Kirtland Air Force Base
Fuel Leak Cleanup

Presenters: Kathryn Lynnes, Air Force
Dennis McQuillan, NMED
Diane Agnew, NMED
Adria Bodour, Air Force Civil Engineer Center

Project Status Update

November 10, 2016

Welcome

Kate Lynnes

Air Force Senior Advisor

Public Technical Workshop

November 12, 2016

9 am to 12:30 pm

Christ United Methodist Church

6200 Gibson Blvd. SE

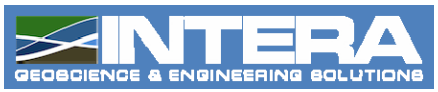
9 - 9:30 am	**Meet and Greet along with Poster Session**
9:30 - 11:30 am	**Breakout Sessions**
11:30 - 12:30 pm	**Final Discussions and Wrap-up**

A Partnership for Success

A collaborative technical team is solving the complex hydrogeologic and engineering challenges posed by the fuel leak with support from Albuquerque's neighborhood groups

US Army Corps of Engineers

Elder Homestead Neighborhood Assoc.



Siesta Hills Neighborhood Assoc.

ABQ City Council District 6 Coalition of Neighborhood Assocs.

Christ United Methodist Church

HAWLEY GEOMATTERS

Thomson and Associates

Cleanup Strategies and Progress

Dennis McQuillan

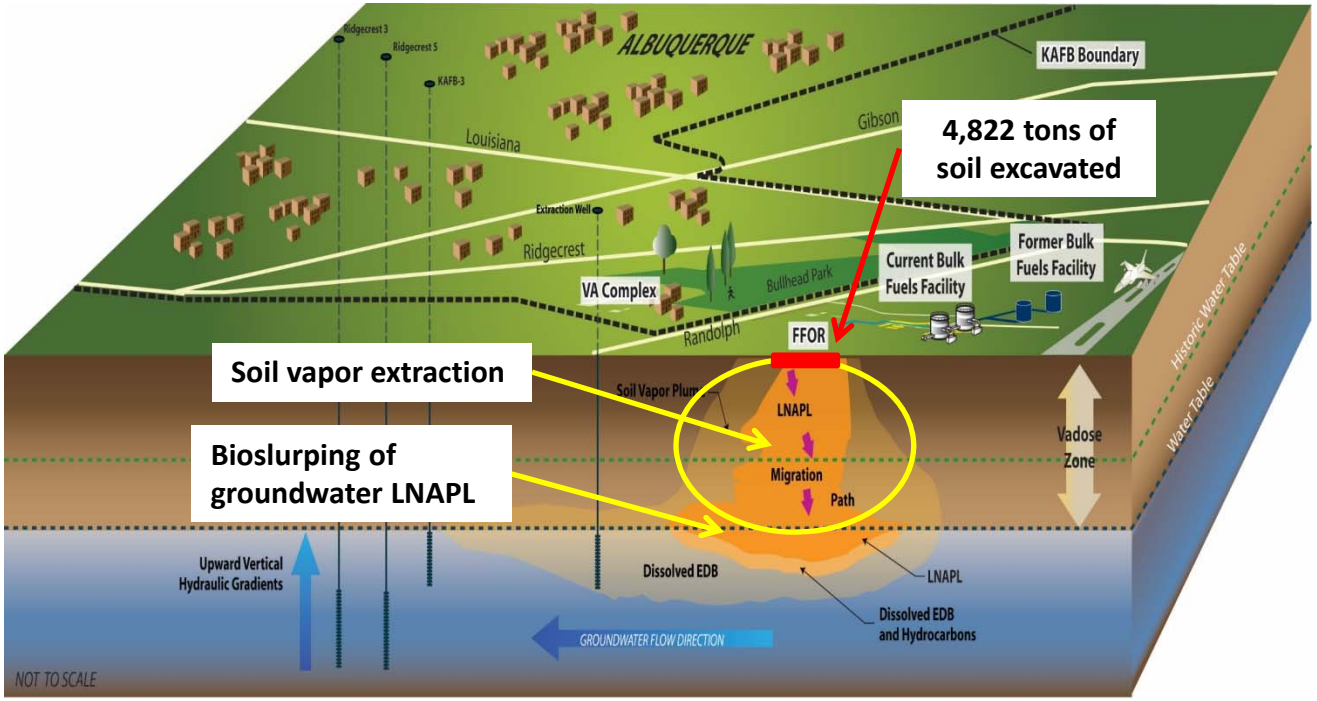
NMED Chief Scientist

Conceptual Site Model Animation

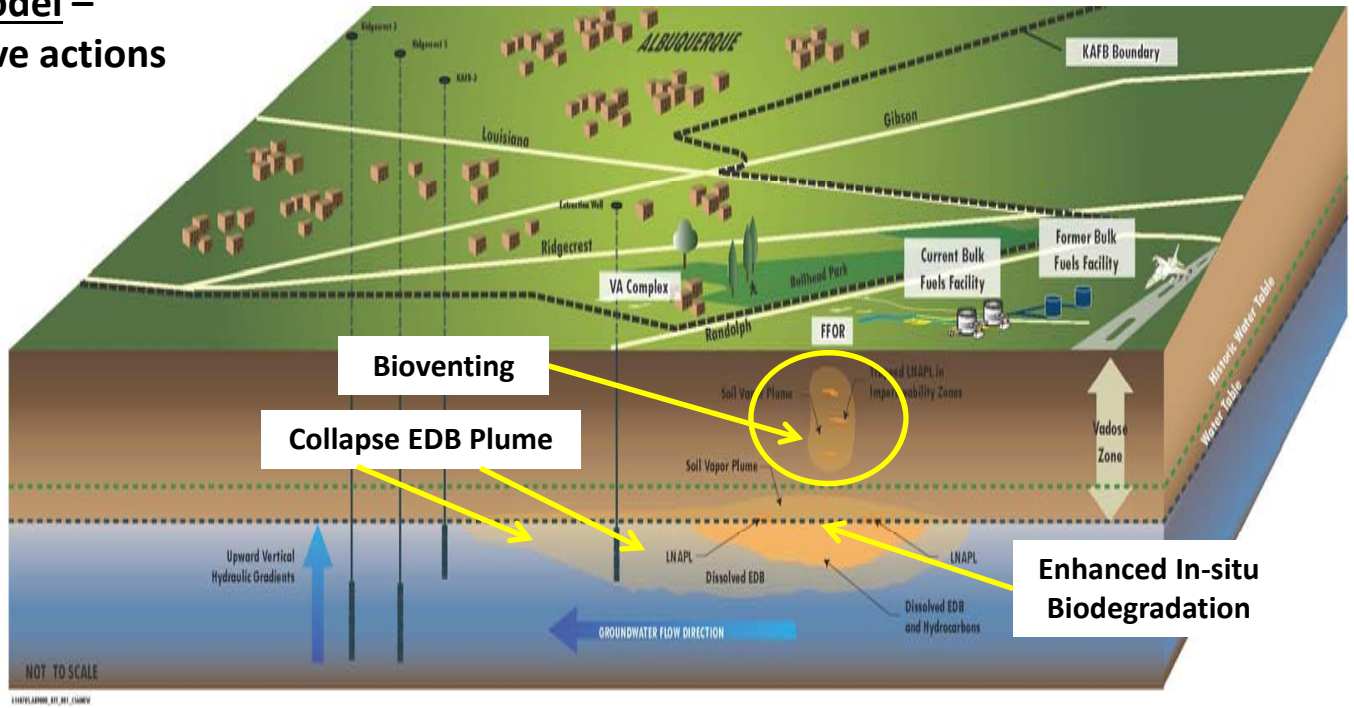
https://www.env.nm.gov/NMED/Issues/KirtlandFuelPlume/KAFBProjectImages.html

Cleanup Strategy

Implement multiple technologies, both simultaneously and sequentially, based on plume anatomy



Conceptual Site Model – before interim corrective actions



Current Conditions –

- 12 years of soil vapor extraction significantly reduced contamination in the vadose zone
- 4 years of bioslurping significantly reduced residual LNAPL

