

# Kirtland Air Force Base Fuel Spill Cleanup

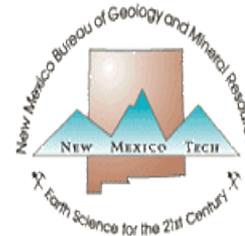
October 14, 2015



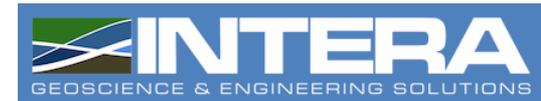
Prepared by  
**Dennis McQuillan, Chief Scientist**  
and  
**Diane Agnew, Hydrogeologist**

# A Partnership for Success

A collaborative technical team is solving the complex hydrogeologic and engineering challenges posed by fuel spill



US Army Corps of Engineers

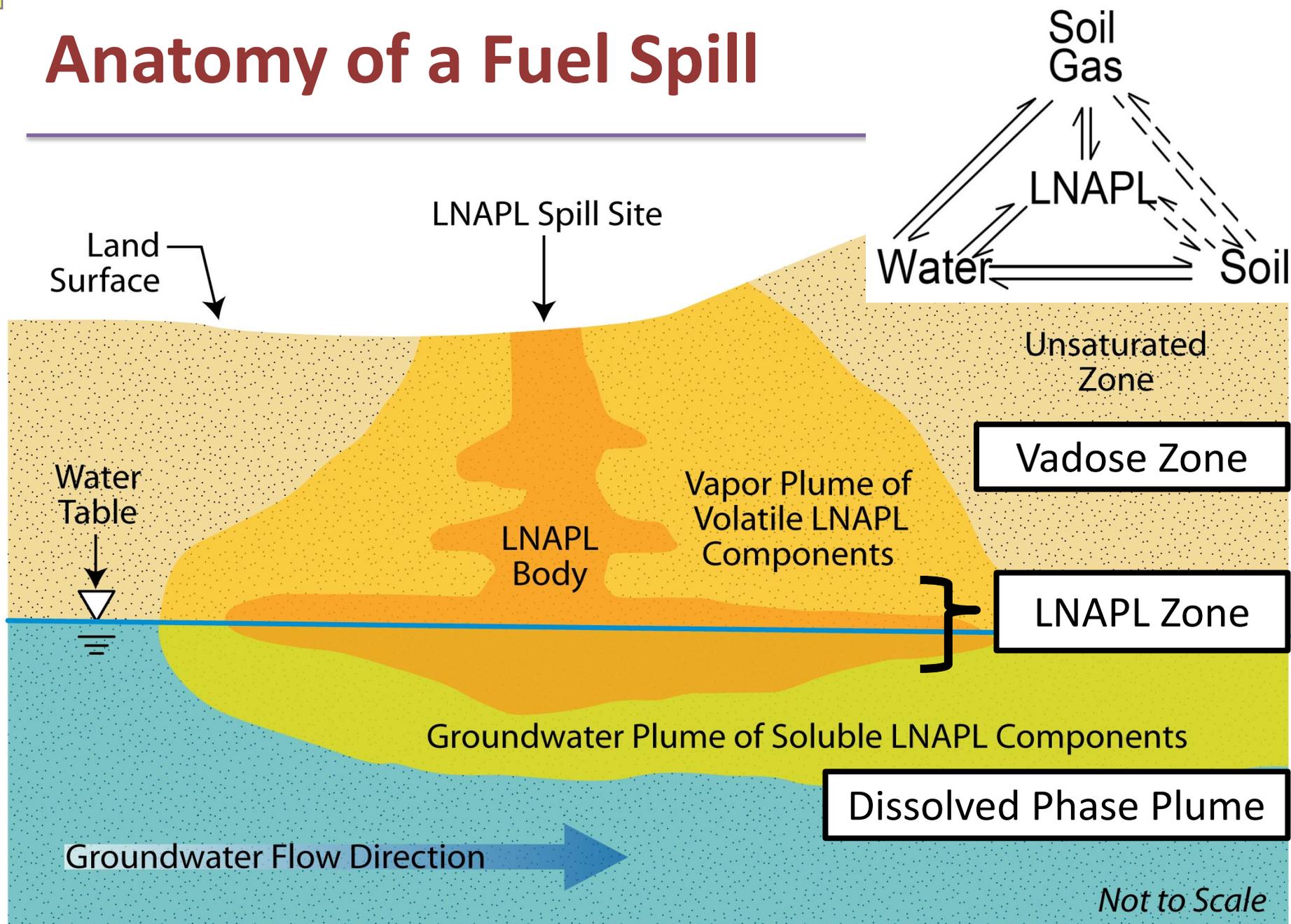


# KAFB Fuel Spill History

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- **1951-53** – Kirtland Air Force Base (KAFB) Bulk Fuels Facility (BFF) constructed
- **1975** – Handling of aviation gasoline containing the additive ethylene dibromide (EDB) discontinued
- **1999** – KAFB notified NMED of soil contamination from underground piping leak, and ceased use of piping
- **2001** – KAFB notified NMED of groundwater contamination with dissolved fuel constituents
- **2003** – Soil vapor extraction (SVE) begins to vacuum contaminants from soil
- **2007** – Fuel (light non-aqueous phase liquid, LNAPL) discovered floating on groundwater
- **2009** – Water level rise begins to submerge LNAPL within aquifer
- **2014-15** – Inter-agency partnership, additional interim measures
- **2015** – Groundwater cleanup begins

