Montrose Superfund Site DNAPL Operable Unit

Dense Non-Aqueous Phase Liquids

Welcome / Bienvenidos

- Introductions
  EPA/State/Local Officials/TASC
- Montrose DNAPL Proposed Plan

Housekeeping

- Restrooms
- Sign In
- Interpretación a Español, disponible
- Coffee and Pastries available in the back
- Please Turn off Cell Phones

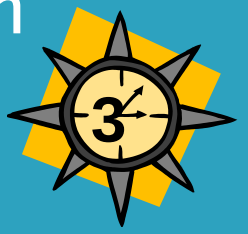
Proposed Plan Meeting

Run different than normal public meetings

Community Involvement	The Plan	Clairifying Questions	Formal Public Comments
Me	**Yarissa Martinez**	**Everyone**	**You**
10 minutes	*40 minutes*	*15 minutes*	*As long as time permits*

Public Speaker Card Available from Me, please raise hands if you need one

Each speaker, initially has 3 minutes. Then we will open the floor



Public Comments

Comment Period through February 13th, 2015

Court Reporter available to record comments if you wish not to speak in public

Mail / *Correo*

Please submit your comments to the EPA Project Manager / *Por favor, envíe sus comentarios a la gerente del proyecto de la EPA:*

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martinez.yarissa@epa.gov

Proposed Plan Briefing Outline

- What is DNAPL?
- Why do we have DNAPL?
- What contaminants make up DNAPL?
- Why should we clean DNAPL?
- How is DNAPL related to Groundwater?
- Difference between mobile and residual DNAPL?
- DNAPL boundaries
- Technologies Evaluated
- Remedies Evaluated
- Preferred Remedy

What is DNAPL?

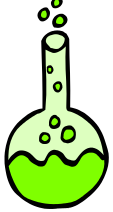
- ***DNAPL (Dense Non-Aqueous Phase Liquid)*** - A DNAPL is one of a group of organic substances that are relatively insoluble in water and more dense than water.

- DNAPL likely entered the ground at the Montrose Chemical Site through the bottom of the Montrose waste disposal pond, through trenches, and via the operations.

Basic Montrose Facts

- Largest Manufacturer of DDT (pesticide) in the United States
- Operated from 1947 until 1982
- Up to 7 million pounds of DDT per month (approx. 84 million pounds per year)
- Historic contamination in soils, groundwater, waste pond, storm water pathways, sanitary sewers, landfills, and dumped in the Pacific Ocean
- Site listed on National Priority List in 1989
- EPA is the lead agency for cleanup decisions

DDT Manufacturing Chemistry



Raw Materials

Trichloro-acetaldehyde (chloral)

+

Mono-chlorobenzene (MCB)

Helps Reaction

Sulfuric Acid

Product

DDT

DNAPL Components

DDT

- Pesticide used for mosquitos control – carrying malaria and other diseases
- Waxy white solid
- Adheres *very* strongly to any organic matter in soils
- Dissolves extremely little in water
- Highly immobile in groundwater
- Highly persistent – many decades

Monochlorobenzene

- Chlorinated, semi-volatile aromatic
- Dissolves little in water
- Dissolves DDT readily
- Drinking Water MCL is 70 ppb

Contaminants

DDT

- Bioaccumulates in food chain
- Carcinogen and endocrine (hormones) disrupter
- Highly toxic to wildlife at low concentrations