2016 Strategic Plan

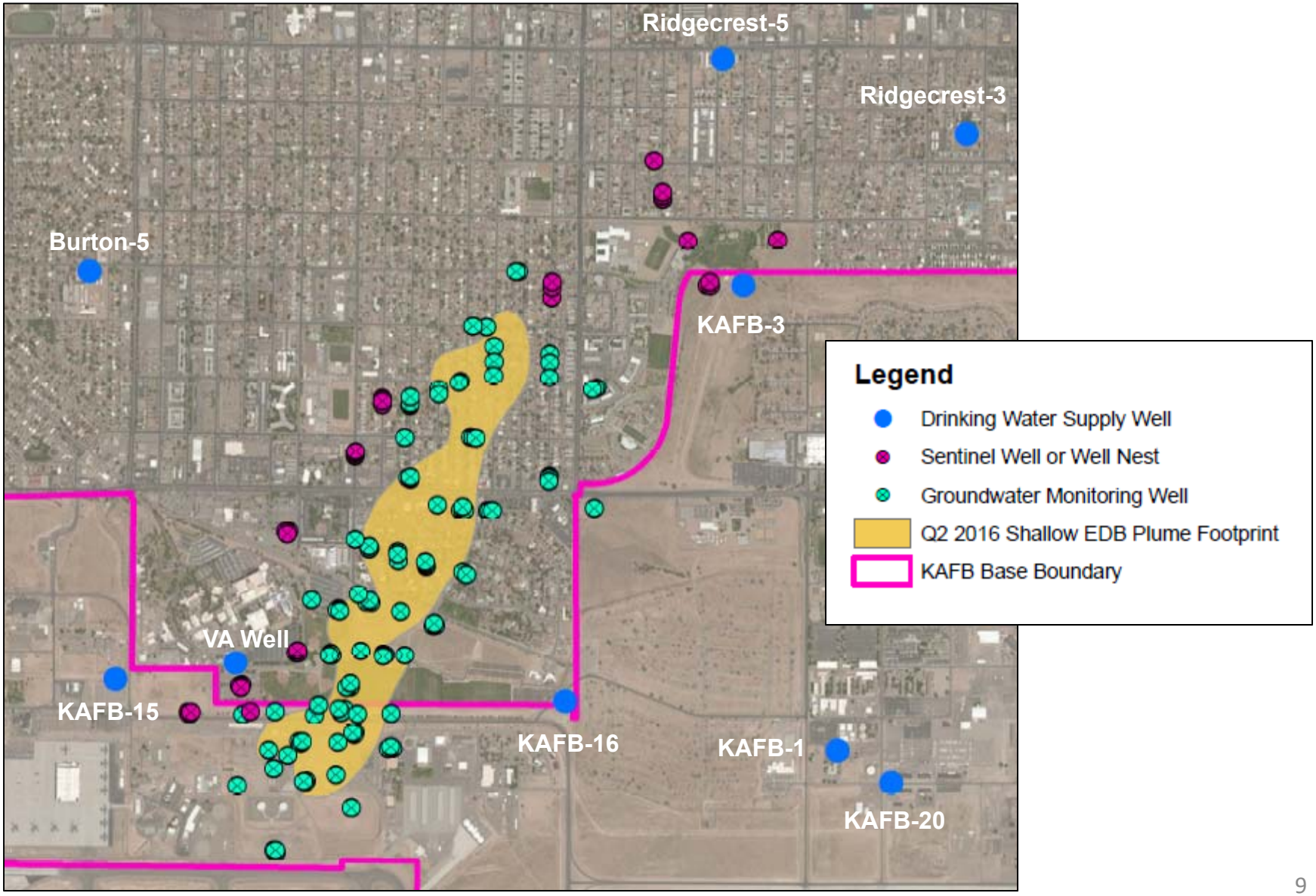
New Mexico Environment Department (NMED) Final 2016 Strategic Plan is available online: **http://www.nmenv.state.nm.us**

Goal: Protect Albuquerque's aquifer and drinking water supply wells in the area of the fuel leak

Strategies to Achieve the Goal:

1. Implement a robust site monitoring & wellhead protection program
2. Characterize and remediate Light Non-Aqueous Phase Liquid (LNAPL), impacted soil, and associated dissolved phases in the source area
3. Collapse the dissolved ethylene dibromide (EDB) plume
4. Meet or exceed all requirements for providing public comment, information and involvement

Site Monitoring and Wellhead Protection



2016 Strategic Plan – How Did We Do?

<u>Strategy #1</u> Implement a robust site monitoring & wellhead protection program

- 2016 groundwater drilling:
  - Additional monitoring wells to define the northwestern plume area, and close this final data gap
  - An additional deep nest of sentinel wells, between the contamination plume and the VA Hospital supply well, to provide a greater level of safety
- Quarterly testing of monitoring wells shows a relatively stable contamination plume
- Quarterly testing of sentinel wells shows no detections of any fuel constituents
- Monthly testing of drinking water supply wells shows no detections of any fuel constituents

2016 Strategic Plan – How Did We Do?

<u>Strategy #2</u> Characterize and remediate LNAPL, impacted soil, and associated dissolved phases in the source area

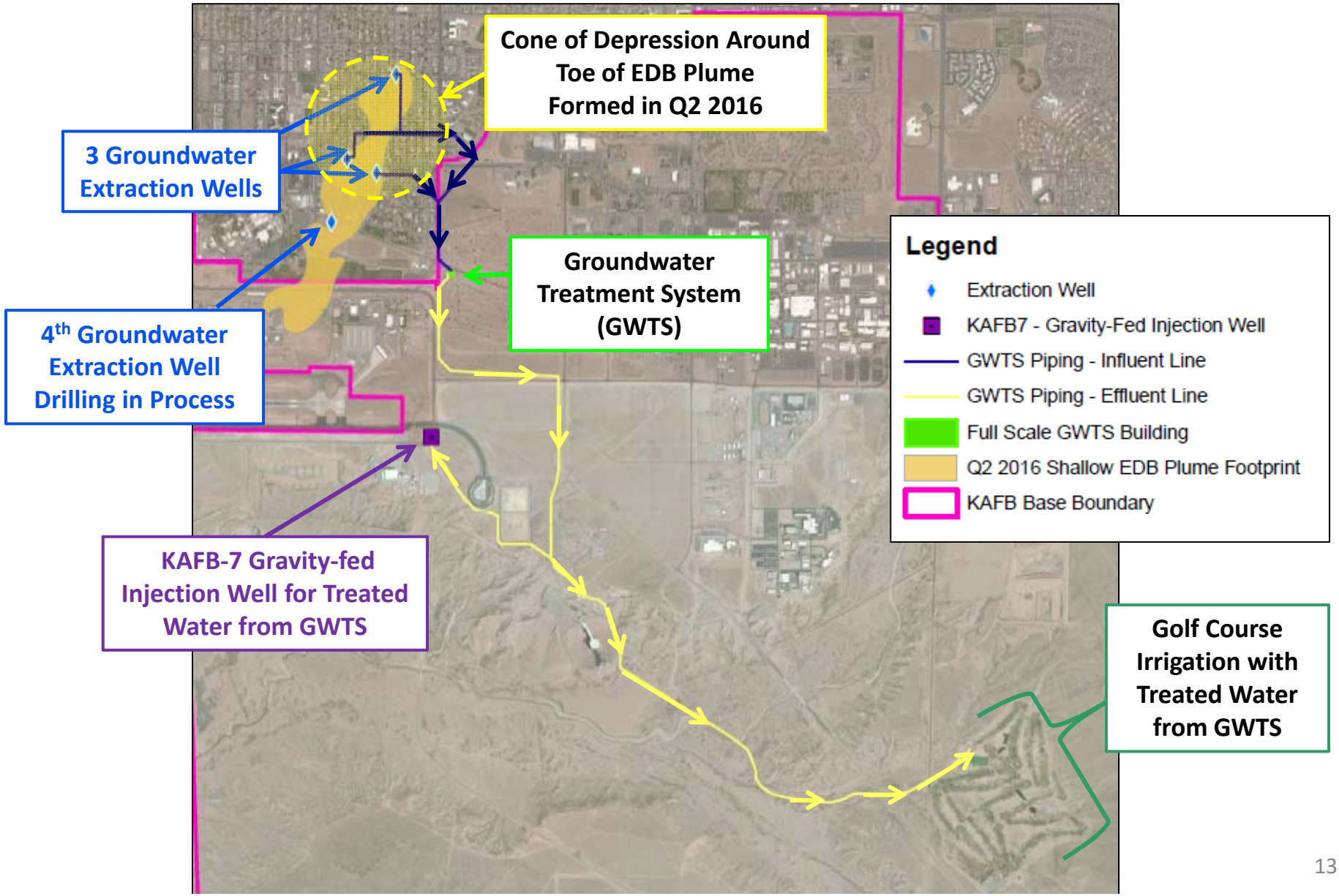
- EDB In-situ bioremediation pilot test (interim measure) drilling and construction beginning December
- Rebound and respiration monitoring continues through 2016, and provides valuable data on how soil bacteria are biodegrading fuel contamination
- Data are being used to plan:
  - LNAPL core drilling; and
  - Bioventing pilot test (interim measure)

