sufficiently.
7. The plan provides no independent oversight.
8. The plan provides no genuine public participation.

Dear Mr. McQuillan The following is applicable to the KAFB jet fuel spill to be added to Citizen Action comments on the 2015 Strategy Plan that still lacks a three dimensional site conceptual plan.

Dave McCoy

Wikipedia: Anisotropy / [ænaɪˈsɒtrəpi](#)/ is property of being directionally dependent

Sterrett, Robert J. *Groundwater and Wells Third Edition 2007* Johnson Screens Litho Tech, Bloomington MN

p. 635

"In aquifers with significant anisotropy-especially fractured rock-the direction of groundwater flow (and chemical migration) might not be parallel to the hydraulic gradient (Fetter 2001). This is an important concept, because a plume of chemicals could migrate in a direction that is very different from the hydraulic gradient."

"The overall objective of a site investigation is to assess the lateral and vertical extent of detectable concentrations of chemicals of interest in soil and groundwater. After this assessment is made, a determination of the fate and transport of chemicals in the subsurface also is made so that all receptors (e.g., drinking-water wells, ecologically sensitive areas) can be protected. Achieving this objective might require the installation of wells at multiple depths and locations."

"Selection of appropriate depends on the density of the chemical of interest, anisotropic characteristics of the aquifer, hydraulic gradients, (vertical and horizontal), and hydrostratigraphy of the site. Wells generally are located within the source area to assess source concentrations, and downgradient of the source to assess the extent of detectable concentrations of chemical."

p. 635-636

"The overall goal of a groundwater monitoring program is to develop a three-dimensional conceptual model of the site and a temporal evaluation of chemical concentration trends."

Attachment C.2.

NMED Response to Dave McCoy

General Responses

Citizen Action New Mexico continues to present inconsistent, contradictory and counterproductive positions on what should be done to investigate and clean up the fuel spill.

CANM has been very vocal and critical of NMED with regard to what CANM believes NMED should not do to clean up the fuel contamination. In fact, as will be discussed below, CANM has objected to many of the technologies that have been proven to be able to clean up gasoline and jet fuel contamination, thereby leaving NMED with few options that CANM has not yet objected to. But, other than what CANM associate Dwight Patterson has proposed, CANM has provided very little information as to what technologies and strategies it believes should be used to clean up the fuel.

Dwight Patterson is described on the CANM Facebook page as a “Citizen Action contributor”, was one of the CANM panelists in the 2014 “teach in”, and has been quoted as a source of technical information on several CANM webpages and documents. Mr. Patterson has proposed to pump Ridgecrest well #5, deliberately pull the contamination into the well, treat the water, and blend it into the Albuquerque drinking water system. Mr. Patterson has delivered his idea to deliberately contaminate Ridgecrest #5 with EDB to the ABC Water Utility and to the Albuquerque Groundwater Protection Advisory Board. In his written proposal entitled, “Dwight Patterson Kirtland EDB Plume Containment Plan” provided to the ABCWUA board on November 9, 2012, Mr. Patterson’s recommended solution was,

“The main idea is this: Convert Ridgecrest #5 into an environmental EDB capture well that will capture 100% of the EDB water so the Charles and Love well fields do not ever see EDB.

Most important rule TO FOLLOW: DO NOT EVER TURN OFF RIDGECREST #5 WELL. EVER! FOR ANY REASON.”

NMED has been under the impression, however, that CANM shared our belief that the EDB contamination should be contained and not allowed to contaminate any of the Ridgecrest drinking water wells. If CANM disagrees with the recommendations of its own expert, we respect that, but CANM should take a clear and consistent position on this issue.

As another example of CANM inconsistency, we find it rather hypocritical that CANM now asserts that, “The necessary number of monitoring wells have not been installed for full characterization,” when CANM had previously asserted that, “More monitoring wells only allow the plume to travel further towards KAFB number 3 and Ridgecrest wells.” (ABCWUA Board, transcript of April 18, 2012 meeting, p. 8) Ironically, Mr. McCoy also recommended that the Board reject a pump-and-treat cleanup proposal that was being considered at the time. It is not clear whether CANM wants more monitoring wells for full characterization, or wants remediation to proceed without full characterization.

