
Ground Water Reclamation & Treatment

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Questions to Address

- What are methods available for remediation of ground water contaminated with hydrocarbons?
- What is the threat to ABQ public water supply?



Terminology

- DNAPL – dense non-aqueous phase liquid (chlorinated solvents)
- LNAPL – light non-aqueous phase liquid (petroleum fuels)
- VOCs – volatile organic compounds – will evaporate at room temperature
- Adsorb – stick to a surface
- GROs - Gasoline Range Organics – hydrocarbons in gasoline
- BTEX – benzene, toluene, ethylbenzene, xylenes
- EDB – ethylene dibromide



General Classes of Ground Water Contaminants

- Inorganic contaminants – (don't have carbon atom in molecule) – metals (arsenic to zinc), non-metals (nitrate, salinity, etc.), radionuclides
- Organic contaminants
 - DNAPLs
 - LNAPLs
 - Others – pesticides, herbicides, etc.



LNAPL Remediation Alternatives Depend On:

- Soil & hydrogeologic properties – Affect contaminant transport
- Solubility – Most hydrocarbons not soluble
- Adsorption – Most hydrocarbons adhere to soil
- Volatility – Gasoline range organics are volatile, Diesel range organics are less volatile
- Biodegradation – Most soluble hydrocarbons are degradable

- Remediation focus is on BTEX & EDB because they're regulated: soluble, volatile, less adsorption, biodegradable



Remediation Strategies



Excavation & Disposal

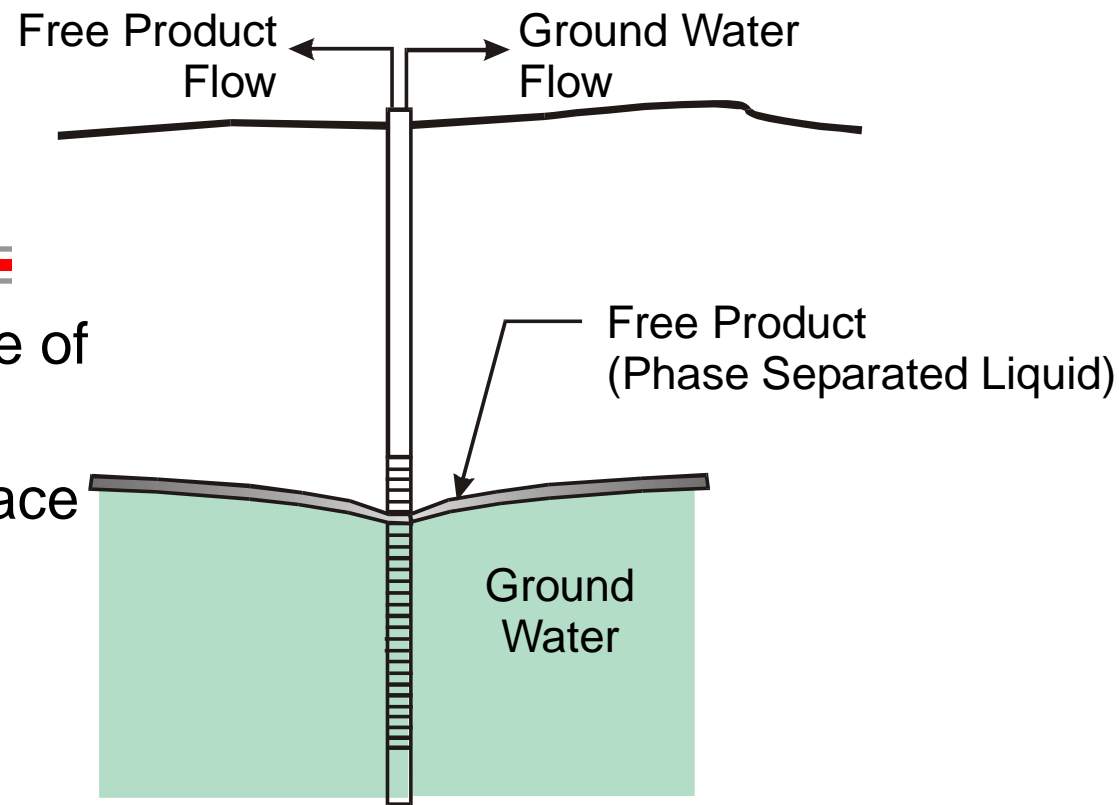
(Muck & Truck)