2016 Strategic Plan – How Did We Do?

<u>Strategy #3</u> Collapse the dissolved EDB plume

- Extraction well 228 has been operating for 16 months
- Extraction well 234 has been operating for 11 months
- Extraction well 233 is being redeveloped and rehabilitated
- 118 million gallons of groundwater has been treated, with 39 grams of EDB removed from the aquifer
- Treated groundwater contains no detectable fuel contaminants
- The cone of depression that has formed around the toe of the EDB plume is a major milestone towards containing and collapsing the EDB plume
- No evidence yet of EDB plume shrinkage

Groundwater Cleanup



2016 Strategic Plan – How Did We Do?

<u>Strategy #4</u> Meet or exceed all requirements for providing public comment, information and involvement

- NMED and the Air Force have exceeded all requirements for providing public comment, information and involvement
- By the end of November, a total of 19 presentations or outreach events will have been conducted

2016 Public Outreach To-Date

Date	Description
January 12, 2016	**Kirtland Partnership Committee:** Provided project update
February 10, 2016	**District 6 Neighborhood Coalition Meeting:** Provided project update
February 24, 2016	**Highland High School Advanced Placement Chemistry and Environmental Science:** Worked with chemistry students to design lab experiments and presented results to April public meeting participants
April 8, 2016	**New Mexico Geological Society Spring Meeting:** Presented on site stratigraphy and migration of the EDB plume at the BFF site
April 13, 2016	**New Mexico Tech Engineering Club:** Presented to undergraduate and graduate engineering students on the BFF site
April 19, 2016	**Regular Public Meeting with Technical Poster Session**
April 23, 2016	**Public Field Trip:** Toured groundwater treatment facility and discharge points
May 23-24, 2016	**Tenth International Conference on Remediation of Chlorinated and Recalcitrant Compounds:** Panel presentation and poster papers on KAFB fuel cleanup provided peer review and comments from national and international experts in the field
May 26, 2016	**International District Healthy Communities Coalition Meeting:** Provided project information

2016 Public Outreach, Contd.

Date	Description
June 22, 2016	**Water Utility Authority Governing Board:** Provided project update
July 12, 2016	**New Mexico Legislature, Radioactive and Hazardous Materials Committee:** Provided project update
July 14, 2016	**Regular Public Meeting with Technical Deep Dive and Poster Session**
August 13, 2016	**Community Conversation:** Answering publics concerns
August 15, 2016	**Rotary Club of Albuquerque:** Provided project information
August 30, 2016	**Kirtland Partnership Committee:** Provided project update
September 16, 2016	**New Mexico Water Law Conference:** Provided project information
September 24, 2016	**Albuquerque International District Fair:** Provided project information
November 10, 2016	**Regular Public Meeting with Poster Session**
November 12, 2016	**Public Technical Workshop 9 am to 12:30 pm** Christ United Methodist Church 6200 Gibson Blvd. SE

Reducing Project Cost to Taxpayers Without Compromising Public Heath & Safety

- **Multiple monitoring wells in a single borehole**
  - Multiple well completion produces better data, is significantly less expensive, less disruptive to the neighborhood, and safer for workers
- **Optimization of groundwater and vadose zone monitoring**
  - With 4 years of robust monitoring data, it is no longer necessary to test every well for every chemical analyte on a quarterly basis
- **Passive diffusion bag (PDB) sampler validation study**
  - If validated, PDB sampling will be significantly less expensive, safer for workers, and produce less waste
- **Elimination of duplicative permitting**
  - Requiring both a Resource Conservation and Recovery Act Hazardous Waste Permit and a Water Quality Control Commission (WQCC) Groundwater Discharge Permit for the same land application of treated groundwater was inefficient
  - A WQCC Underground Injection Control (UIC) Permit is required and the Permit application has been submitted

Drilling and Interim Measures Progress

Diane Agnew
NMED
Hydrologist

Dr. Adria Bodour
AFCEC
Environmental Remediation Specialist

Data Gap Wells and 4th Extraction Well

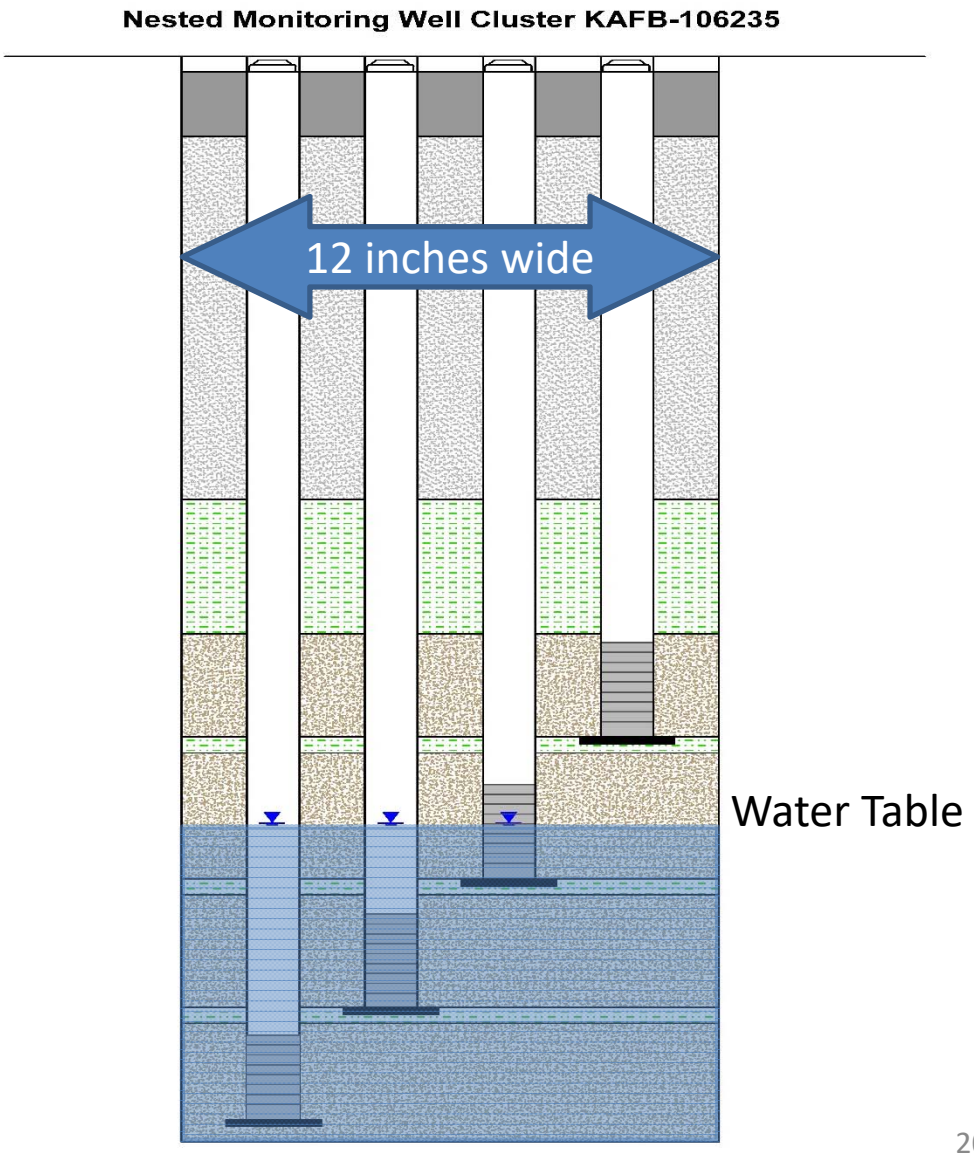
Thank You Neighborhoods!