Lastly, CANM has heavily criticized the Air Force and NMED for not having done enough to clean up groundwater. NMED agrees with CANM on this issue. In the 14 years since groundwater contamination was first discovered in 2001, no groundwater remediation system has been put into place, and this is completely unacceptable to NMED. CANM, however, also has objected to many of the

technologies that have been proven at many other sites to be capable of cleaning up fuel contamination in groundwater:

- Pump and treat
- Sparging
- Soil vapor extraction, especially when used in conjunction with sparging
- Enhanced bioremediation
- Bioaugmentation
- Surfactant flushing
- Monitored natural attenuation

As is discussed below, most of CANM's objections to these technologies are not based on sound science. Due to the complexity of this site, a combination of technologies will have to be used both simultaneously and sequentially to clean up the soil and groundwater. NMED believes that if CANM cannot take a clear, consistent, and technically sound position on what cleanup strategies and technologies should be employed, then CANM needs to stop trying to obstruct the cleanup work that is moving forward.

Specific Responses

Independent Scientific Task Force

Please see the general response to HJM-13 above.

The KAFB Fuel Spill Does Not Constitute an Emergency Situation

Please see the general response to this issue above.

The term "collapse" is an appropriate term as it is used in scientific discourse. In this context collapsing the EDB plume will involve extraction wells that will contain and remove EDB contamination while pulling the EDB plume away from the Ridgecrest drinking water wells.

RCRA Procedures

The Strategic Plan is not a technical work plan or a regulatory document. Instead, the Strategic Plan presents a vision of work that we would like to see accomplished during calendar year 2015, and a road map of how to accomplish the work. As explained in the Plan, NMED has been delegated primacy by the U.S. Environmental Protection Agency to administer the RCRA and Safe Drinking Water Act. Within NMED the lines of authority extend from the Secretary of Environment to the Bureau Chiefs.

While we already have extensive understanding of many of the physical, chemical and biological processes that control the migration and fate of the fuel contaminants, development of a comprehensive conceptual site model is one of the tasks identified in the mission statement of the Hydrogeology Working Group. The Strategic Plan also clearly provides for the filling of data gaps, as is now being done.

With regard to the RCRA Facility Investigation (RFI) reports, NMED concurs with the Air Force decision to withdraw the reports due to technical errors and incompleteness.

Notwithstanding CANM's contradictory position on drilling additional monitoring wells to fill data gaps, discussed above, the August 1, 2014 work plan makes progress towards filling data gaps. Site specific hydraulic conductivities will be determined during aquifer performance testing of the extraction wells as they are installed. Hydrogeologic information obtained from each new monitoring well and extraction well will improve our knowledge of this aquifer system. The "proof" of EDB plume containment will be made using water level and water quality measurements. If additional extraction wells or other technology is needed to achieve full containment, it will be required by NMED. Significant progress on filling data gaps in the vadose zone also will be made during 2015.

Strategies and Goals

CANMs comment about NMEDs motivation to produce the Strategic Plan is unjustified, but consistent with CANMs lengthy history of false accusations and counter-productive negativity. NMED strongly disagrees with the assertion that the strategies will do little if anything to prevent the further advance or containment of the EDB plume. Goal 2, collapsing the EDB plume, is all about containing and extracting the EDB plume and pulling it away from the Ridgecrest drinking water wells.

NMED appreciates the comments on Goal 1 and we have amended the final Plan to reflect one goal and five strategies that will help to achieve that goal.

With regard to Goal 2, the Notice of Violation issued by NMED on January 15, 2015 requires the Air Force to install up to seven additional extraction wells, in addition to the first extraction well approved under the August 1, 2014 work plan. The exact number, locations, depths and pumping rates of the extraction wells will be determined in phases. All of the data obtained from additional drilling, pump testing and chemical sampling will be used to guide the next well or set of wells. Pump tests on the new extraction wells will provide valuable information on aquifer hydraulics.

With regard to Goal 3, sparging, surfactant injection, and bio-stimulation are proven technologies used by the groundwater industry to remediate groundwater contamination. These technologies, and others, will be evaluated by a highly qualified panel of experts that NMED has assembled into the biogeochemistry/LNAPL working group. These experts have a sound understanding of the hydrological conditions affecting the contamination site and the experience to recognize that not all spill sites are created equal and thus not all strategies and technologies will work at every site. Technologies deemed to be potentially suitable to remediate the KAFB fuel spill will be advanced to laboratory and field scale pilot testing in a safe and controlled manner and will include review and approval by NMED. All regulatory permits for the injection of carbon energy sources, electron acceptors, or other amendments will be obtained in accordance with all state and federal regulations.