- Excavate heavily contaminated soil near source
 - Removes the source of underlying contaminants
 - Limited to practical limits of excavation



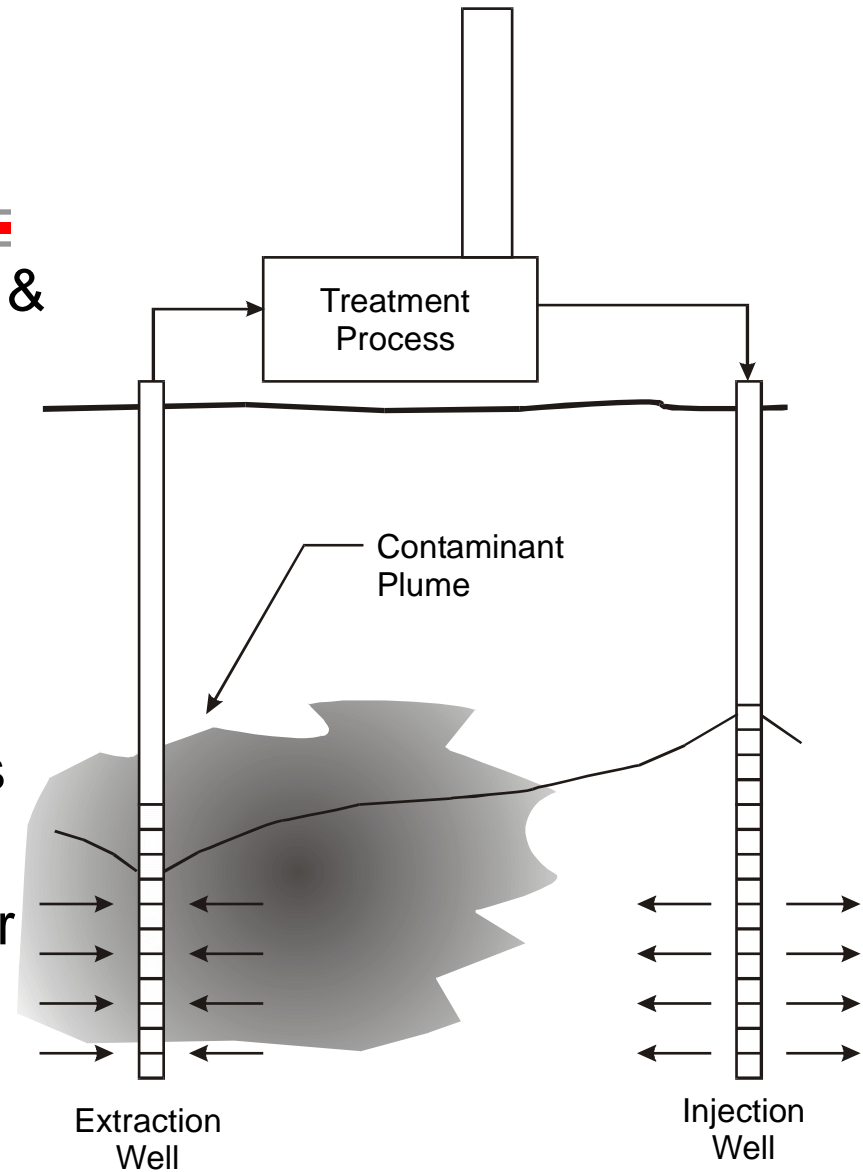
Free Product Recovery

- Pump water to create cone of depression
- Pump free product to surface
- Comments
 - Difficult to pump thin layer of free product
 - Free product flows VERY slowly
 - Often limited success



