Evaluation of Potential Exposures
Bulk Fuels Facility Groundwater Plume
Kirtland Air Force Base
Albuquerque, New Mexico

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Water Protection Advisory Board
July 30, 2013
Community Concerns

- Characterization/Remediation Process
- Sampling/Monitoring Methods/Locations
- Remediation Goals and Strategy
- Evaluation of Potential Exposures
Could potential human exposures to contaminants from the leaked fuels harm people’s health?
What does this Health Consultation evaluate?

- Pathways of exposure to BFF contaminants
- Contaminant concentrations and distributions in groundwater wells and air/soil vapor samples
- Comparison of contaminant concentrations with the health comparison values used to identify exposures of public health concern
Water Supply Wells

Legend
EDB Result (ug/L)
- 0.002 - 0.050
- 0.051 - 1.0
- 1.1 - 10
- 11 - 100
- 110 - 1000
- Water Supply Well
- Not Sampled

Groundwater Level Contour (ft msl)
EDB Concentration Contour (ug/L)

Historical Area of Observed NAPL (July 2009)

EDB Concentration (ug/L)
- 0.014 - 0.1
- 0.11 - 1
- 1.1 - 10
- 11 - 100
- 110 - 1000

Note: EDB concentrations were gridded using effective ETM with a major range of 1400 ft, minor range of 700 ft, DNAPL exponent of 4, and a smoothing factor of 0.5.

Results for water supply wells are posted for information only and were not included in gridding.

Data concentrations are posted to 2 significant figures. The lowest contour data value is the RFA MCL or the New Mexico Groundwater Protection Standard, whichever is lower.

J = validation qualifier for estimated values greater than the LOQ.
J = estimated value, high bias.
J = estimated value, low bias.
L = analysis not detected, associated numerical value is at or below the LOQ.
U = analysis was technically not detected, associated numerical value is at or below the LOQ.

SITE LOCATION

FIRST QUARTER 2013
BULK FUELS FACILITY
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 5-13
1,2-DIBROMOETHANE (EDB) CONCENTRATIONS IN SHALLOW GROUNDWATER

Revision Date: 04/25/13
Projection: NAD83 State Plane New Mexico Central Foot
1 inch = 1,000 feet
LAB TOTAL VAPOR VOC PLUME FOOTPRINTS BY ELEVATION JUNE 2011

Legend:
- SVI Well with Vapor VOC Concentration (ppmv)
- Cross-Section Line
- VOC Concentration Contour (ppmv)
- VOC Concentration (ppmv)
  - 10 - 99
  - 1 - 9.99
  - 1,000 - 9,999
  - ≥ 10,000
- Installation Boundary
- Aboveground Fuel Transfer Lines
- Underground Fuel Transfer Lines
- Highway
- Major Road
- Road
- Structure
- Demolished Structure
- Runway

Note:
- The various SVI plots were plotted with the same dimensions and ground elevation data.
- Concentration plots were developed at 90° intervals.
- Ground elevations range from 5,114 ft to 5,414 ft above mean sea level across the Site 1-100-151-111 investigation area.

SVI well locations are presented with the total vapor VOC concentration in parts per million for each elevation. Samples results within 25 ft of the elevation are plotted. For example, Plot 9500 includes sample results within the 0.025 to 0.025 ft interval. Locations are not shown at elevations where there is no sample result for the elevation interval.

See Figure 4-2 for SVI well locations with ID numbers.
When is a chemical a health hazard?

- When you are exposed at levels that may make you sick,
- Most chemicals are present at background levels everywhere.
How do we find if a chemical is a health hazard?

• Look for a complete exposure pathway
  ▪ Eating, breathing, or contacting a chemical creates a potential pathway

• Estimate exposure dose
  ▪ How much of each chemical a person may have come in contact with

• Compare exposure doses at the site with other doses that have harmed people
What is an exposure pathway?