With regard to Goal 4, soil vapor extraction is a technology used to clean up the vadose zone and prevent contaminants in the soil from reaching groundwater. The Strategic Plan made no claim that soil vapor extraction would stop the dissolved phase from spreading.

With regard to Goal 5, the highly qualified panels of experts that NMED has assembled into working groups must be able to openly and candidly propose and debate hypotheses, in accordance with the scientific method that we use. Additionally, some of the technical group discussions involve settlement negotiations among NMED, the Air Force and the agencies who own public water wells in the area. We object to the false accusation that we assume that no members of the public would be able to

comprehend the highly technical issues, as our experts are made freely available to the public during poster sessions and field trips. We would add, however, that CANM, with its lengthy history of false accusations, unsubstantiated technical assertions, and inflammatory fear mongering, would be especially unwelcome at the technical working group meetings. In any case, information and recommendations developed by the working groups will be made available to the public through the NMED website.

Risk – Mobilization of Contamination

The fuel contamination plumes in the vadose zone and groundwater are extensive and complex. We agree that different technologies are more or less effective for different contaminants in different phases. This complex site, however, often has multiple phases at the same location. Therefore, a combination of technologies, both simultaneous and sequential, will be required to achieve cleanup. The application of these technologies will cause contaminants to move, both in location and between phases. This movement is not necessarily bad, and will actually be beneficial if the movement results in better capture or destruction of the contamination. A robust groundwater monitoring program that already exists will be enhanced with the addition of indicator parameters that will provide early detection of contamination migration in the direction of the drinking water wells.

While some of CANM's technical comments in this section are correct, several are incorrect and are addressed as follows.

Incorrect CANM Assertions

The CANM assertion that, "air sparging and SVE systems are not effectual for the removal of dissolved EDB" is incorrect. "The most common treatment technologies for EDB are air sparging, soil vapor extraction and groundwater pump and treat with granular activated carbon." (EPA report, Lead Scavengers Compendium: Overview of Properties, Occurrence and Remedial Technologies, May 2006, p. ES-3). Indeed, all these of these technologies have been successfully used for EDB remediation at many sites in New Mexico.

The CANM assertion that, "EDB does not respond to natural attenuation" is incorrect. As we have explained in our public presentations, elevated groundwater bromide levels provide compelling evidence that EDB is degrading in area where dissolved hydrocarbons also exist in the groundwater. We suspect that EDB is acting as an electron acceptor during hydrocarbon oxidation, and undergoing reductive debromination. The possibility that other degradation reactions are releasing bromide into groundwater also is being explored.

The EPA statement, that air sparging should not be used if free product exists, was made in the context of LNAPL floating on the water table. The concern expressed by EPA was that sparging could cause the floating LNAPL to migrate. The LNAPL that had previously been floating at the KAFB site, however, is now submerged and trapped below the water table. The effect that sparging may have on trapped LNAPL is not well established. As such sparging will be evaluated as a potential remediation technology.

The CANM assertion that, "Installation of one or even up to eight pump and treat extraction wells will not be adequate to contain EDB plume movement." is scientifically unsubstantiated with regard to aquifer hydraulics. CANM's comparison of pumping rates of the extraction wells with the pumping rates of the much deeper, multi-aquifer drinking water wells in the area is inappropriately simplistic. The fuel

contamination is in the shallow unconfined aquifer zone, while the drinking water wells pump water from the shallow zone as well as from two deeper confined aquifer zones. Pumping the extraction wells at the same rate as a drinking water well could accelerate contaminant migration, and could result in contaminated groundwater being mixed into clean groundwater.

The technical working groups have been given the assignment of making mass balance calculations of the amount of fuel in various phases in the vadose zone and groundwater. These calculations will be made available to the public after they have been completed and have undergone peer review.

Public Participation

All of the RCRA requirements for public participation are being met or exceeded. Both NMED and the Air Force provide the public with unrestricted access to their experts during poster sessions and field trips. We place great value in the open and candid discussions that we have with the public during these events. Indeed, the public has made a number of constructive suggestions during these events that are now being implemented. This issuance of this draft Strategic Plan is another significant opportunity for the public to have input on how the investigation and cleanup are going to proceed.