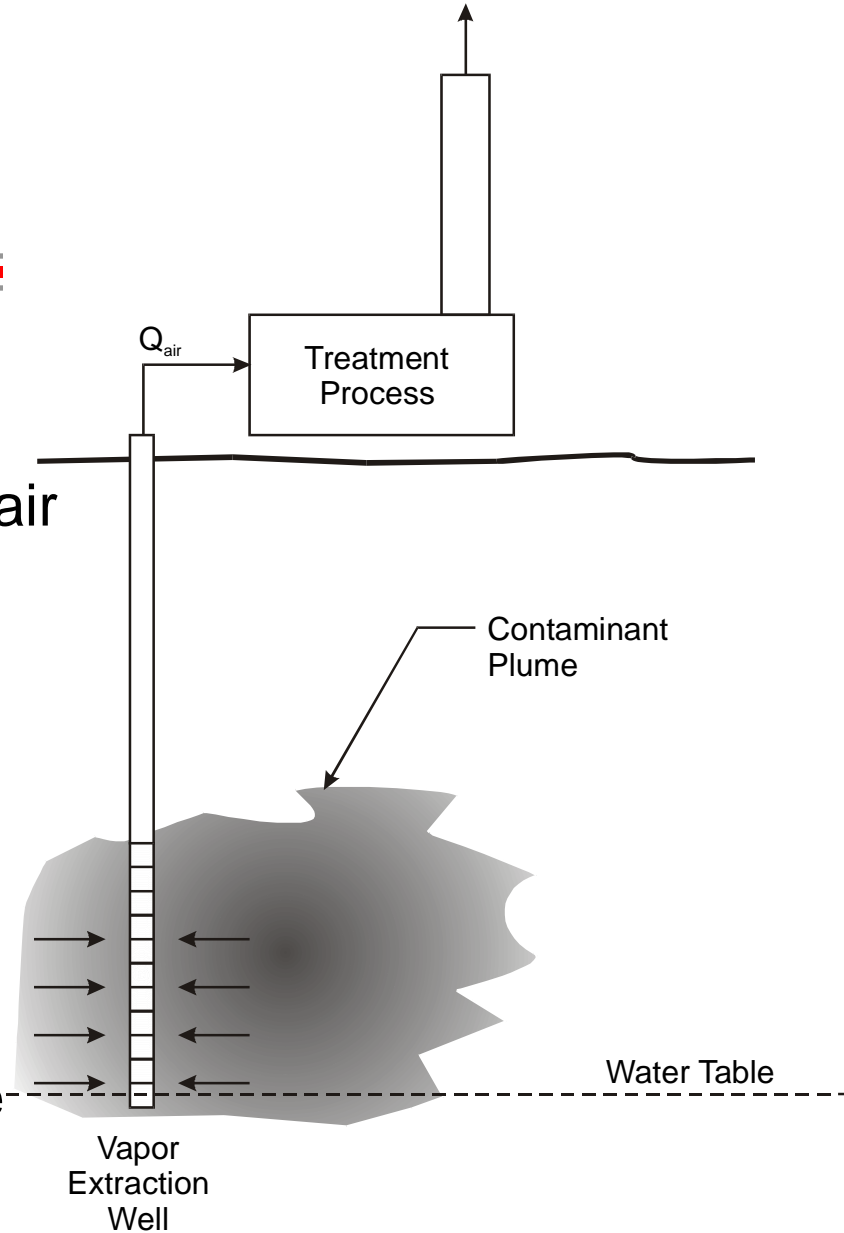
Pump & Treat

- Pump contaminated water to surface & treat
- Discharge treated water or re-inject (depends on regs & local conds)
- Comments
 - Most contaminants adsorb to soils & slow to desorb
 - Must pump large volumes of water for long times
 - Pump & treat provides gradient control
 - Not often used for petroleum spills