The Air Force, NMED, and all the collaborating organizations sincerely thank the neighborhoods for putting up with the temporary road blocks and noise from the well drilling rigs

Drilling Activities: Data Gap Wells

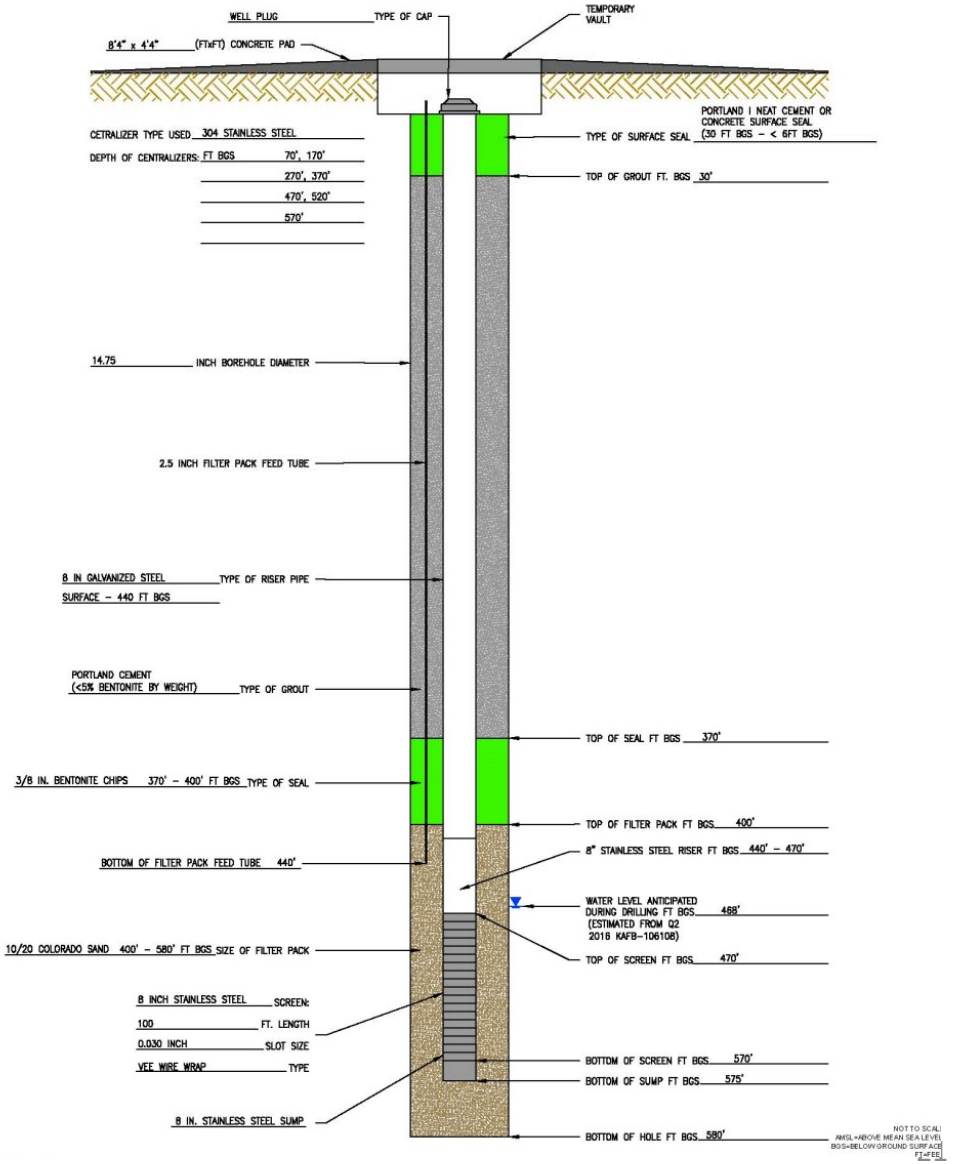
Two data gap groundwater monitoring well nests

- KAFB-106235 is complete
- Currently drilling at KAFB-106236
- Well development will be completed by the end of November/early December

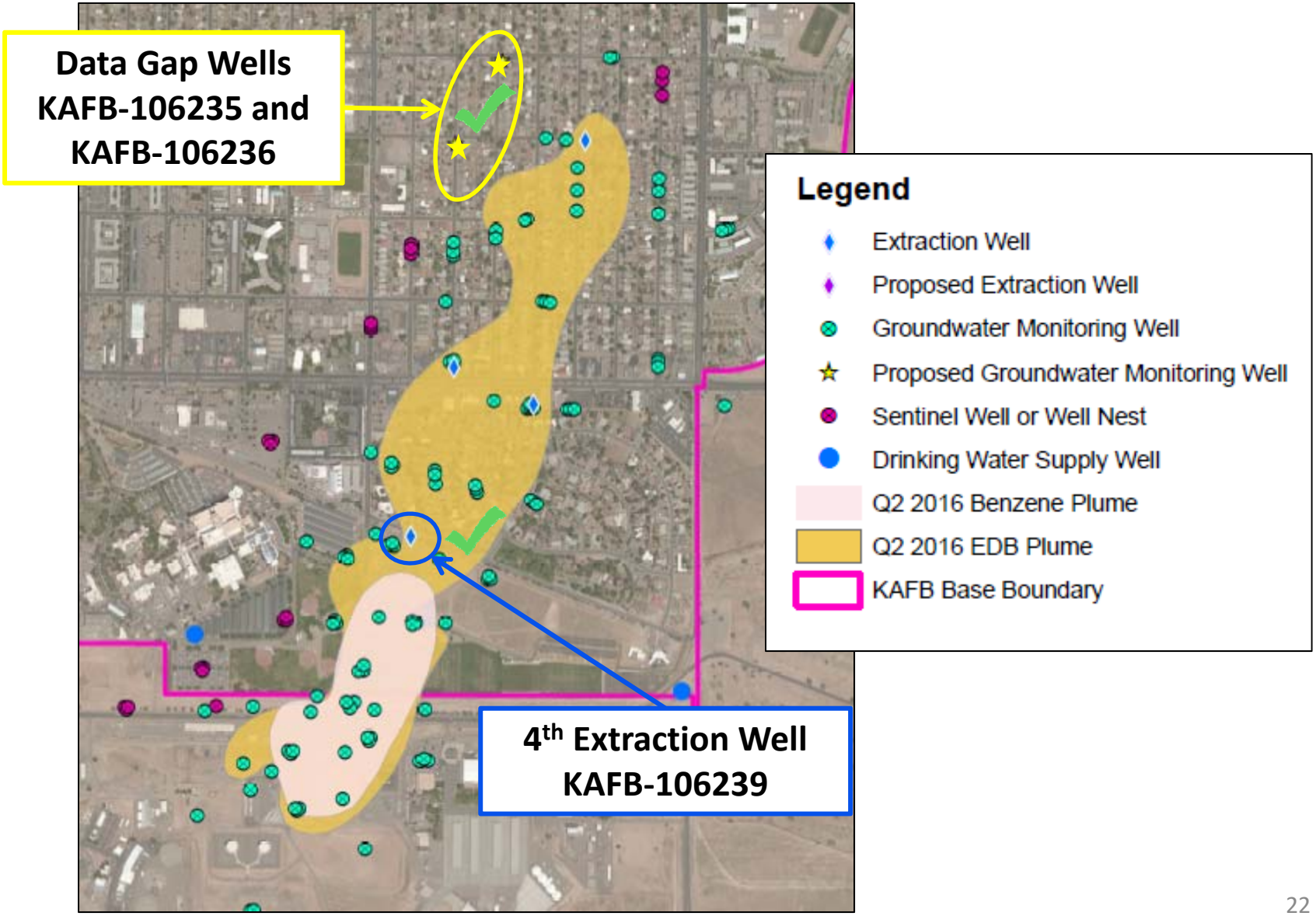


Drilling Activities: Extraction Well

- Drilling at 4th extraction well began Nov 3rd
  - Geophysical logging of open borehole prior to building the well
  - Well construction and development to be complete by end of the year