Safety of Municipal Water

Ensuring the safety of municipal drinking water is the primary goal of the federal Safe Drinking Water Act program. The U.S. EPA has granted primacy to NMED to administer the Safe Drinking Water Act program. One of the requirements of the Safe Drinking Water Act program is that drinking water comply with the maximum contaminant levels established by EPA. Contrary to the false accusation posted on the CANM website that New Mexico has a less stringent standard than EPA, (<http://radfreenm.org/index.php/environmental-disaster-you-never-heard-of>), EPA's and NMED's enforceable drinking water standards are both set at 0.05 µg/L.

Municipal wells in the vicinity of the plume are tested for EDB monthly. This testing continues to show no detections of EDB in any municipal well whatsoever. Given that these wells produce water with no detectable EDB, NMED is shocked and appalled by the CANM suggestion that citizens, "panic about what their drinking water may contain." (New Mexico In Focus, KNME-TV, aired on June 20, 2014 <https://www.youtube.com/watch?v=Swl0rL0cCz8&index=3&list=PL0QUHGAlftJg3x3AyOobI4GLI6bbd9myF>, start at minute 7:25)

Alleged Deficiencies in the 2015 Plan

1. The 2015 Strategic Plan only covers interim measures and other actions anticipated to be accomplished in 2015. The Plan does not propose a multi-year roadmap through the final remedy for this site. Hydrodynamic extraction and containment is a demonstrated technology that can be used to collapse the EDB plume and pull it away from municipal wells.
2. The final Strategic Plan will contain project schedules and milestones.
3. The plan does not lock in sparging. An air sparging pilot test was completed at the end of 2014 and the test results will be used to help evaluate the potential suitability of this technology for the site. SVE has been operational for 12 years, and the plan is to make the system more

robust. The plan also proposes pump-and-treat as an interim measure to collapse the EDB plume and pull in away from the municipal wells.

4. The Strategic Plan meets or exceeds RCRA procedures and requirements. The RFI reports that had been submitted by the Air Force were retracted, and will be resubmitted. The CSM and CME have not yet been completed, but will be prepared in accordance with RCRA.
5. The aggressive proposal that Mr. Mark Correll proposed to the community in September 2014 calls for up to 8 extraction wells. This proposal became a requirement by NMED's Notice of Violation that was issued on Jan. 15, 2015.
6. NMED agrees that it is illegal to further contaminate the aquifer. This is why the Strategic Plan calls for pulling the EDB plume back to the source area, away from the municipal drinking water wells. NMED notes, however, that CANM associate Dwight Patterson has proposed to deliberately pump the contamination into Ridgecrest well #5.
7. The work is being overseen by panels of highly qualified experts.
8. The Strategic Plan provides substantial opportunities for public participation, including a public comment period on the Strategic Plan itself, that have not been available in the past.

Anisotropy and Three-Dimensional Conceptual Site Model

NMED agrees that anisotropic conditions exist in the aquifer system affected by the fuel spill. In fact, Stop 1 of the October 2014 geologic field trip was selected specifically to show outcrops of both coarse and fine grained sediment that can impart anisotropy to the aquifer. NMED was pleased that discussions of anisotropy occurred during the field trip, among both technical and non-technical participants. The discussions included anisotropic conditions that can occur in short distances within the same stratigraphic unit, as well as larger-scale anisotropy caused by the a1 and a2 clay-rich sequences in the Sierra Ladrones Formation. NMED appreciates the questions and discussion that CANM participated in during the field trip.

The conceptual site model that the technical working groups are developing will include a three-dimensional analysis of stratigraphy, aquifer hydraulics, aquifer geochemistry, and contaminant plume migration.

Attachment D1

My name is Jim McKay. What follows are my comments, observations, critiques and suggestions with regard to NMED's document:

2015 Strategic Plan
Kirtland Air Force Base Spill
DRAFT 12/19/14

Of the 19 (PDF) pages in this document, only 11 deal specifically with the spill. Of those 11, page 1 is a very brief fuel spill history and page 2 repeats NMED's authority within the regulatory apparatus, and contains a brief 6 "bullet point" highlight of "support for the corrective action process" and critical goals. These 2 pages state nothing new, as most everything said there has been said by the Air Force and its contractors, repeatedly, for some years now.

Page 3's strategy is similarly redundant: for example it states monthly tests at municipal wells. This activity has been in practice over 2 years. I would expect this to be an addendum, not descriptive of new activity for characterization and cleanup. NOTE: I am convinced this sampling is ineffective & incapable of being reliable for detecting the presence of early arriving EDB: the diffusion and dilution render the sampling amount (approx. 2 liters) out of approximately 130m gallons per month, wishful thinking.