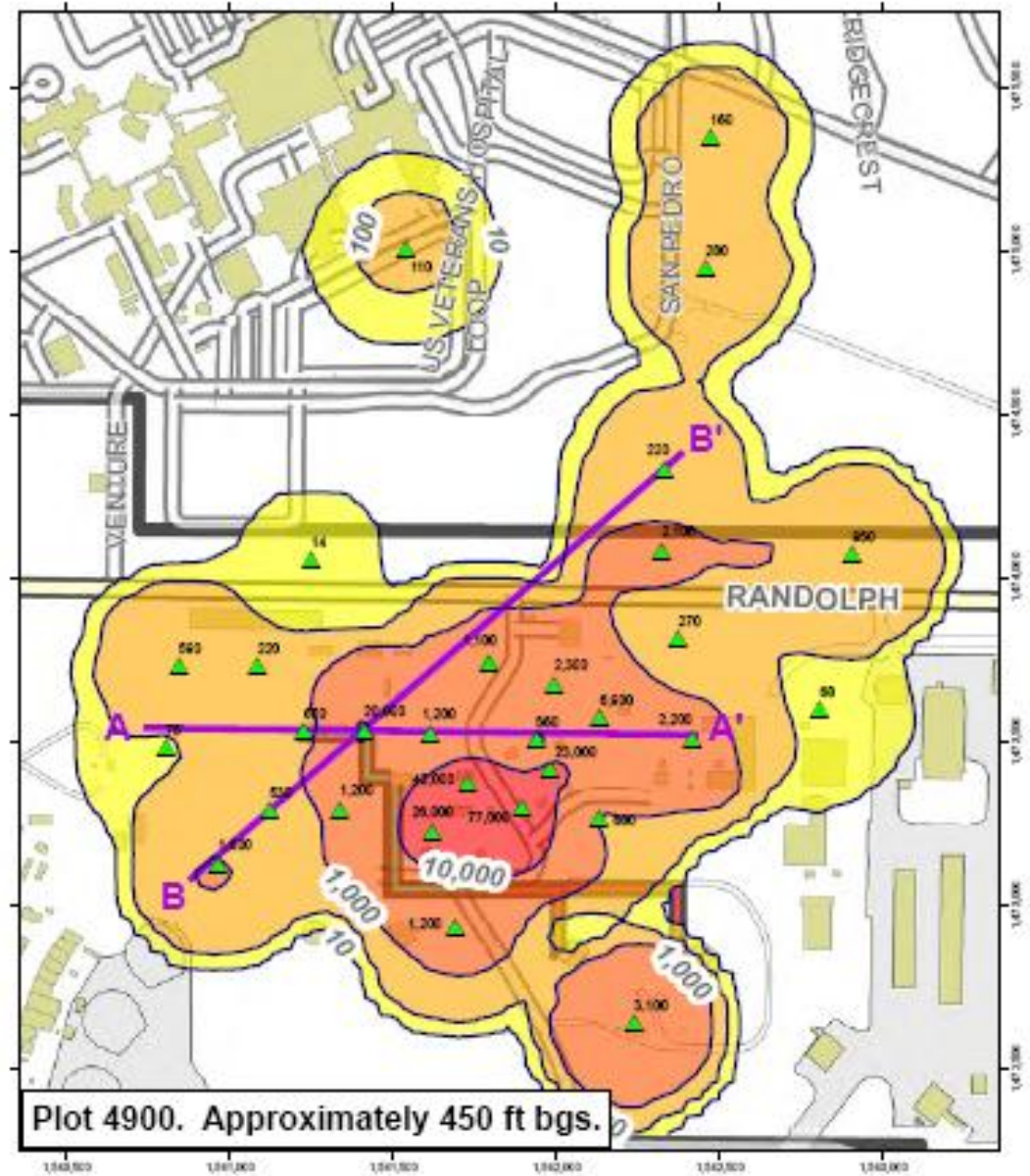
Soil Vapor Extraction (SVE)

- Suck soil gases through unsaturated zone (vadose zone)
- VOCs evaporate & are removed with air
- Treat air at surface
 - Catalytic oxidation (catox)
 - Internal combustion engine
- Comments
 - Widely used in NM
 - Comparatively fast & cost effective
 - Will enhance biodegradation