Monochlorobenzene

- Affects the liver
- not a carcinogen

Montrose Operations, Mid 1960's

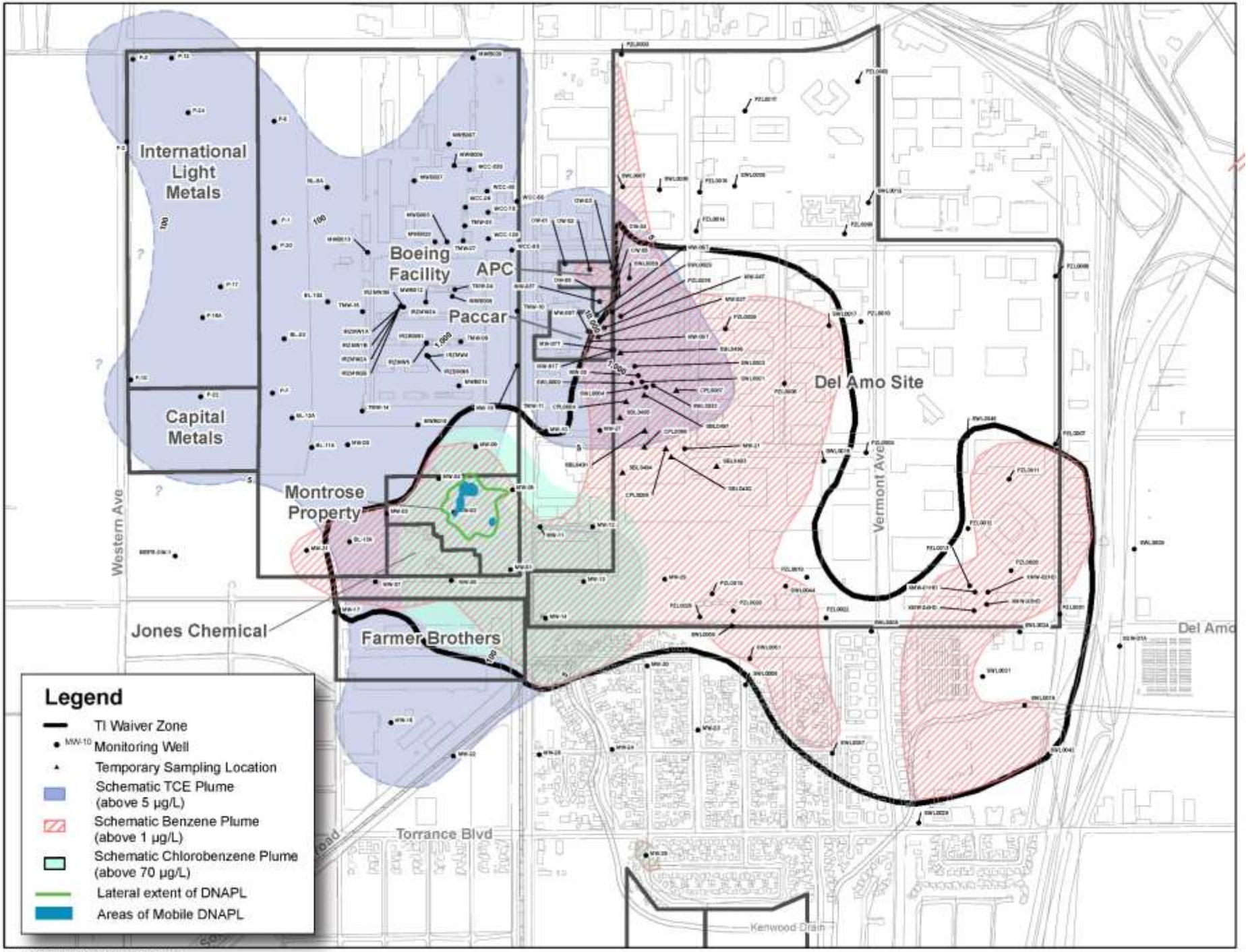
Tech Grinding

Former Montrose Plant Property

(before groundwater treatment plant construction)