I am disappointed sentinel wells are not planned with close proximity (+/- 250 ft.) to Ridgecrest 3 & 5: this is clearly established "best practice". This is the means by which, what is implied above (sampling production wells), can and should be done reliably.

Page 3, bullet point 4: Establish geochemical indicator parameters and action levels for sentinel wells, is a very welcome activity. Having read the last 2 quarterly reports from 2014 written by CB&I for the purpose of gaining precision in various additives being considered for sparging/introduction into the aquifer to accelerate EDB degradation, this is a very welcome activity. CB&I has been negligent in not having done this in this adequately through 2013: I applaud NMED's team for bringing this about.

I have also read NMED documents on positioning and number of these "sentinel" wells: this workplan does not specify this information: I think it would be a good idea links to this information are written into the document. I applaud, again... NMED's leadership/insistence the Air Force install them. This also is long overdue.

With that said, I have serious concerns about the Air Force's budgetary commitment to see the installation of necessary wells through to completion. That as I am told, of the approximately 30 NMED asked for the Air Force has agreed to only 16 is troubling. The Air Force has nickel and dimed this project for decades, and explicitly stated as recently as 2010 budget shortfalls dictated their decision to limit NMED's requested (+/-) 90 monitoring wells (30 clusters) in 2010 to about 1/3 of that. Had the Air Force installed those wells then, we'd be much further along now: many of these new wells would not be necessary, and still remaining data gaps would be largely filled.

The workplan does not mention the dye tracing wells or proposed testing. I suggest NMED includes links to the more detailed documents describing these wells in this document, and their purpose. These wells will go a long way towards establishing groundwater speed in this most critical area, something (at best) EPA and published modeling predictions only guess at. This data will give a much better idea how much time remains before EDB hits municipal wells: this is critical.

Page 4, Drinking water standards... in my opinion is also redundant. This is not "Workplan" data, and this information has been stated verbally and in charts at every CAB meeting I've attended since 2010. This information should be an addendum.

Page 5: "Collapsing the EDB Plume", is amongst the most problematic pages in this document.

Some background is in order: this term (collapsing) was never used by NMED, Kirtland or SHAW/CB&I until after Dr. Bodour arrived from AFCEC last (2014) spring. The first I heard this term was in a meeting at Citizen Action's offices with Mr. McQuillan and Dr. Bodour to discuss cleanup issues. Dr. Bodour described her (at that time just a burgeoning) notion for an approach to EDB containment: create "reverse gradients", increasing back towards the base, to (her term) "collapse" the EDB plume.

This was clearly described: drill wells pulling enough water to create a series of "sinks" so that advancing EDB would "spill" the opposite direction from its current flow towards the municipal wells. Given known ROI of high volume municipal wells "pulling" (and accelerating) EDB towards them by this exact same means, this idea made perfect sense. Given decades of doing nothing resulting in EDB (unnecessarily) advancing beyond the base and under Albuquerque neighborhoods, this was the first time I'd heard from any official responsible for cleanup a plan I thought could work.

Again: Dr. Bodour's use of this term was original as pertaining to EDB cleanup, not used before, and described means (creating "sinks") never before discussed here.

In reading this Workplan, the term is used (as it has been in at least the last 2 public meetings) but there is no mention of creating "reverse gradient(s)", calculating well production and placement to achieve this, or even suggestions this is still being considered. The only remedies listed are pump/treat (extraction) and generalized descriptions of various sparging techniques.

"Collapse" does not describe what these activities (sparging/pump & treat) may accomplish, and omit any reference whatsoever to the process Dr. Bodour's "notion" would require to execute.

I would like to see this word (e.g. collapse) replaced, and also receive a statement from NMED (or AFCEC) whether Dr. Bodour's execution of "collapsing the plume" is still being considered. It's not mentioned in either of last 2 published 2014 quarterly reports by CB&I.

Otherwise, page 5's "Phase 1" goals are welcome, and I applaud NMED's leadership in getting this done. It's long overdue. I would personally like to see a lot more, however.

Phase 2 measures are adequate, as far as they go. 1st bullet point describes using "numerical modeling", to construct (I assume) more accurate models based on "data gaps" filled through Phase 1 data gathering. The modeling done to date by EPA 6 & CB&I has been... poor. I would say (respectfully)... dismal. I think modeling activity needs expert oversight. For starters, software used for this by EPA 6 is well behind better tools used elsewhere in the world. To date, modelers have been asked to make predictions impossible to do with existing data, yet they made predictions anyway (eg: # of years before EDB hit's municipal wells).