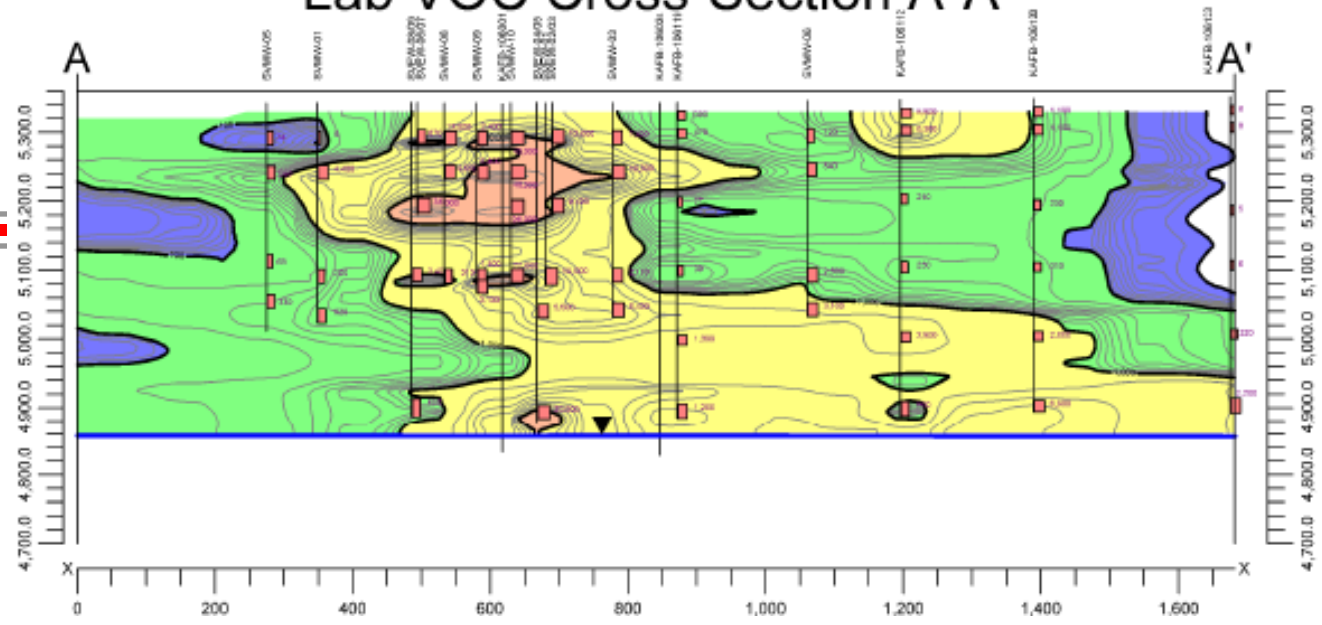
VOC Distribution at KAFB

- Distribution at 450 ft depth

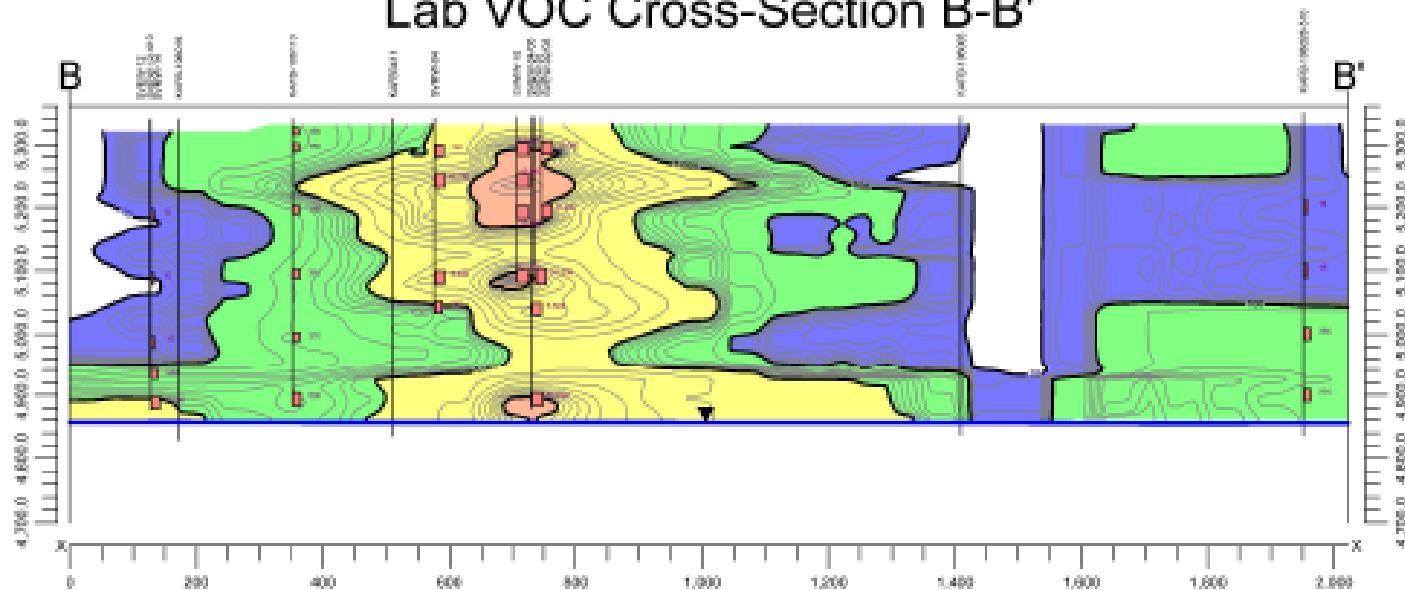


VOC Profiles

Lab VOC Cross-Section A-A'