Drilling Activities



A Persistent Cone of Depression

Q2 2016 GW Contours

Q3 2016 GW Contours

Q4 2016 GW Contours

Cone of Depression Take Away

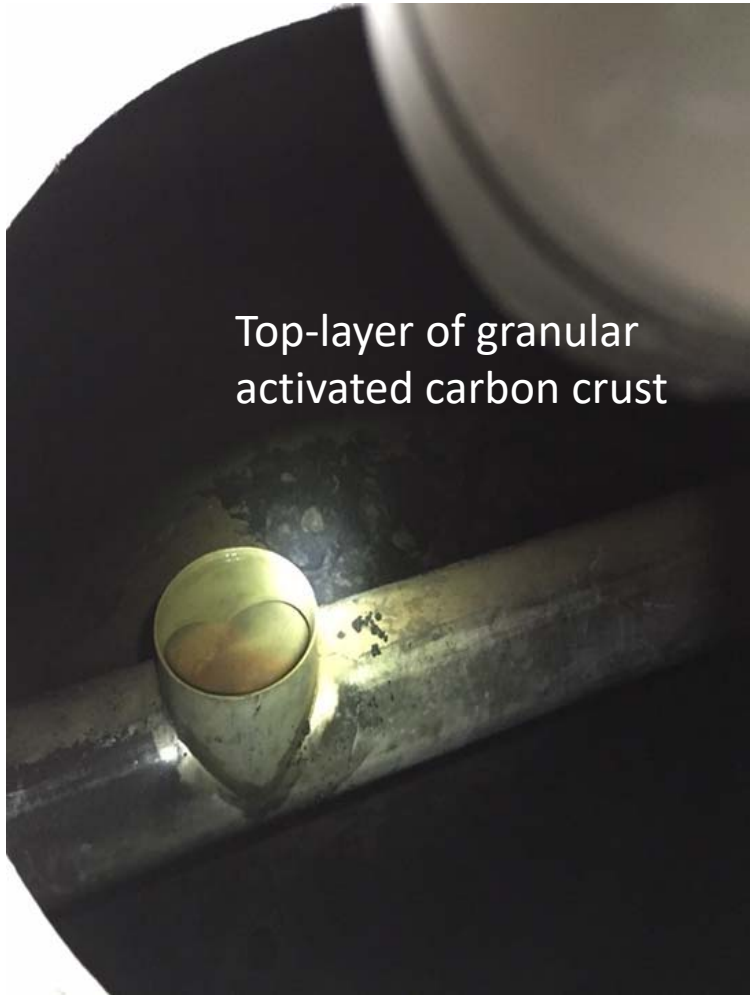
- Q3 and Q4 2016 groundwater contours show a cone of depression encompasses “toe” of EDB plume
- Plume collapse will be confirmed with EDB concentrations over time
- Persistence of cone of depression → robust system design

GWTS Operation

- Continued operation; system maintenance and repair activities
  - Troubleshooting of system fouling
  - High-level sensor at Golf Course vs. fish
  - Installation of variable flow devices
  - Pump replacement at GWTS
- Two of 3 extraction wells operating at a pumping rate of approximately 300 gallons per minute

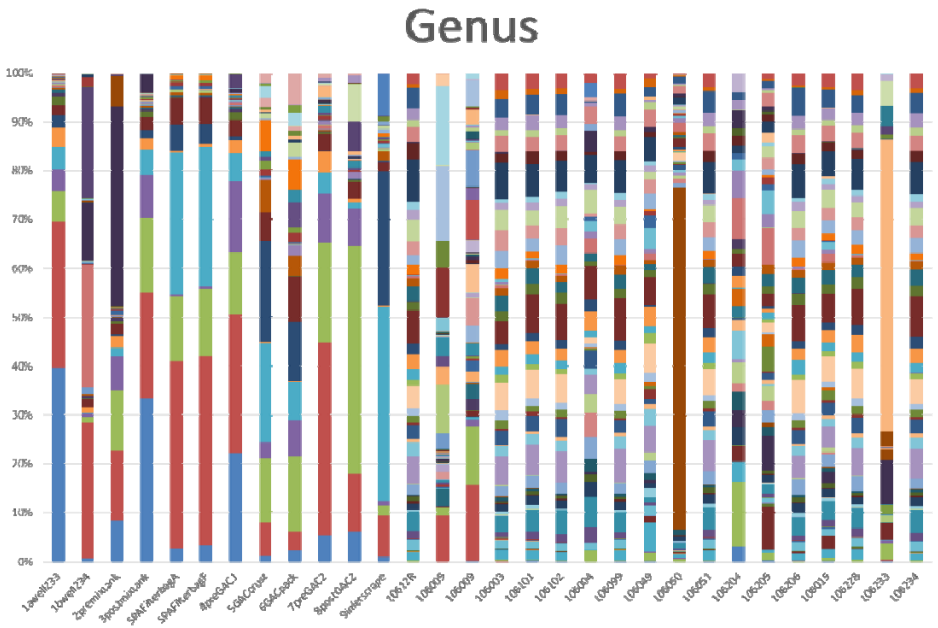
Extraction Well 233 Troubleshooting

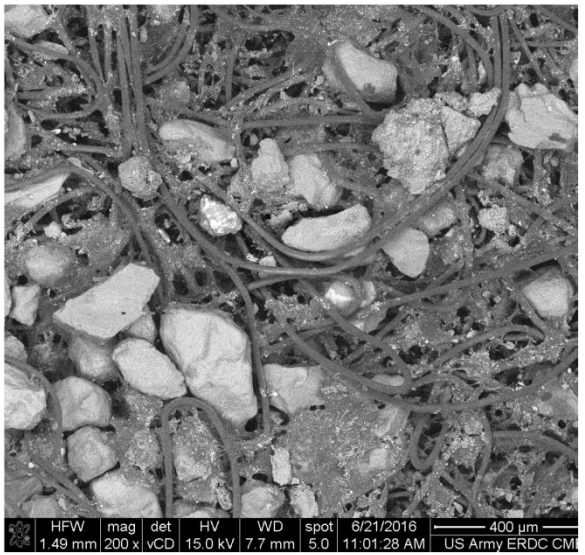
- Extraction well 233 was taken out of operation on June 18, 2016
- Fouling of GWTS pinpointed issues originating from extraction well 233
- Potential cause of fouling investigated during July groundwater monitoring
  - Chemical and microbial analyses of groundwater monitoring wells, extraction wells, and GWTS



Extraction Well 233 Troubleshooting

- Results indicate aquifer and filter pack material entering GWTS
- Source of biofouling is extracellular polysaccharide (EPS) most likely being extracted from in the aquifer outside of extraction well 233