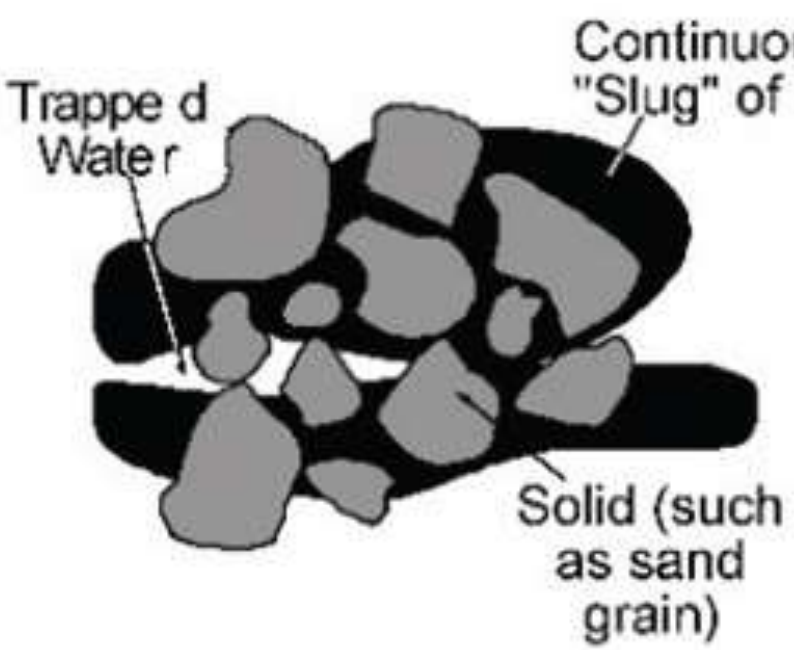
Groundwater Remedy

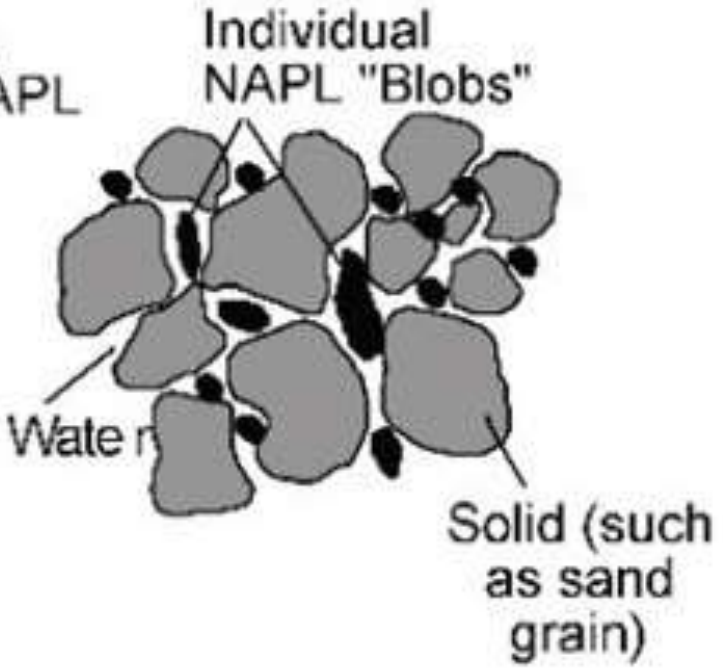
- **DNAPL acts as a source of groundwater contamination**
- **Leaving DNAPL onsite may impact how effective the groundwater remedy can be**
- The public is not drinking contaminated groundwater
- EPA selected a groundwater remedy for all area contamination, including the Montrose Chemical and Del Amo Superfund Sites.
- **Cleanup decision issued in 1999, construction of the system complete in a couple of weeks**



Prepared by CH2M Hill, April 2007

Mobile vs. Residual NAPL





Mobile NAPL or (Free-Phase NAPL) is a continuous mass of NAPL that can flow under a hydraulic gradient

Residual NAPL is trapped in the pore spaces between the soil particles, and cannot be easily moved hydraulically

DNAPL Extent

- Defined by at least 200 soil borings (collected over more than 10 years of investigations)
- As shallow as 7 feet below ground surface
- As deep as 101.5 feet below ground surface

Extent of Mobile DNAPL – 26,000 ft²

Remedy Objectives

- Prevent human exposure to DNAPL
- Limit the migration and reduce mobile DNAPL contamination as much as possible
- Make sure DNAPL does not continue to act as a source of groundwater contamination