- Complete pathways have 5 components
  - Source (e.g., leaked fuels)
  - Contaminant migration from source to people
  - Exposure area or location
  - Exposure route (e.g., breathing, swallowing, touching)
  - Exposed people

- Can occur in past, present, or future
## Pathways of Exposure to Fuels Released from Bulk Fuel Facility, KAFB

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Timeframe and Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater: Down-gradient Water Supply Wells (KAFB and Water Authority wells)</td>
<td><em>Incomplete</em> for past/present/future exposure. Ongoing and planned remedial actions should retard migration and contingency plans are in place to prevent exposure should contaminants reach water supply wells.</td>
</tr>
<tr>
<td>Indoor air at BFF Buildings</td>
<td><em>Potentially complete</em>, past/present/future. Benzene air concentrations below occupational limits and 10E-04 risk for occupational exposures. Levels are within background range for indoor air and fuel facility- no indication that benzene is due to VI.</td>
</tr>
<tr>
<td>Vapor Intrusion at VA Hospital and vacant land (San Pedro and Ridgecrest Drives)</td>
<td><em>Indeterminate</em> for past/present/future exposure. Subsurface (15-25 ft. bgl) benzene vapor concentration is elevated in these areas. No indoor air or shallow subsurface (5 ft. bgl) data are available.</td>
</tr>
<tr>
<td>Air emissions from SVE treatment system at BFF</td>
<td><em>Incomplete</em> for past/present/future exposure. Emissions are treated prior to release with appropriate monitoring and permitting.</td>
</tr>
</tbody>
</table>
What is the Exposure Dose?

- **Doses are measured in units of mg/kg/day**
  - Milligrams of contaminant per kilogram of body weight per day

- **Child and adult doses are calculations of how much chemical the body absorbs**
  - Intake rates
  - Body weights
  - Absorption rates (bioavailability)

- **For completed pathways doses are calculated for**
  - Short term exposures (hours to 14 days)
  - Intermediate exposures (14 to 365 days)
  - Long term exposures (a year or more)
How is cancer risk estimated?

- Benzene exposure can cause cancer

- Estimated cancer risk = dose x cancer slope factor (CSF)
  - CSF derived from animal studies

- Estimated cancer risk is “excess occupational exposure risk”
  - 20 years, 40 hours/week, 50 weeks/year

- Rate of background cancer risk is high
  - One of three in US will get cancer; lifetime risk of 0.35
  - ATSDR considers risk range of 0.0001 to 0.000001 to be “low to no apparent increased risk”
### Indoor Air Sampling Results and Non-residential Screening Levels

<table>
<thead>
<tr>
<th>Compound</th>
<th>Bldg. 1026 µg/m³</th>
<th>Bldg. 1032 µg/m³</th>
<th>Bldg. 1033 µg/m³</th>
<th>Indoor Air SL µg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>16</td>
<td>22</td>
<td>13</td>
<td>31,000 EMEGc</td>
</tr>
<tr>
<td>Benzene</td>
<td>23</td>
<td>6.4</td>
<td>0.7</td>
<td>1.4 CREG&lt;sub&gt;adj&lt;/sub&gt;</td>
</tr>
<tr>
<td>Bromomethane</td>
<td>ND</td>
<td>1.3</td>
<td>0.72</td>
<td>19 EMEGc</td>
</tr>
<tr>
<td>2-Butanone (MEK)</td>
<td>4</td>
<td>4</td>
<td>5.9</td>
<td>5,000 RfC</td>
</tr>
<tr>
<td>Carbon tetrachloride</td>
<td>0.39 J</td>
<td>0.44</td>
<td>0.46</td>
<td>1.8 CREG&lt;sub&gt;adj&lt;/sub&gt;</td>
</tr>
<tr>
<td>Chloromethane</td>
<td>0.9</td>
<td>1.3</td>
<td>1</td>
<td>100 EMEGc</td>
</tr>
<tr>
<td>Dichlorodifluromethane</td>
<td>2.1</td>
<td>2.2</td>
<td>2.1</td>
<td>260 NJ NR SL</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>14</td>
<td>1.8</td>
<td>0.2 J</td>
<td>260 EMEGc</td>
</tr>
<tr>
<td>Methylene chloride</td>
<td>0.9</td>
<td>4.2</td>
<td>0.3 J</td>
<td>1000 CREG&lt;sub&gt;adj&lt;/sub&gt;</td>
</tr>
<tr>
<td>Styrene</td>
<td>1</td>
<td>ND</td>
<td>5.4</td>
<td>850 EMEGc</td>
</tr>
<tr>
<td>Tetrachloroethylene</td>
<td>ND</td>
<td>0.5 J</td>
<td>ND</td>
<td>3.8 CREG&lt;sub&gt;adj&lt;/sub&gt;</td>
</tr>
<tr>
<td>Toluene</td>
<td>37</td>
<td>14</td>
<td>0.8 J</td>
<td>300 EMEGc</td>
</tr>
<tr>
<td>Trichlorofluoromethane</td>
<td>1.2 J</td>
<td>1.1 J</td>
<td>1.3</td>
<td>1,000 NJ NR SL</td>
</tr>
<tr>
<td>1,1,2-Trichloro-1,2,2-trifluoroethane</td>
<td>0.5 J</td>
<td>0.6 J</td>
<td>ND</td>
<td>44,000 NJ NR SL</td>
</tr>
<tr>
<td>o-Xylene</td>
<td>13</td>
<td>1.8</td>
<td>0.3 J</td>
<td>220* EMEGc</td>
</tr>
</tbody>
</table>
## Maximum Measured Soil Gas/Outdoor Air Contaminants from Vacant Land, Bullhead Memorial Park, and VA Hospital