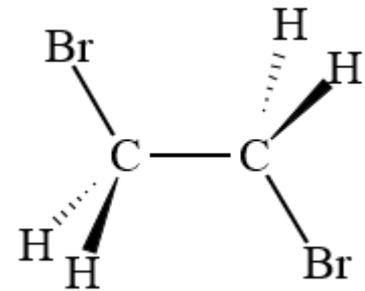
# Anatomy of a Fuel Spill



# What is EDB?

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- Ethylene dibromide (EDB) is a colorless liquid that is found naturally in oceans and is also manufactured for industrial purposes.
- Use of EDB as a pesticide was banned in 1984.
- Until 1983, EDB was used as an anti-knock agent in leaded gasoline and aviation fuel



*For more information visit the sites below:*

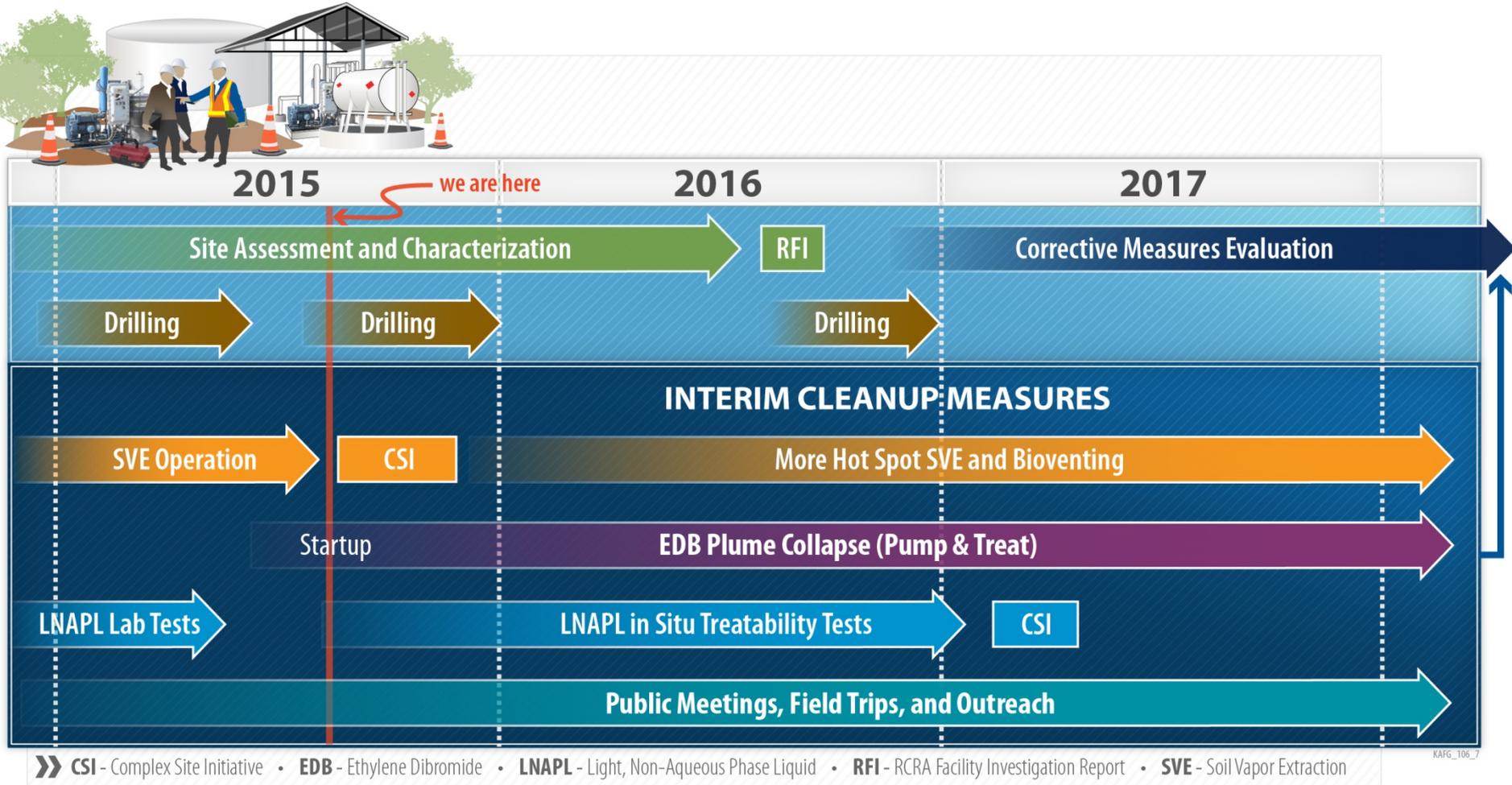
United States Environmental Protection Agency

<http://water.epa.gov/drink/contaminants/basicinformation/ethylene-dibromide.cfm>

Agency for Toxic Substances & Disease Registry

<http://www.atsdr.cdc.gov/MMG/MMG.asp?id=1143&tid=251>

# RCRA Corrective Action Timeline 2015-17



# Regulatory Basis

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**The New Mexico Environment Department (NMED) has been granted primacy by the U.S. Environmental Protection Agency to administer:**

- **The Safe Drinking Water Act (SDWA) program; and**
- **The Resource Conservation and Recovery Act (RCRA) program**

**Public water systems, the ABC Water Utility Authority, Kirtland AFB and the VA Hospital, must deliver water to consumers that meets SDWA standards.**

**Kirtland AFB must comply with their RCRA Hazardous Waste Permit, including the Corrective Action Process.**

# Drinking Water Protection

## EDB Drinking Water Standards

<b>U.S. EPA</b>	<b>0.05 µg/L</b>
<b>State of New Mexico</b>	<b>0.05 µg/L</b>

- EPA and NMED both recommend that EDB be kept to zero concentration in drinking water. However, the enforceable standard is set at 0.05 µg/L.
- Federal law requires testing once every 3 years for EDB and benzene; sampling increases to quarterly if contaminants are detected.
- Drinking water supply wells in the area are being tested monthly.
- No detections of any fuel contaminants in any production well.
- EDB regulatory detection limit = 0.01 µg/L for public water systems.
- Sentinel wells have been installed to provide early detection of any plume migration in the direction of the water supply wells.