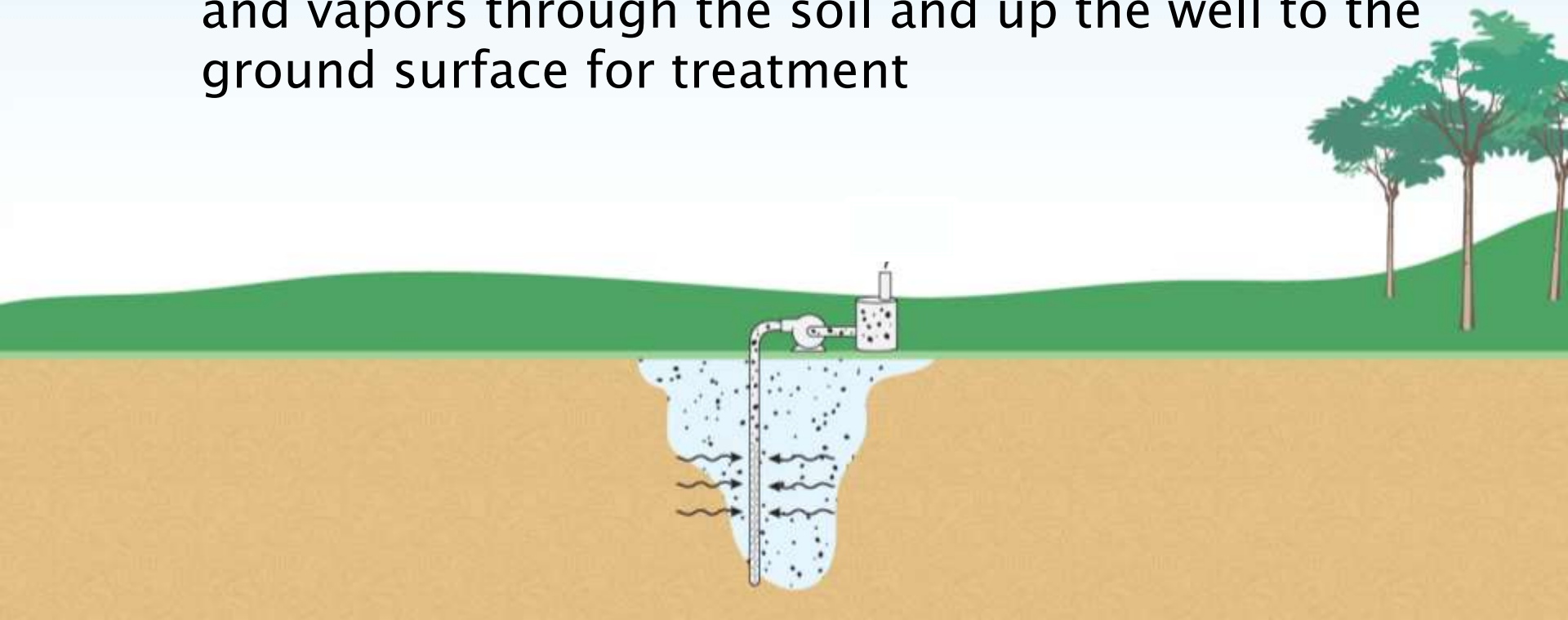
Technologies Evaluated

- Some technologies were discarded because they were not the right actions for this site:
  - Hydraulic extraction
  - Bioremediation or other Injections to reduce contaminants
  - Excavations
  - Slurry walls
- After passing technologies through our nine criteria analysis: 8 remedial actions, composed of 4 different active technologies (SVE, hydraulic displacement, steam injection and electrical resistance heating) and various institutional controls are being considered in this plan.

Soil Vapor Extraction (SVE)

Vacuums vapors out of soil, treats vapors on site

- How does it work?
  - Drilling extraction wells into the contaminated soil to a depth above the water table. Attached to the wells is equipment that creates a vacuum. The vacuum pulls air and vapors through the soil and up the well to the ground surface for treatment



SVE Examples

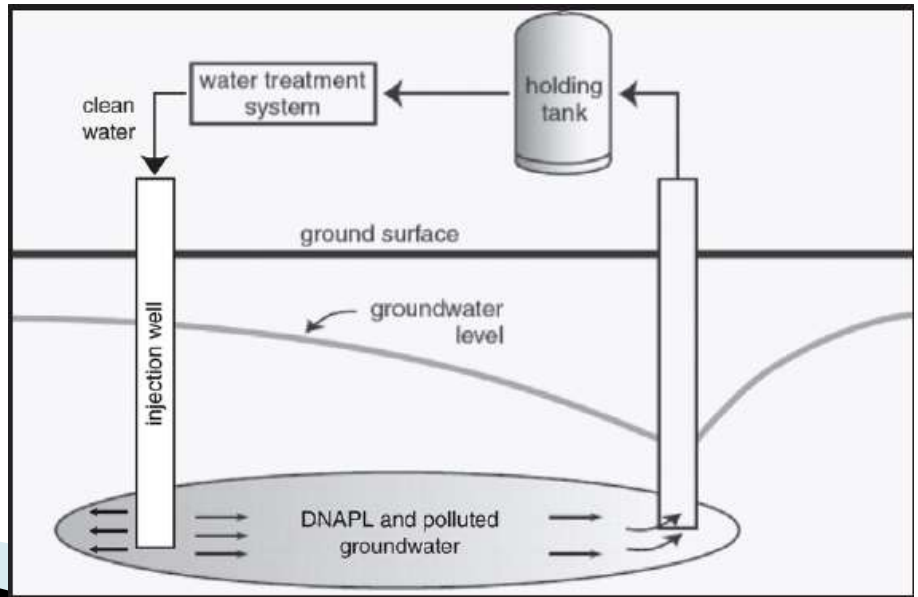
Typical SVE Well

Del Amo SVE System

Hydraulic Displacement (HD)