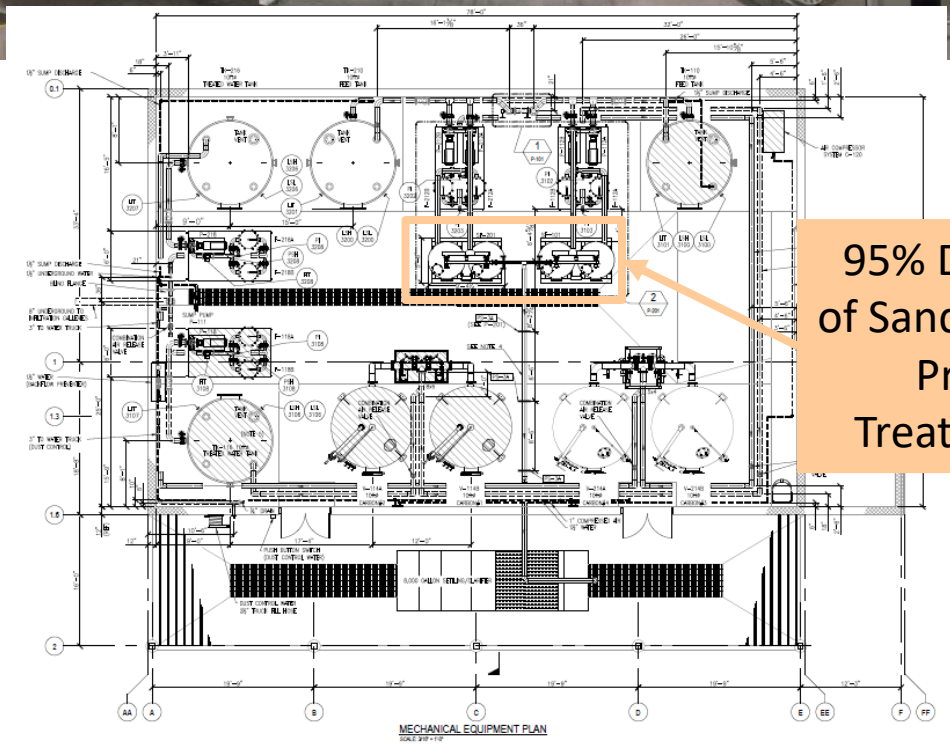


Changes to GWTS operations pre-treatment required to address material and EPS

GWTS Expansion

2 New 20,000 pound GAC Tanks added

Sacrificial anode added to extraction wells to prevent corrosion



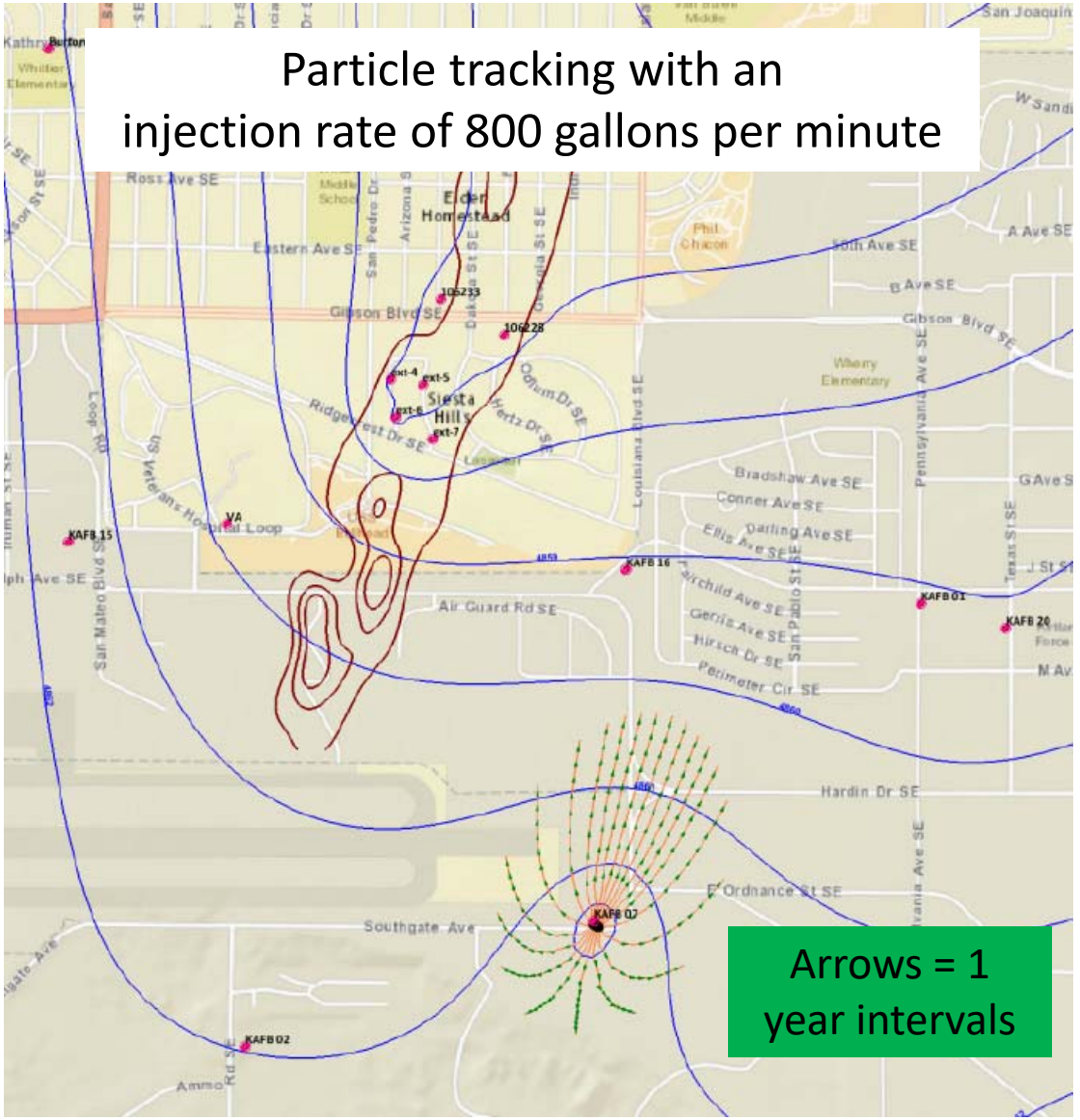
95% Design of Sand Filters Pre-Treatment

KAFB 7 Injection Pilot Test

- Pilot test gravity-fed injection at KAFB-7 from Feb 20 thru Jun 21, 2016
- No contaminants in treated effluent
- Initial vs. steady-state operations during injection
  - Groundwater rose with KAFB-7
    - 2-14 feet vs 3-6 feet
- Minimal aquifer response to observation wells surrounding KAFB-7

KAFB-7 Pilot Test Take Away

- Injection is a viable, beneficial use of treated water
- Sustainable gravity-fed injection
- Minimal loss