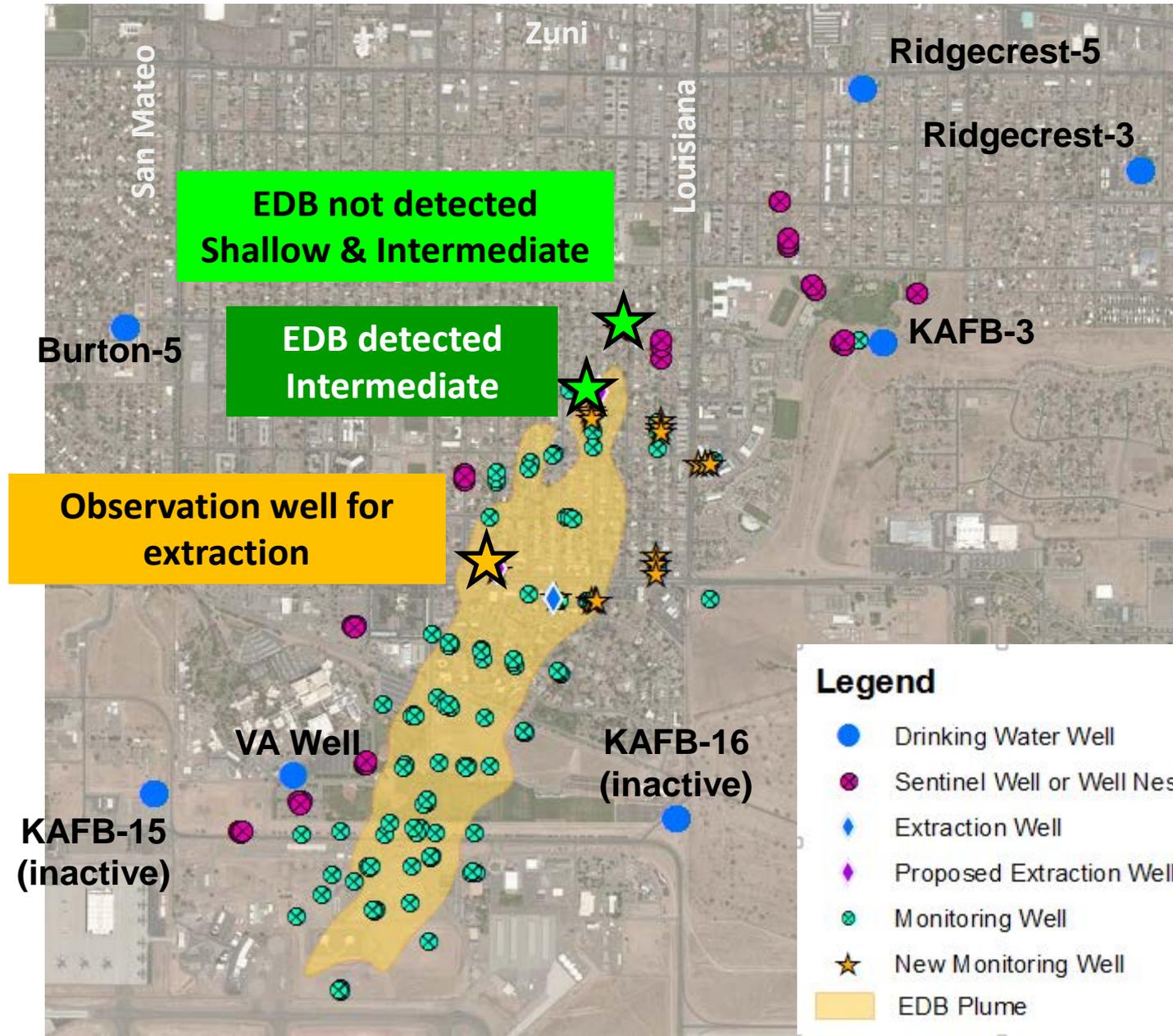
**Dissolved EDB will not be allowed to impact any drinking water supply system at detectable concentrations.**

# Monthly Wellhead Testing Shows No Drinking Water Contamination

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# Protecting Drinking Water Wells



# Collapsing the EDB Plume

2<sup>nd</sup> and 3<sup>rd</sup>  
Extraction  
Wells (2015)