<table>
<thead>
<tr>
<th></th>
<th>Vacant Land Soil Gas 15-30 ft. bgl µg/m³</th>
<th>Bullhead Memorial Park µg/m³</th>
<th>VA Hospital Soil Gas 15-25 ft. bgl µg/m³</th>
<th>Soil Gas SL (Residential) (5 ft. bgl) µg/m³</th>
<th>Soil Gas SL (non-Res) (5 ft. bgl) µg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminants</td>
<td></td>
<td>Soil Gas</td>
<td>Outdoor Air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>190</td>
<td>2.8</td>
<td>0.6</td>
<td>1,242</td>
<td>16</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>680</td>
<td>NM</td>
<td>NM</td>
<td>3,440</td>
<td>310,000</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>140</td>
<td>22.8</td>
<td>0.3</td>
<td>660</td>
<td>53,000</td>
</tr>
<tr>
<td>Heptane</td>
<td>560</td>
<td>NM</td>
<td>NM</td>
<td>3,985</td>
<td>NA</td>
</tr>
<tr>
<td>Hexane</td>
<td>2,100</td>
<td>NM</td>
<td>NM</td>
<td>945</td>
<td>36,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>3,400</td>
<td>263</td>
<td>2.8</td>
<td>5,320</td>
<td>260,000</td>
</tr>
<tr>
<td>Xylene (total)</td>
<td>1,100</td>
<td>56.8</td>
<td>ND</td>
<td>1,892</td>
<td>5,500</td>
</tr>
</tbody>
</table>

Maximum Measured Soil Gas/Outdoor Air Contaminants from Vacant Land, Bullhead Memorial Park, and VA Hospital.
Observed and estimated cancer effect levels for chronic benzene inhalation and background air concentrations
Conclusion 1

• Based on currently available groundwater monitoring data there are no past or current exposures via groundwater at down-gradient water supply wells. Future exposures, which are possible, will be prevented if water is treated or supply wells are removed from service prior to contamination.
Conclusion 2

- BFF workers may be exposed to benzene in air via vapor intrusion into buildings. As measured benzene air concentrations are within the normal range of US residences and below regulated occupational concentrations, these exposures are not expected to harm people’s health.
Conclusion 3

- Workers and patients at the VA Hospital may be exposed to benzene in air via vapor intrusion into buildings. Estimated benzene air concentrations are within the normal range of US residences and below regulated occupational concentrations. Based on available data, these exposures are not expected to harm people’s health.
Conclusion 4

- BFF workers may be exposed to hydrocarbon compounds in air via airborne emissions from the SVE treatment system. Assuming the SVE system is operated and maintained per permit conditions, potential exposures are not expected to harm people’s health.
ATSDR Recommendations

- Continue ongoing and implement proposed monitoring and remedial actions as planned.
- Further characterize soil gas and/or indoor air at the VA Hospital.
ATSDR Next Steps

- Evaluate any new environmental data (including planned and recommended indoor air samples) to ensure that potential exposures do not pose a public health hazard.
- Present the results and conclusions of this health consultation to the Albuquerque community and respond to community health concerns as appropriate.
Public Comment Period

• Health Consultation is available now for public review.

• Public comment period ends August 26, 2013.

• All comments submitted will be discussed in final version.
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