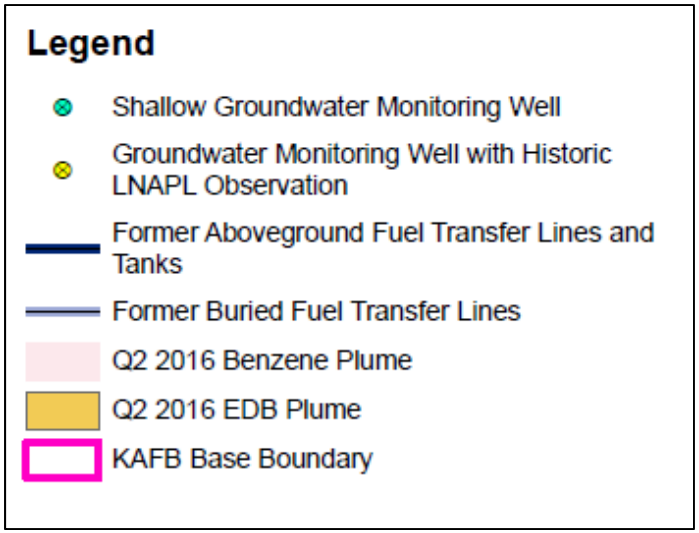


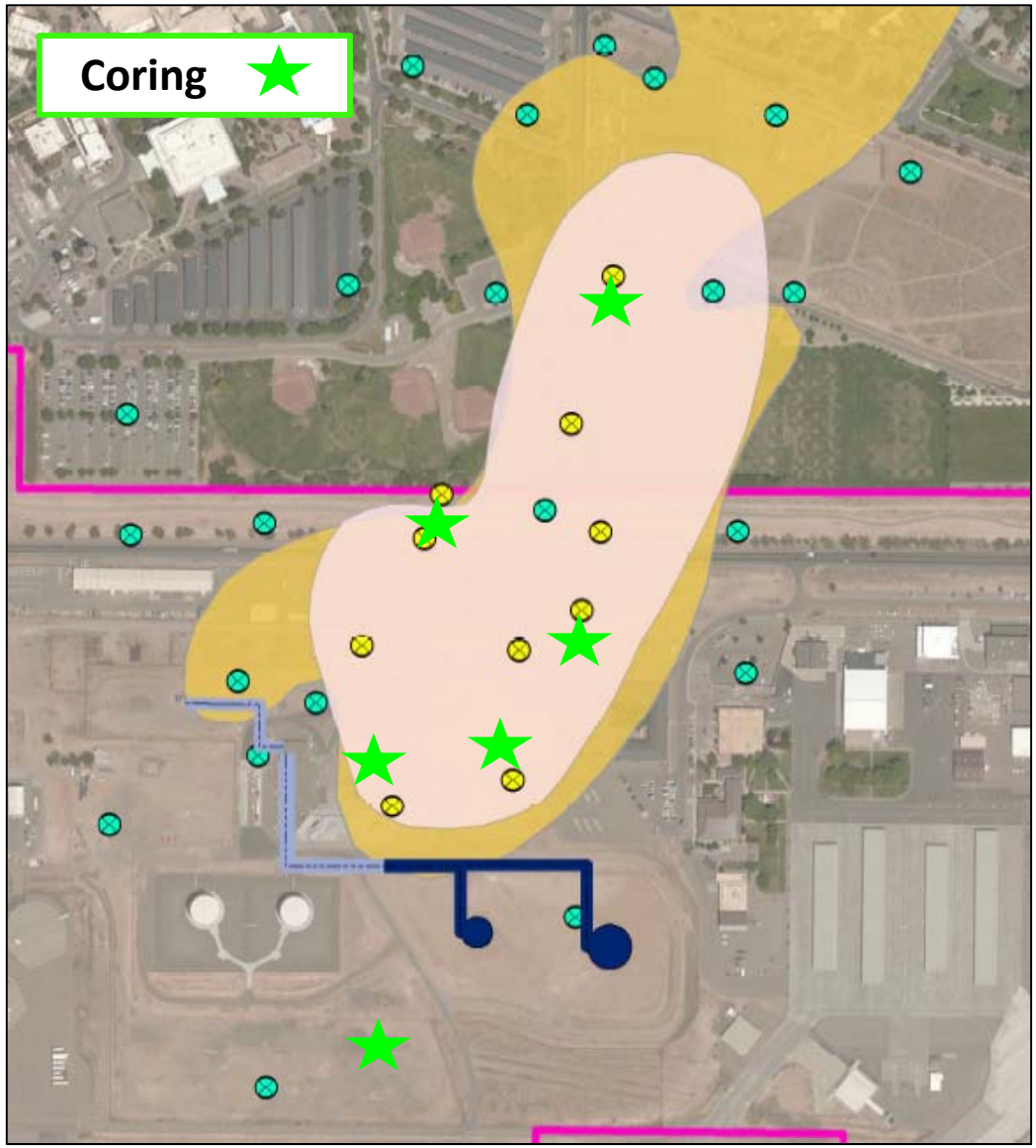
Class V UIC Discharge Permit

- KAFB golf course reduces irrigation in winter months; therefore another discharge option is needed
- Gravity-fed injection of clean water is green and sustainable technology
- Permit proposes gravity-fed injection wells into the regional aquifer including KAFB-7
- Permit posted for Public Comment
  November 9, 2016
- Currently, operating under a temporary permission to gravity-fed KAFB-7 treated effluent from GWTS

2017 LNAPL Data Gaps

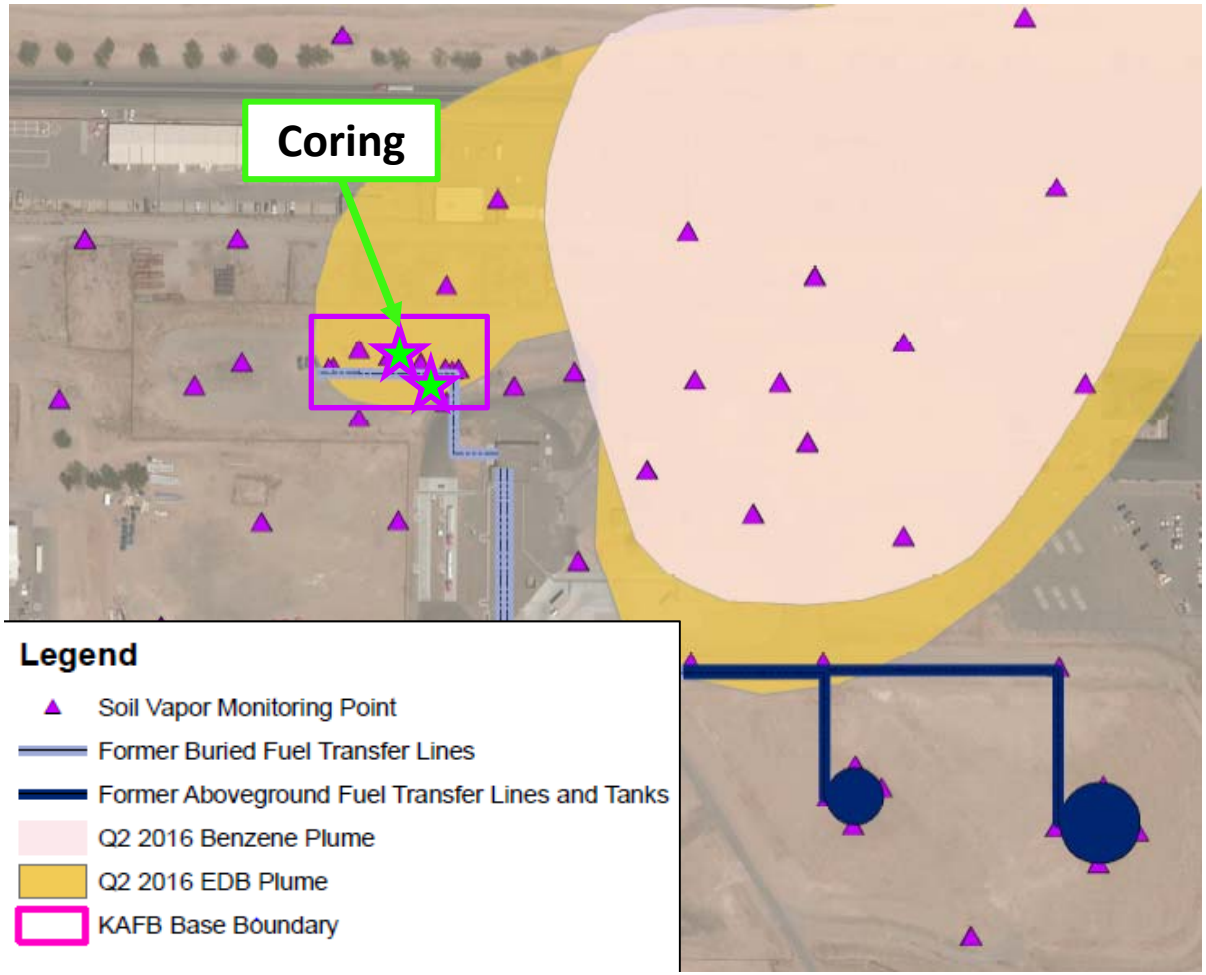
- Interim measure bioslurping removed LNAPL
- Water table fall and rise affected LNAPL
- Understanding LNAPL remaining vertically (i.e., smearing)