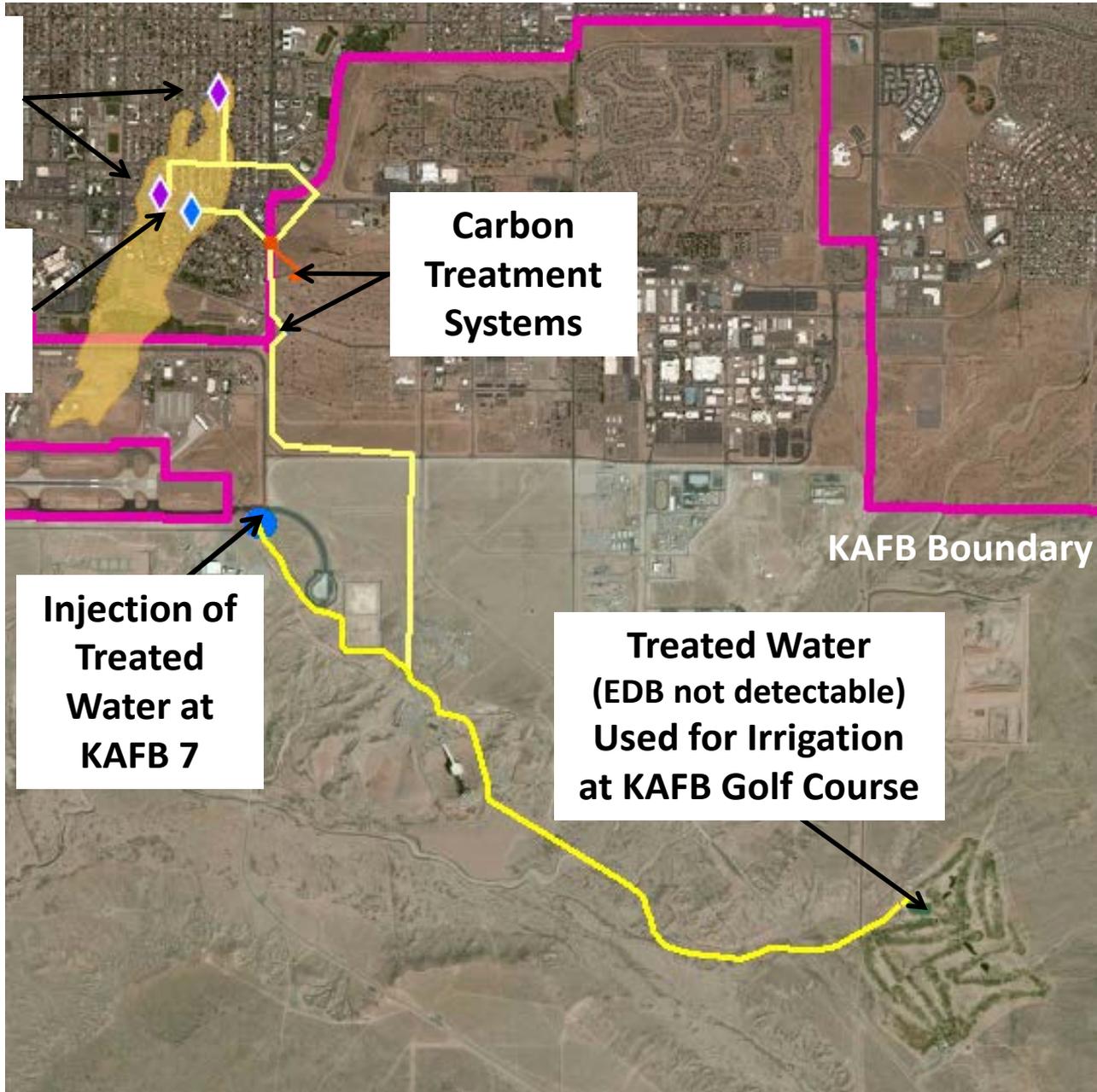
First  
Extraction  
Well

Carbon  
Treatment  
Systems

KAFB Boundary

Injection of  
Treated  
Water at  
KAFB 7

Treated Water  
(EDB not detectable)  
Used for Irrigation  
at KAFB Golf Course



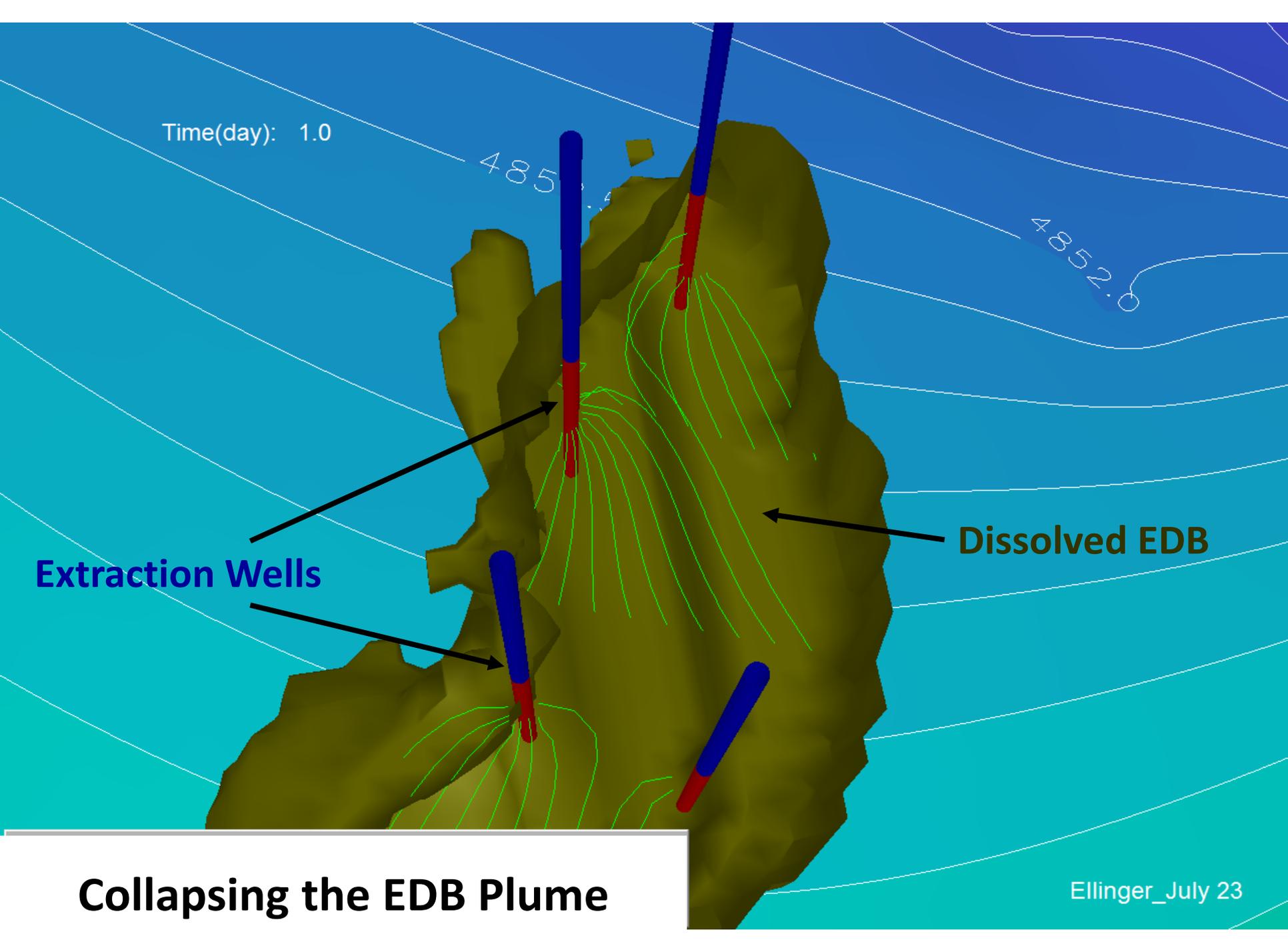
Time(day): 1.0

Extraction Wells

Dissolved EDB