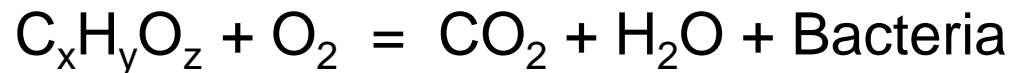


Lab VOC Cross-Section B-B'



Biodegradation

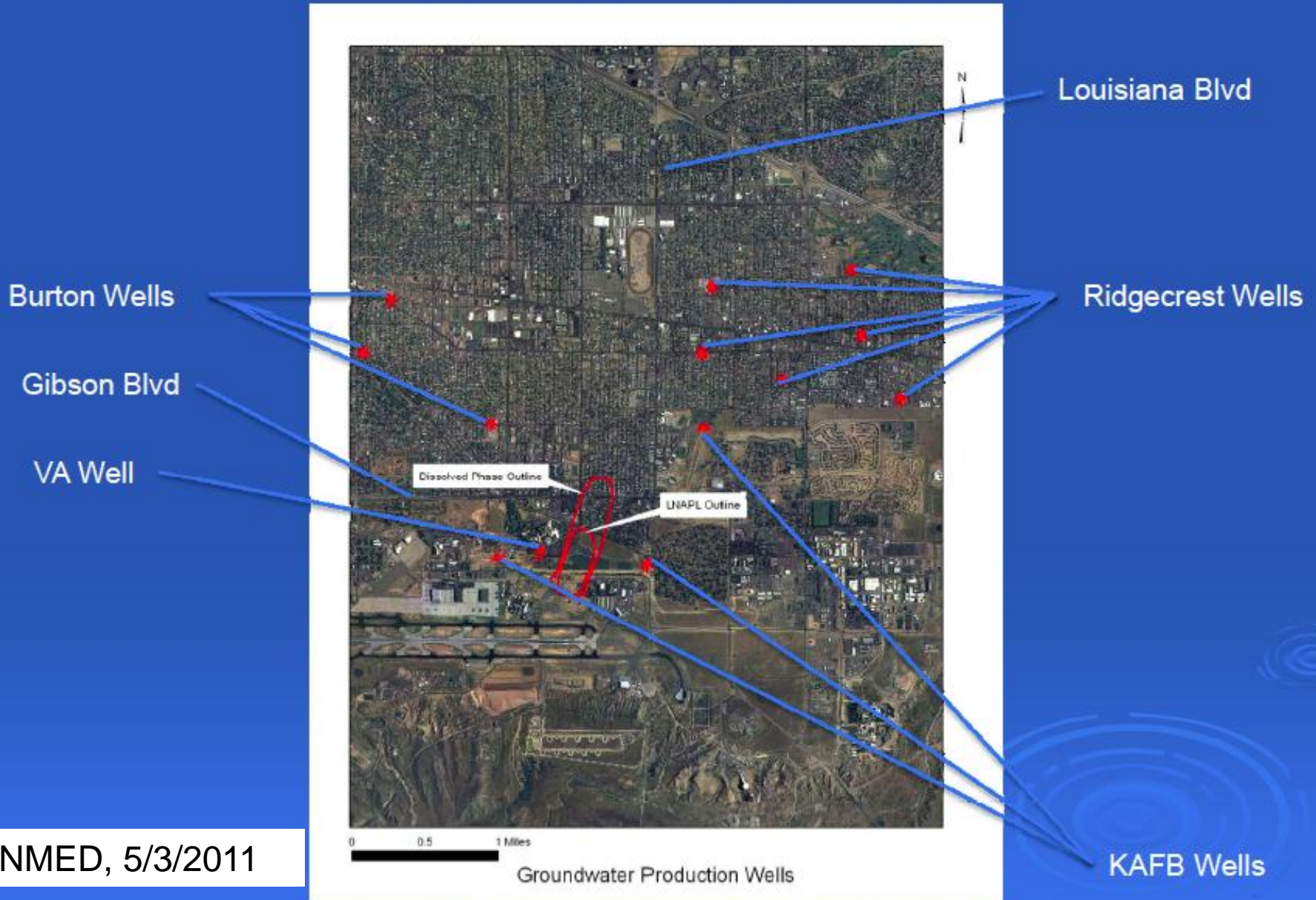
- BTEX, EDB, alcohols & low molecular weight hydrocarbons will biodegrade
- Degradation by natural soil microorganisms – augmentation with engineered cultures is not needed
- Conditions for biodegradation
 - Aerobic (O_2 present) (EDB degrades faster under anaerobic conditions)
 - Nutrients (N & P)