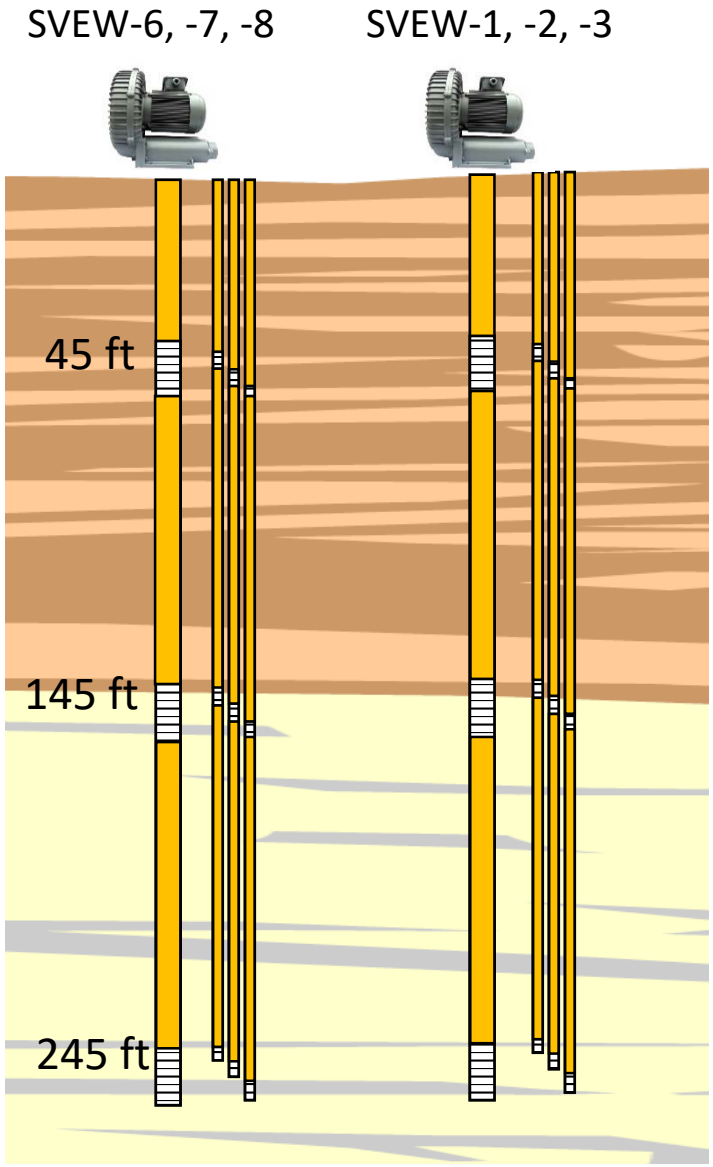




2017 Vadose Zone Interim Measure

- Bioventing area targeting rebound zone 50 – 300 feet below ground surface
- Aerobic degradation fuel and cometabolism EDB

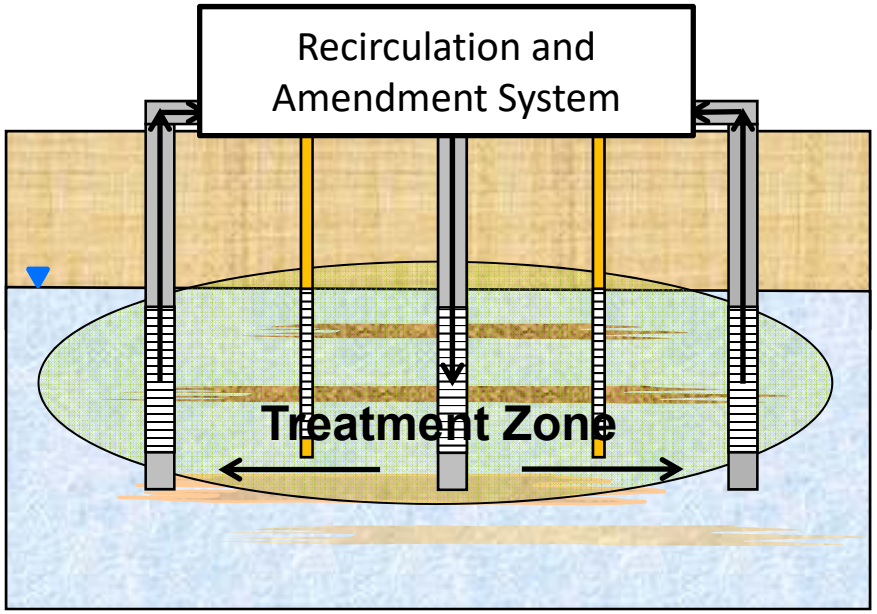




2017 LNAPL Interim Measures

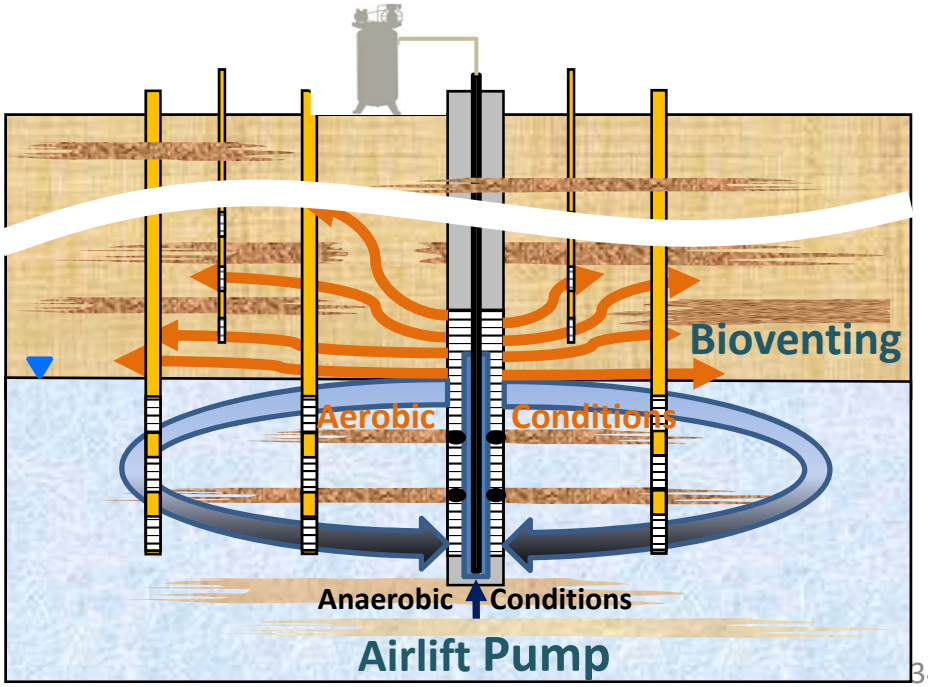
EDB In Situ Biodegradation

- Treating EDB trapped in smeared LNAPL through anaerobic biodegradation



Air-lift Enhanced Bioremediation

- Treating smeared LNAPL through aerobic biodegradation



2017 EDB Plume Collapse Interim Measure

- Complete system expansion GWTS
- Begin operation of 4th extraction well KAFB-106239
- Redevelopment and rehabilitation of extraction well 233
- Continued adjustments to GWTS operation
- Evaluate effectiveness and efficiency of collapsing the EDB plume
  - EDB concentration trends in extraction wells
  - EDB concentration trends in groundwater monitoring well network
  - Observe EDB footprint trends
- Aquifer performance testing on extraction wells

Current Timeline

we are here

2016 | 2017 | 2018

Site Assessment and Characterization

RFI

Corrective Measures Evaluation

Drilling

Core Drilling

Site Soil and Groundwater Monitoring Program

INTERIM CLEANUP MEASURES

Vadose Zone: Bioventing Pilot Test

LNAPL: Air-lift Enhanced Bioremediation Pilot Test

LNAPL: EDB In-situ Biodegredation Pilot Test

Groundwater: EDB Plume Collapse (Groundwater Treatment System)

Site Permitting

Public Meetings, Field Trips, Workshops, and Outreach

CSI - Complex Site Initiative • EDB - Ethylene Dibromide • LNAPL - Light Non-Aqueous Phase Liquid • RFI - RCRA Facility Investigation Report • SVE - Soil Vapor Extraction

Questions and Answers

- One question/comment per turn at the microphone
- We request that each question/comment be limited so that everyone has an opportunity to be heard
- Comment cards have been made available:
  - Return completed comment cards to NMED and/or Air Force staff
  - Questions will be incorporated into the Kirtland AFB BFF project website:

    www.kirtlandjetfuelremediation.com

How do I get more information?

Contact NMED:

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NMED Website and Listserv: www.env.nm.gov/kafbfuelplume

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Air Force Bulk Fuels Facility website: www.kirtlandjetfuelremediation.com

Kirtland AFB website: www.kirtland.af.mil **in the Environmental Issues section for Public Records**