**Collapsing the EDB Plume**

Ellinger\_July 23



# Groundwater Pump-and-Treat Full-Scale System



Excavation and leveling of building pad



Pouring of floor of building



GAC tanks and building walls

Pump on skid for full-scale treatment system

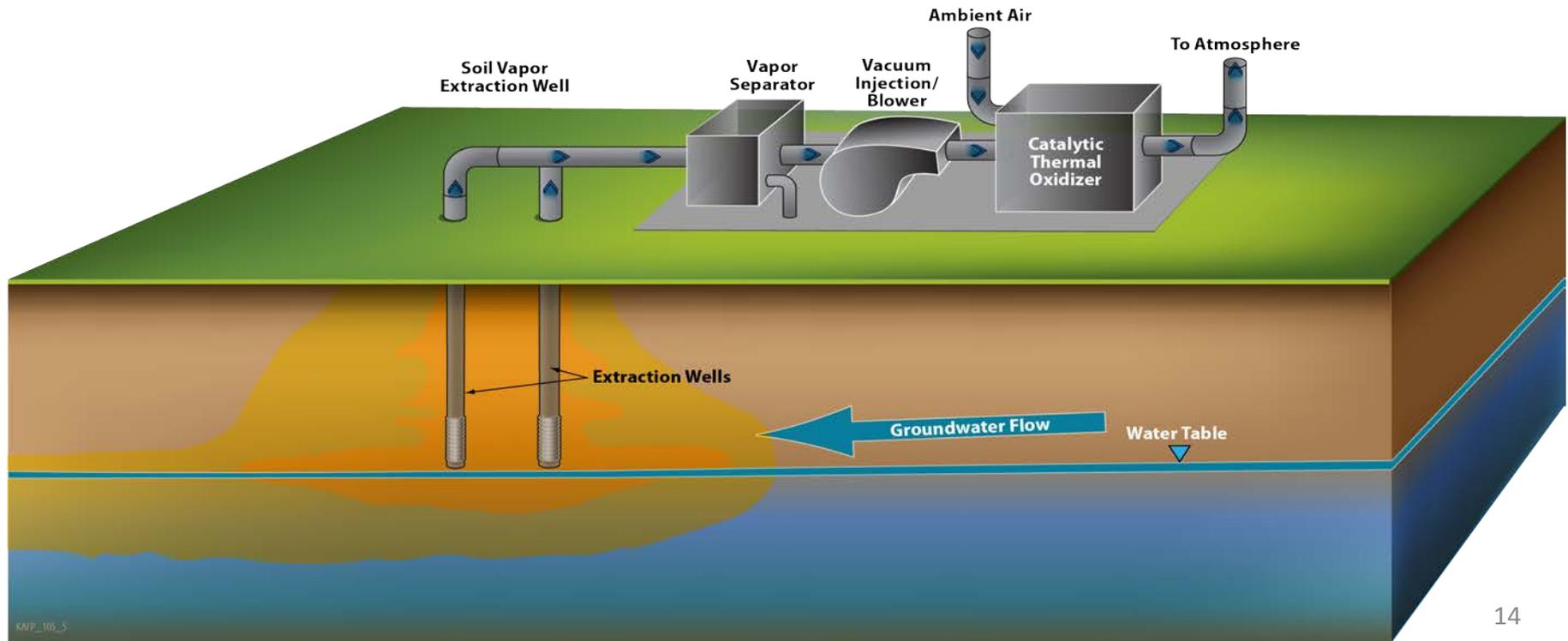


Discharge point at Tijeras Golf Course pond on Kirtland AFB