Injection and extraction of water to move contaminants

- How does it work?
  - Extraction and injection of groundwater at the same time to help control water flow and pull DNAPL toward extraction wells. The extracted DNAPL / groundwater would be separated and treated.



HD at a site

You would see are wells with pumps to extract and inject.

Thermal Remedies

Heat is applied to the ground to turn contaminants into vapors so as to collect & treat them

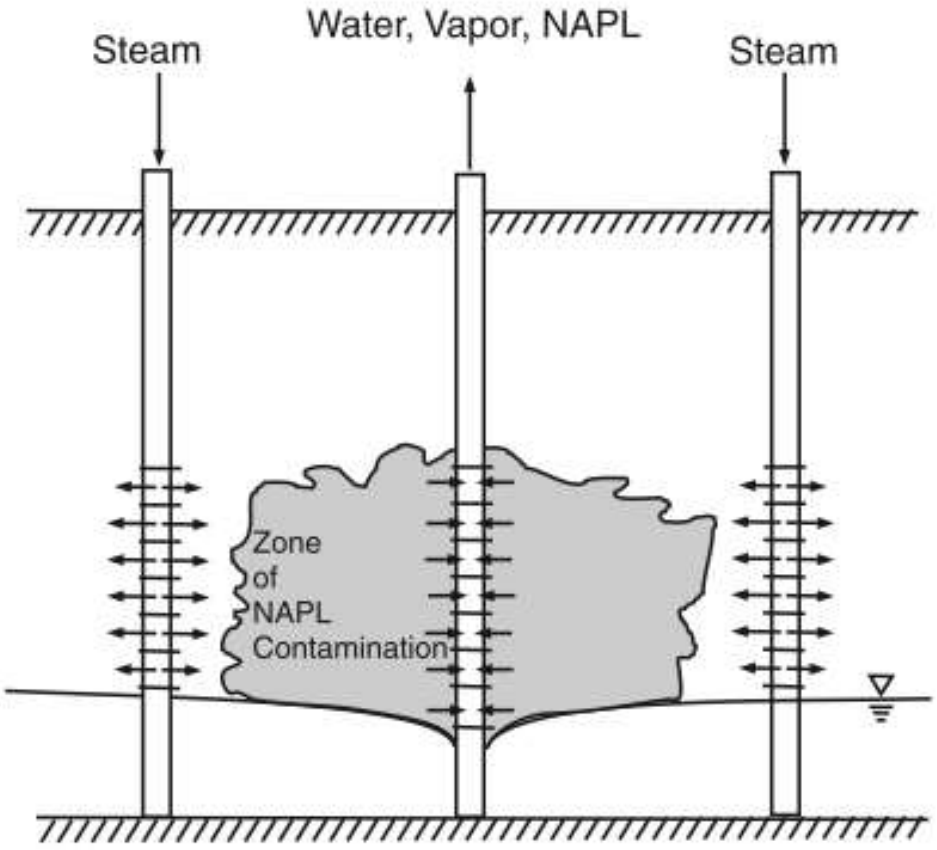
- In situ thermal treatment methods heat chemicals in soil and groundwater to turn them into vapors. The chemicals move through soil and groundwater toward wells where they are **collected** and piped to the ground surface to be treated using other cleanup methods.
- Thermal treatment is described as “in situ” because the heat is applied underground directly to the contaminated area.

Thermal Remedies

Steam Injection

Steam injected underground helps turn contaminants into vapors to collect & treat them

Steam Injection or **Steam enhanced extraction (SEE)** injects steam underground by pumping it through wells drilled in the contaminated area. The steam heats the area and mobilizes and evaporates contaminants.