Similarly, Phase III points are ok as far as they go. I note "Implement long-term operation" mentions only pump & treat and "maintenance", visibly absent the "reverse gradient" work I described above.

The diagram on Page 6: Pump and Treat System, (also under subject: Collapsing the EDB Plume) similarly makes no mention of Dr. Bodour's "reverse gradient" idea. The well in that diagram depicts a "sink" (is this an implication the sink size is being calculated for the purposes I mention?), but no explicit indication Dr. Bodour's ideas are being implemented.

The "LNAPL Remediation" bullet points on page 7 are fine, as far as they go. Again, I applaud NMED's new leadership for pushing hard for installation of this technology.

I have great concerns about any of the mentioned technology's ability to "collapse" or remove EDB, in the time available before it hits municipal wells. The other DOD sites with (roughly) comparable to KAFB's EDB plume had limited success with these methods. The result was municipal wells that had to be filtered for EDB, with aquifer remediation left for a decades long process.

The page 7: LNAPL Measurement Techniques, is again... welcome and long overdue. Same with (generalized) bullet points on page 8 & 9: NMED deserves credit for getting those long overdue actions in place.

Page 10: Soil Vapor Extraction, does not distinguish between Vadose and Sparging purposes. I have read the various technical documents describing NMED's directed expansion of the Vadose SVE system. Again, I applaud this action and recognize it is long overdue.

I quibble with other references to Vadose SVE in this document. Secretary Flynn's statement on page 1:

"The soil vapor extraction system, which has already removed more than 500,000 gallons of fuel from the subsurface, was upgraded."

I recommend removing "already" from that statement: Vadose SVE removal design and management going back almost 9 years, has been dismal and neglected. The Air Force did a terrible, non-dedicated job for this... perhaps the technologically least challenging aspect of cleanup. Their "upgrade" nearly 2 years ago was poorly designed and ineffective. Sec. Flynn's language (already) suggests noteworthy SVE accomplishment: that is simply not true. Vadose zone SVE removal is many years behind.

Page 11: Public Participation & Outreach: with all due respect, I find this page's assertion wholly inadequate and misleading.

I do applaud the NMED run CAB meeting since Mr. McQuillan assumed lead duties overseeing this fuel spill: mis-information from previously KAFB managed CAB meetings has been largely eliminated, and the available information from participants NMED has had at the last several meetings is a huge improvement: There is far more useful, insightful and comprehensive information available now to interested citizens, entirely obscured prior.

However, the statement: "Maintain a high level of project transparency that exceeds statutory RCRA requirements for public information and involvement"... again, with all do respect, I simply cannot agree with. There is more to transparency than just NMED's work.

Committed, professional public citizens have invested 1000's of hours researching, advocating, informing the public and raising visibility of this issue. A number of us have been, over time, proven correct about critical issues... technical, political and legal, which the Air Force, for whatever reasons, was simply not telling the truth.

"Public participation" should include the opportunity for some of these local citizens mentioned to be participants where decisions are made. This has not happened here ever, and is not on the horizon now. Having this "element", or meaningful participation has greatly accelerated progress on other major DOD sites when employed: this fact is acknowledged in those communities by all participants. It's very difficult to accept, in this "advanced" technological society, that so many local people giving their time and efforts freely, having the courage to stand in public (in some cases for years) and correctly challenge what has proven to be many years of false Kirtland statements, and then have the same authorities publicly dismiss these citizens and reinstate their oversight over this matter so critical to Albuquerque's future... it's discouraging.

There is much to indicate the Air Force is reverting to these habits.

I have great concerns that, regardless of NMED's best efforts from their limited role in this process, that the Air Force will forget and lose the inertia gained in the last 8 months or so, through their inadequate cleanup effort gaining public awareness after all these years.

I think the Air Force must be compelled to:

- 1) Publish detailed accounting of what they've spent to date, what's budgeted for the future in each of the next 5 years.
- 2) One office, responsible for only cleanup activities, be established on Kirtland AFB. This office needs an adequate, independent budget for necessary staff, a person competent to understand the technical challenges, and tasked with no other military duties other than manage this cleanup.
- 3) This office must be accessible to the public.
- 4) This office must be "in charge": not subject to subordination for other base business and duties. This office must have the authority to act, request funding, and initiate remediation activities autonomously, without need for approval from Base management or Pentagon higher ups. To put in another way: the Air Force must respond to the cleanup requirements here, not dictate resources available based on relegating our cleanup to 2nd/3rd tier priorities subordinated their "normal business".