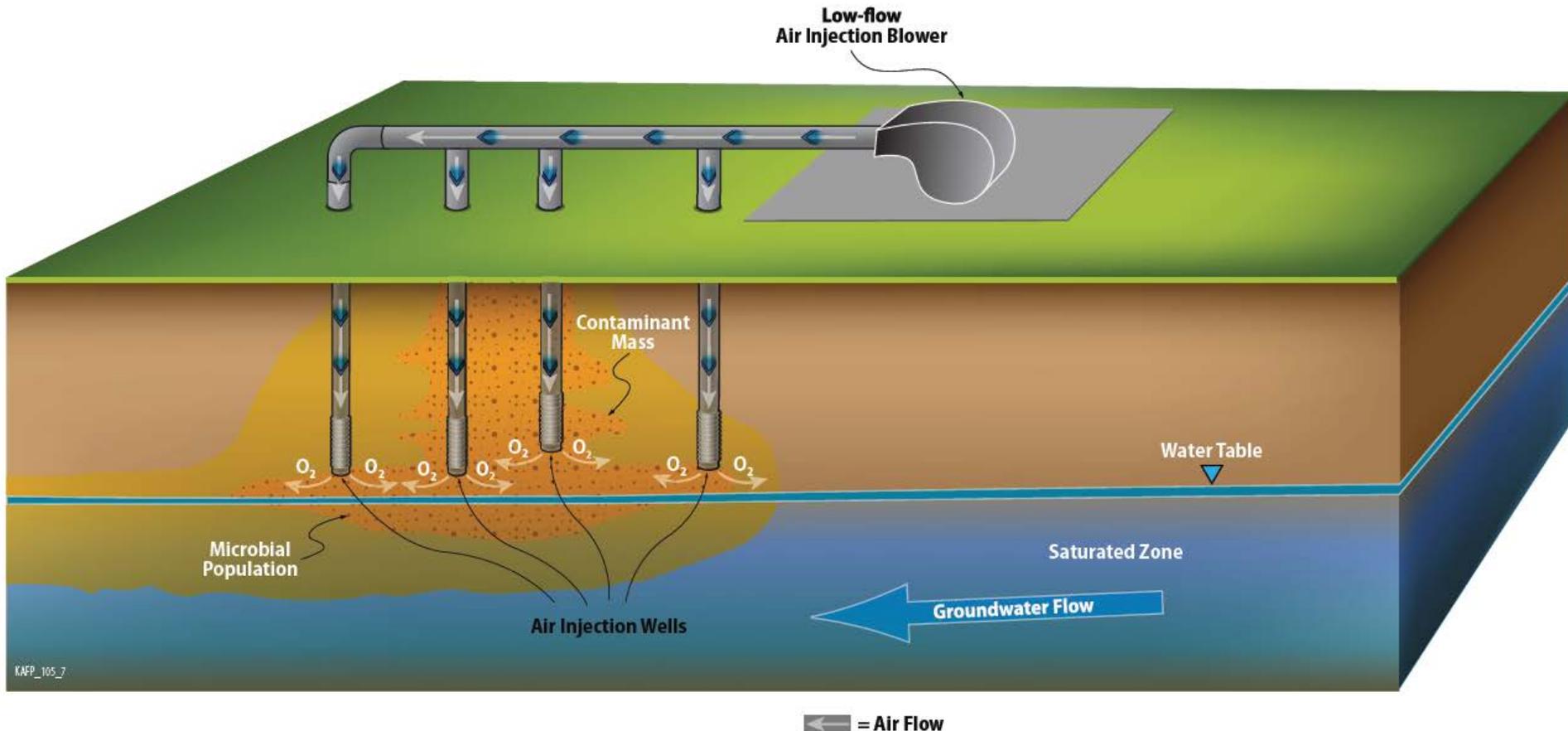
# Soil Vapor Extraction

- More than 600,000 gallons of fuel recovered by SVE
- After 12 years of SVE, soil vapor concentrations are decreasing
- Vapor is treated in accordance with City of Albuquerque Air Quality Permit requirements
- SVE rebound and bio-respiration testing completed in July 2015