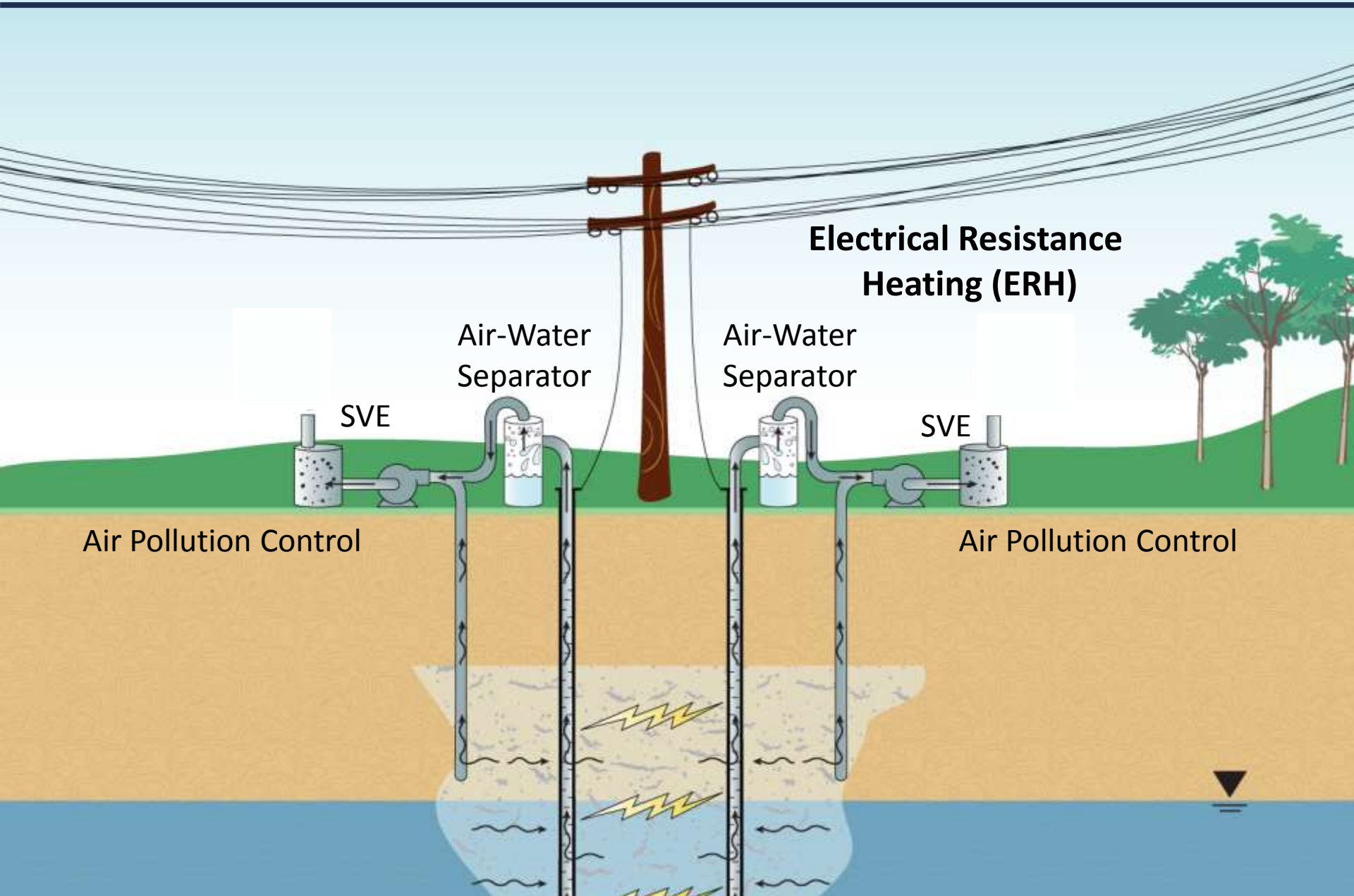


Thermal Remedies

Electrical Resistance Heating (ERH)

- **Electrical resistance heating (ERH)** delivers an electrical current between metal rods called “electrodes” installed underground. The heat generated as movement of the current meets resistance from soil converts groundwater and water in soil into steam, vaporizing contaminants.