I say this because, in recent months... since Air Force Secretary Ferguson was compelled to express newfound commitment to this cleanup... "transparency" from the Air Force has receded to previous means whereby there was nobody in their organization available and responsive with verifiable facts.

Attachment D.2.

NMED Response to Jim McKay

The Strategic Plan contains information, and plans for investigation and cleanup, that NMED and KAFB had presented during numerous public presentations in the 2nd half of 2014. We felt it would be useful to condense this information into a short, clear compilation of our vision on how to advance the fuel cleanup during 2015, and to request public comment on our vision. Not everyone in the public is as informed about site conditions and about ongoing site investigation/cleanup as yourself, and we regret if you were offended by information that you considered to be redundant.

Municipal wells in the vicinity of the plume are tested for EDB monthly. This testing continues to show no detections of EDB in any municipal well whatsoever. This sampling confirms that the water produced by these wells complies with the EPA drinking water standard of 0.05 µg/L EDB as it enters the drinking water distribution system.

With regard to sentinel wells, locating them very close to the municipal wells will result in less time for intervention if they begin to show contamination. Locations further away, but still in the potential migration path of contamination, will provide more time to react and intervene if the sentinel wells begin to show detections.

We appreciate your support on the development of geochemical indicator parameters. We have already been informally using oxidation-reduction potential as a sentinel well indicator parameter for the VA well, and will develop other parameters for wells that are in the northeastern area of concern. The positioning of sentinel wells is provided in the final Strategic Plan.

The Strategic Plan does not address the Air Force budget as this is a matter beyond NMED's authority.

The use of a non-reactive, non-toxic tracer is being considered for purposes of aquifer testing and estimation of transport time. As has been raised by another commenter, however, there may be public objections to the introduction of such material into the aquifer. Consequently, this technique may, or may not, be included in future work plans.

The false accusation that has been made by some, that NMED has a less protective EDB drinking water standard than EPA, continues to be very problematic for NMED. This false accusation remains posted on the Citizen Action website, "Despite EPA standards, NMED permits EDB in drinking water at levels at or below 50 parts per trillion (ppt)." <http://radfreenm.org/index.php/environmental-disaster-you-never-heard-of> This false accusation remains posted on the Citizen Action website even though NMED has repeatedly asked Citizen Action to correct this error. As such, the enforceable drinking water standards, set at 0.05 µg/L (equal to parts per trillion) by both EPA and NMED, will remain in the main text of the Strategic Plan.

The term "collapse" is used in scientific discourse, and its use in the context of the EDB plume is appropriate. The final Strategic Plan will clarify "collapsing the EDB plume" to include reversing

gradients, and containing, capturing, extracting and pulling the EDB contamination away from the Ridgecrest well field.

Thank you for your support on the Phase 1 strategy to collapse the EDB plume.

With regard to computer modeling, both analytic element and finite difference models will be used in parallel to help with the location and design of extraction wells. All models have advantages and disadvantages, and this project will benefit by having the results of two different modeling approaches.

A combination of technologies, both simultaneous and sequential, will be required to clean up this complex site. Technologies that will be effective for dissolved phase, may be less effective for LNAPL. We appreciate your support of our proposed process to review and identify technologies that may be potentially suitable to remediate the KAFB fuel spill, and to advance those technologies to laboratory and field scale pilot testing in a safe and controlled manner. We also wish to assure you that all required regulatory permits will be obtained for all phases of this project in accordance with all state and federal regulations.

Developing LNAPL measurement and compliance techniques for the deep groundwater conditions at this site will be a challenge and we appreciate your support in this task.

Soil vapor extraction (SVE) is a vadose zone technology, but SVE is also used in combination with sparging of groundwater. We will make this distinction clearer in the final Strategic Plan.

Secretary Flynn has appropriately noted that removal of more than 500,000 gallons of fuel by SVE is a significant accomplishment.

NMED disagrees with most of your comments on public participation and outreach. Both NMED and the Air Force provide the public with unrestricted access to their experts during poster sessions and field trips. We place great value in the open and candid discussions that we have with the public during these events. Indeed, the public has made a number of constructive suggestions during these events that are now being implemented. This issuance of this draft Strategic Plan is another significant opportunity for the public to have input on how the investigation and cleanup are going to proceed.