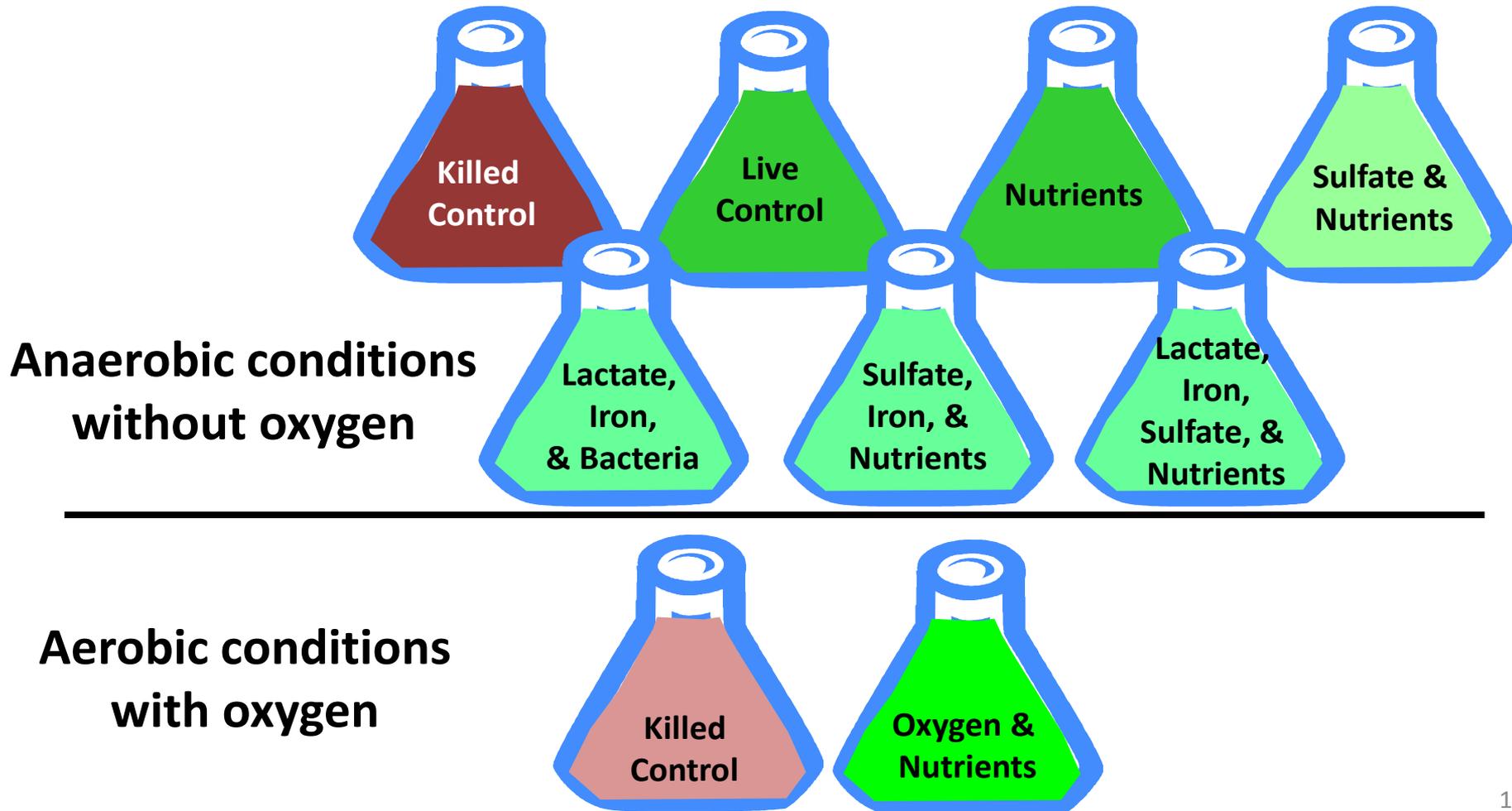
# Bio-Venting

- Air is injected into the vadose zone to deliver oxygen to soil bacteria to help them biodegrade contaminants



# Laboratory Microcosm Testing

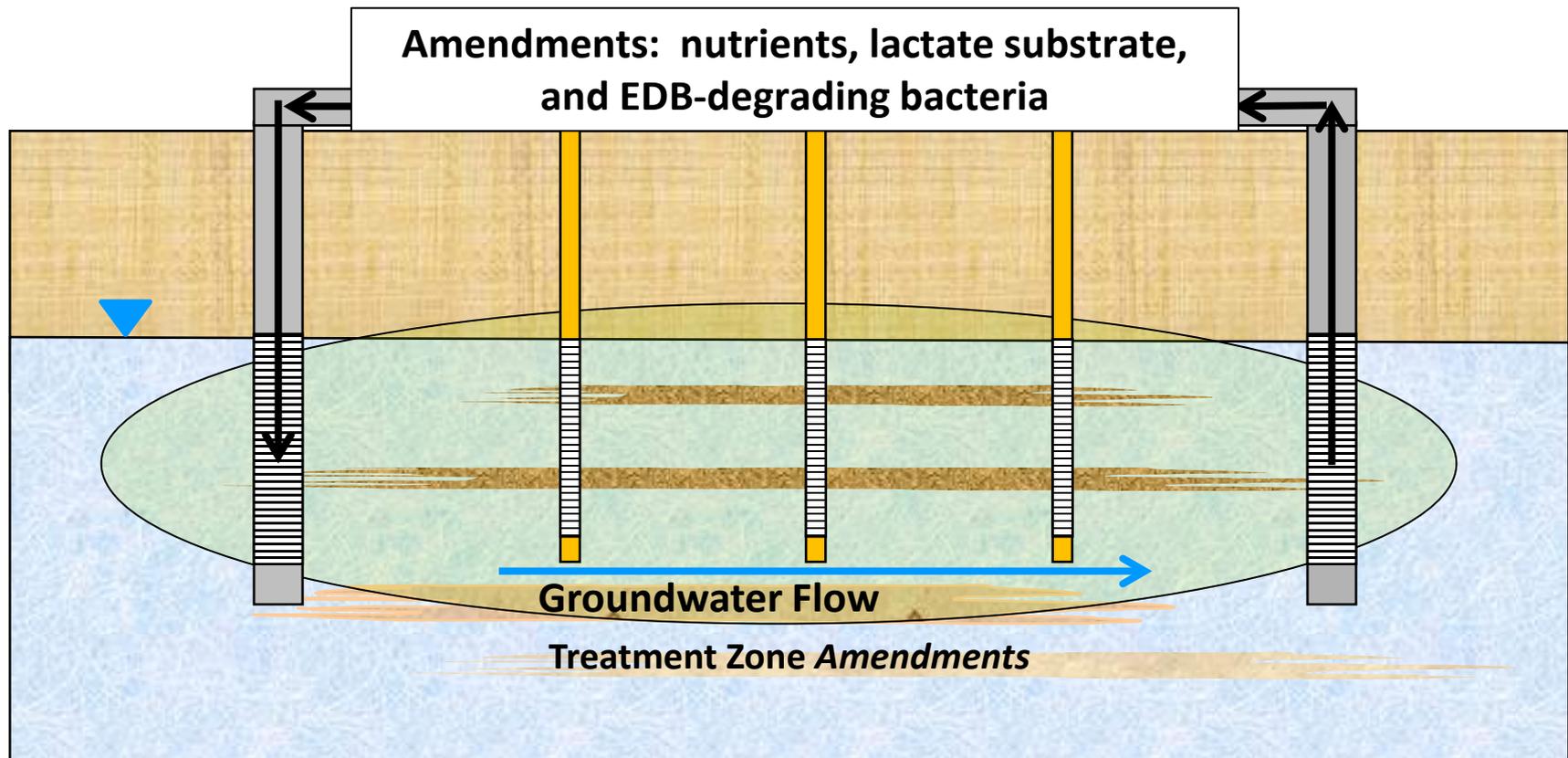
Identify potential technologies to biodegrade EDB