ERH Basics


Electrical Resistance Heating (ERH)
Air-Water Separator
Air-Water Separator
SVE
SVE
Air Pollution Control
Air Pollution Control

Proposed Remedies

- 1 – No Action
- 2 – Institutional Controls
- 3 – Institutional Controls & Soil Vapor Extraction
- 4a – Hydraulic Displacement Untreated Water Injection
- 4b – Hydraulic Displacement with Treated Water Injection
- 5a – Steam Injection, Focus Treatment Area
- 5b – Steam Injection, Entire Treatment Area
- 6a – Electrical Resistance Heating , Focus Treatment Area
- 6b – Electrical Resistance Heating , Entire Treatment Area

1 – No Action

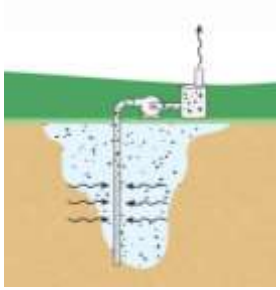
- EPA is required to look at this alternative
- No action to reduce or contain DNAPL

2 – Institutional Controls

- Legal and administrative controls applies to properties to minimize the potential for exposure or to protect the remedy.

- A land use covenant will restrict future activities at the Montrose property for industrial use only.

RA 3 – Institutional Controls and Soil Vapor Extraction



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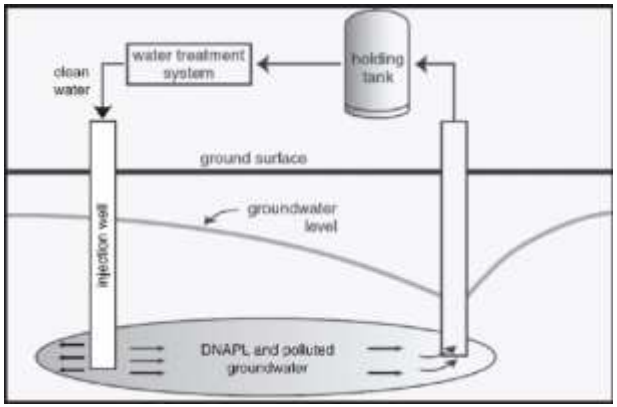
4A – HD with Untreated Water Injection

Extracted groundwater would not be treated prior to reinjection.

Injected groundwater would be contained by extraction wells

DNAPL Separated and treated

Cost – $12.1 Million Dollars



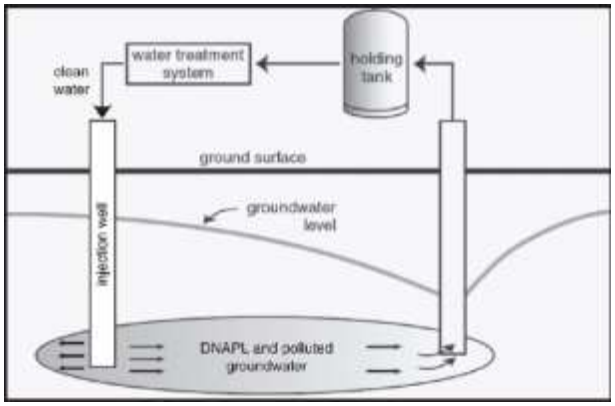
With
Untreated water

4B – HD with Treated Water Injection

Extracted groundwater would be treated prior to reinjection.

Treatment would include DNAPL separation, liquid-phase Granular Activated Carbon (GAC), HiPOx

Cost – $20.3 Million Dollars

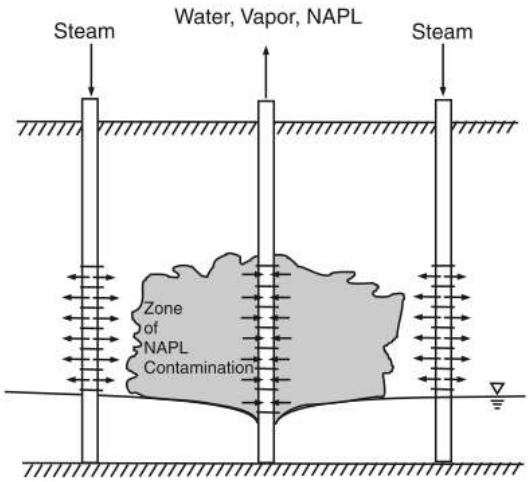


With
Treated water

RA 5A – Steam Injection, Focused Treatment Area

Steam injection would be implemented over a focused treatment area of 26,000 ft^2