NMED has no authority over Air Force budget or office management.

We hope that the Notice of Violation that NMED issued to the Air Force on January 15, 2015 alleviates at least some of your concern that the Air Force may have lost inertia towards cleaning up the site.

Attachment E

January 29, 2015

To:
Dennis McQuillan
New Mexico Environment Department
Environmental Health Division

From:
Ray Shortridge
Rio Grande Chapter, Sierra Club

Re: Comments on 2015 Strategic Plan -- KAFB Base Fuel Spill

We commend the Department for publishing the draft of the plan and calling for public comments and welcome Secretary Ryan's commitment to cleaning up the fuel spill.

We support Goal 5's objective in providing transparency on the progress of the clean-up throughout the process.

However, we believe that the Department and the public would be better served if Goals 1-4 contained measurable achievements, time lines, milestones, resource requirements and budgets. Without these, this document is not so much as a strategic plan as it is a statement of strategic goals and tasks and does not provide the metrics necessary for the Department and the public to monitor the clean-up.

For example:

Goal 1: protect drinking water wells:

- "drill nests of sentinel wells (minimum of 3 wells per nest) located between the fuel plume and drinking water supply wells" -- the plan does not project
 - how many nests/wells will be required
 - the cost of each well nor provide a budget for well drilling per quarter/year
 - how many nests or wells will be drilled per month/quarter/year
 - where the nests/wells will be drilled

Goal 2: collapse the dissolved-phase EDB plume...

- the key to this project seems to be drilling at least 16 additional monitoring wells but the plan does not project
 - the cost of each well nor a budget for this phase
 - where the wells will be drilled

Goal 3: remediate the LNAPL floating on top and submerged in the groundwater

- the plan references “the evaluations performed by the Air Force and their contractors to explore the feasibility and effectiveness of the following remediating technologies...” but the plan does not project
 - specific dates for the commencement and conclusion of the remediation evaluations
 - a budget for each of the technologies

Goal 4: vacuum fuel vapor from the soil... however, the plan does not present

- a time-line for the various steps
- a budget for this process

The plan omits providing for a key component of the process -- well maintenance. At the recent presentation at Albuquerque’s West Side Coalition for Neighborhood Associations, mention was made that a substantial number of existing wells are currently malfunctioning, so this is not a trivial issue. Again, the plan should identify the resources required to maintain the wells and present a budget for that function.

Provisions should be made for the cost of maintaining the wells, identifying wells that are malfunctioning, cost for repairing them, resource requirements and budget.

Without project planning information on time-lines, milestones, resource requirements, and budgets for each measurable achievement, the Department and the public cannot assess how effectively the measures being proposed to protect drinking water wells and other remediation steps are being implemented.

Holly A. Wilkie
1914 S. De Baca Circle SW
Albuquerque, NM 87105
January 30, 2015

Dennis McQuillan
NMED Environmental Health Division
PO Box 5469 Santa Fe, NM 87502

Dear Mr. McQuillan

As a citizen of Albuquerque, I applaud the KAFB Strategic Plan's stated intent to install monitoring wells. It is important to assess hydrogeological conditions fully in order to develop a site conceptual model, which should be the first step in any remediation plan.

According to Sterrett's *Groundwater & Wells*, when groundwater resources are impacted by chemicals, three things must happen. The source of contamination must be eliminated, which is addressed by the SVE and air sparging activities, as well as the bioremediation studies. The second two steps are trickier: containment and cleanup. According to ABCWUA contractor INTERA, pump and treat is the only possible way to accomplish this, so I urge NMED and KAFB to focus on this technology as they proceed in the future.

It should be no secret to you, at the Environmental Department, that regional snowpacks are decreasing and surface water is becoming an increasingly less reliable source for municipal supply. The Middle Rio Grande aquifer is a tremendous resource to both Albuquerque and the state of New Mexico that should not be squandered. Every drop of groundwater exposed to EDB, (and to a lesser extent the benzene and other hydrocarbons involved), is one less drop for current and future residents of the valley to consume without treatment by elaborate and expensive means.

I urge you to keep in mind the true value of the water at stake as you proceed and focus on the site conceptual model, followed by a pump and treat strategy. Let's get it right!

Sincerely,



Holly Wilkie