# Anaerobic Biodegradation Pilot Test

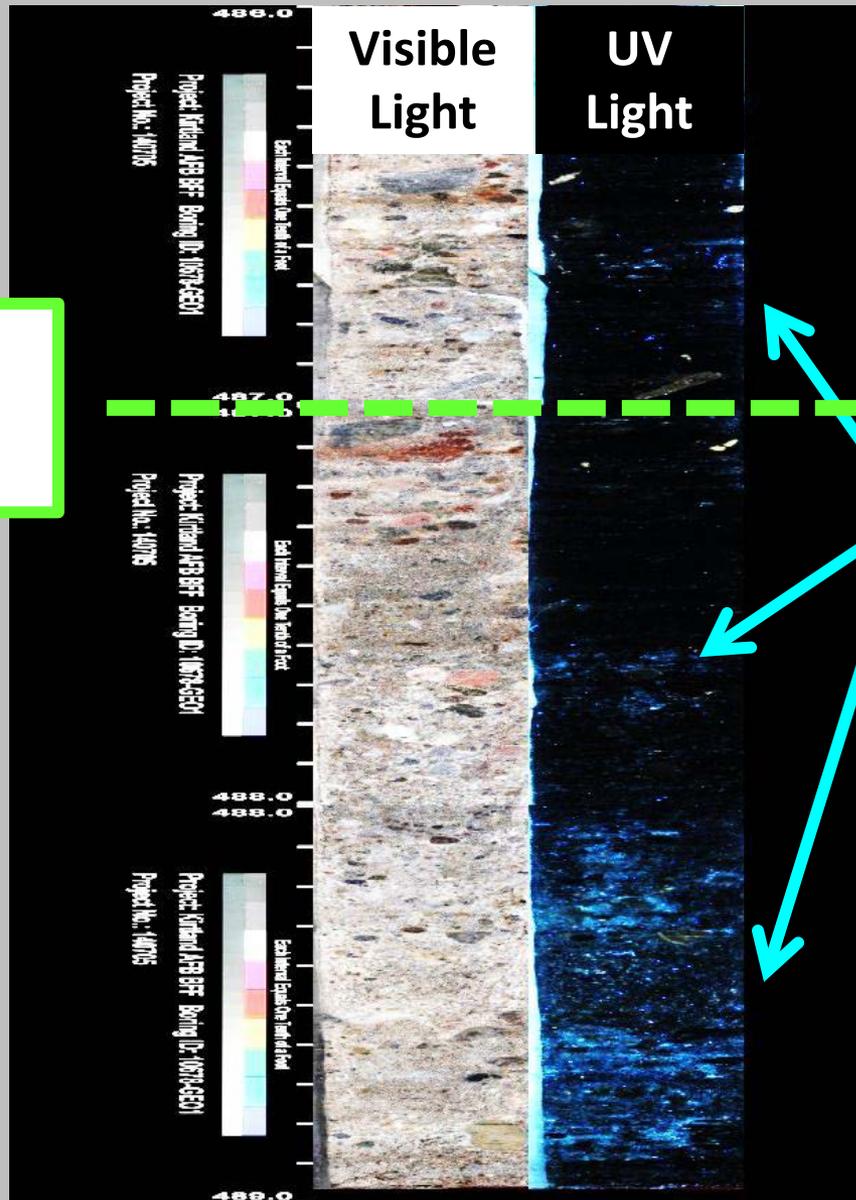
## Groundwater Recirculation

- Pump groundwater - Add amendments
- Inject amended water up-gradient to create recirculation cell to support anaerobic biodegradation EDB



# Drowned LNAPL – Soil Cores

**Groundwater Table**



**LNAPL Under UV Light Fluoresces Blue**



# LNAPL Clean Up

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- **Technically challenging due to groundwater depth and submerged LNAPL from rising water table**
- **Screening potential technologies for interim measures**
- **Conduct laboratory and field scale pilot tests for potentially suitable technologies**
- **Collect continuous core samples from the source area to determine evaluate presence and nature of LNAPL at the site**

# 2015 Site Status

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- **4020 tons of contaminated soil excavated since 2000**
- **287 soil monitoring wells installed since 2000**
- **More than 600,000 gallons of fuel recovered by SVE since 2003; soil vapor levels are decreasing**
- **135 groundwater monitoring wells installed since 2000**
- **Water table continues to rise**
- **Groundwater plumes are relatively stable**
- **Monthly testing of drinking water wells continues to show no evidence of contamination**
- **No contaminant detects in any sentinel wells**
- **First of up to 8 extraction wells to collapse EDB plume began operation in June 2015 with an additional two online by end of the year**

# NMED Strategic Plan Summary

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

**Strategies to Achieve the Goal:**

- 1) Continue robust groundwater and wellhead monitoring**
- 2) Collapse the dissolved EDB Plume away from the Albuquerque Bernalillo County Water Utility Aquifer Wells**
- 3) Clean up soil in the spill area**
- 4) Remediate Light Non-Aqueous Phase Liquid (LNAPL) and associated dissolved phases in the LNAPL area**
- 5) Meet or exceed all requirements for providing public information and involvement**

# Thank You Neighborhoods!

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**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**

# Upcoming Events

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- **Public Field Trip – October 24, 2015 (registration closed)**
- **Public Meeting – November 17, 2015 (no registration required)**



# How do I get more information?

## Contact NMED:

Dennis McQuillan,  
KAFB project technical lead  
[dennis.mcquillan@state.nm.us](mailto:dennis.mcquillan@state.nm.us)  
505-827-2140

Jill Turner,  
KAFB project communications lead  
[jill.turner@state.nm.us](mailto:jill.turner@state.nm.us)  
505-222-9548

NMED Website and Listserv: <http://www.nmenv.state.nm.us/>

## Contact the Air Force:

Air Force Civil Engineer Center  
Office of Public Affairs  
2261 Hughes Ave, Ste 155  
Joint Base San Antonio-Lackland TX 78236-9853  
(210) 925-0956 or (866) 725-7617  
Email: [afcec.pa@us.af.mil](mailto:afcec.pa@us.af.mil)

Air Force BFF-specific spill website: [www.kirtlandjetfuelremediation.com](http://www.kirtlandjetfuelremediation.com)

Kirtland AFB website at <http://www.kirtland.af.mil> in the Environmental Issues section for Public Records.