- Natural degradation & dilution forms basis of “Monitored Natural Attenuation”



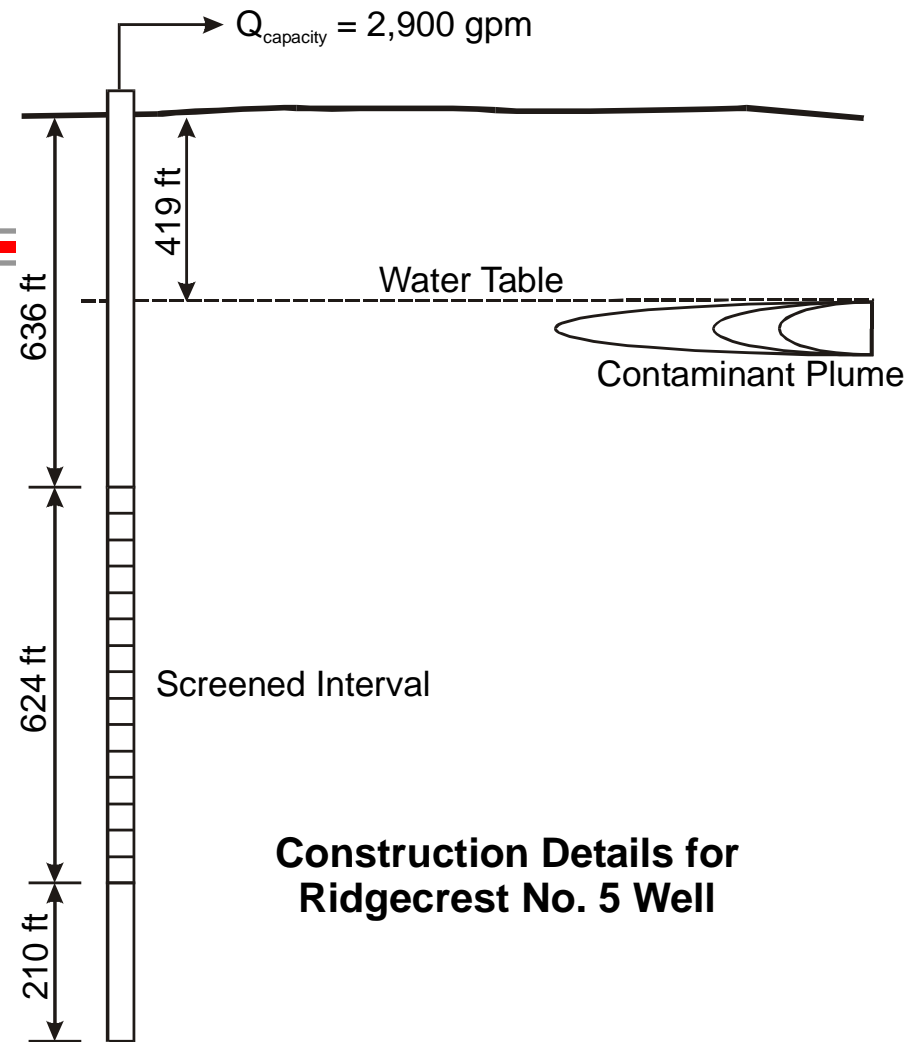
Threat to ABQ Water Supply



NMED, 5/3/2011

Threat of KAFB Fuel Plume to ABCWUA Water System

- Contaminants must migrate horizontally & vertically
 - Need to determine plume depth
- Large dilution factor
- Monitoring
 - ABCWUA monitors wells monthly (paid by KAFB)
 - No VOCs detected in Ridgecrest or Burton wells



**Construction Details for
Ridgecrest No. 5 Well**



Summary Remarks

- Depth & size of the KAFB fuel plume make remediation difficult
- Design of remediation system depends on extent of plume, nature of contaminants, soil characteristics, & hydrogeology
- Immediate threat to public water supply is small
- Important to
 - Monitor well water quality
 - Further characterize plume's 3-D extent