Cost – $24.1 to $32.5Million Dollars

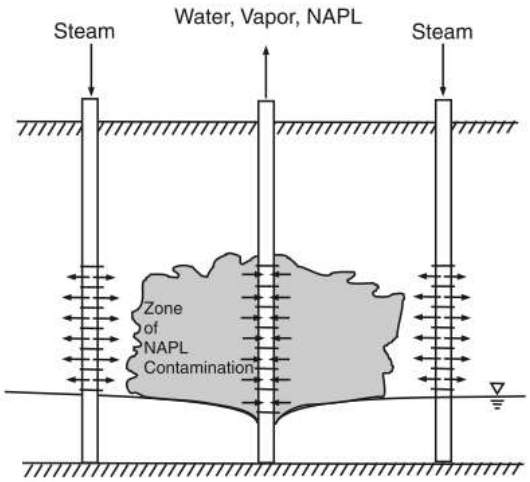


Over Focused
Mobile DNAPL Area

RA 5B – Steam Injection, Entire Treatment Area

Steam injection would be implemented over a entire treatment area of 160,000 ft^2

Cost – $56.5 to $84.2 Million Dollars



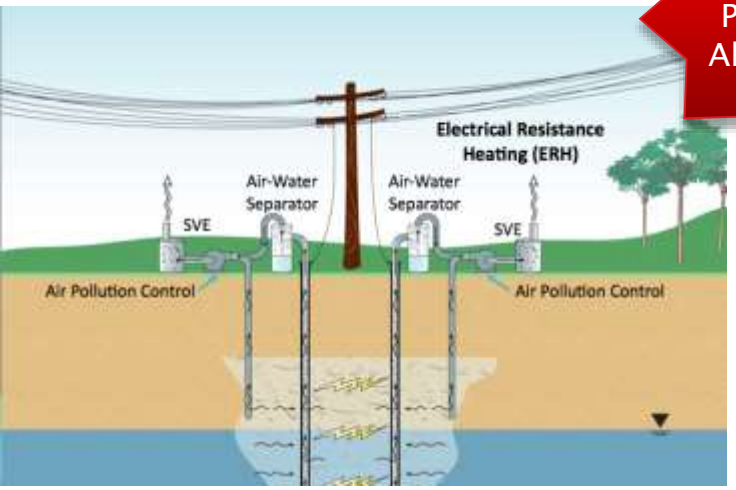
Over Entire
DNAPL Area

6A – Electrical Resistance Heating , Focused Treatment Area

ERH would be implemented over a focused treatment area of 26,000 ft^2

Cost – $20.1 to $25.0 Million Dollars

EPAs Preferred Alternative

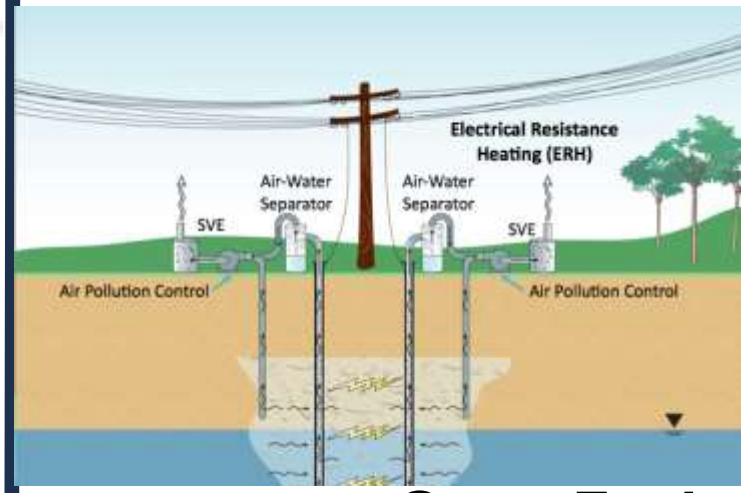


Over Focused Mobile DNAPL Area

6B – Electrical Resistance Heating , Entire Treatment Area

Steam injection would be implemented over a entire treatment area of 160,000 ft^2

Cost – $52.6 to $69.5 Million Dollars



Over Entire DNAPL Area

Nine Criteria Analysis

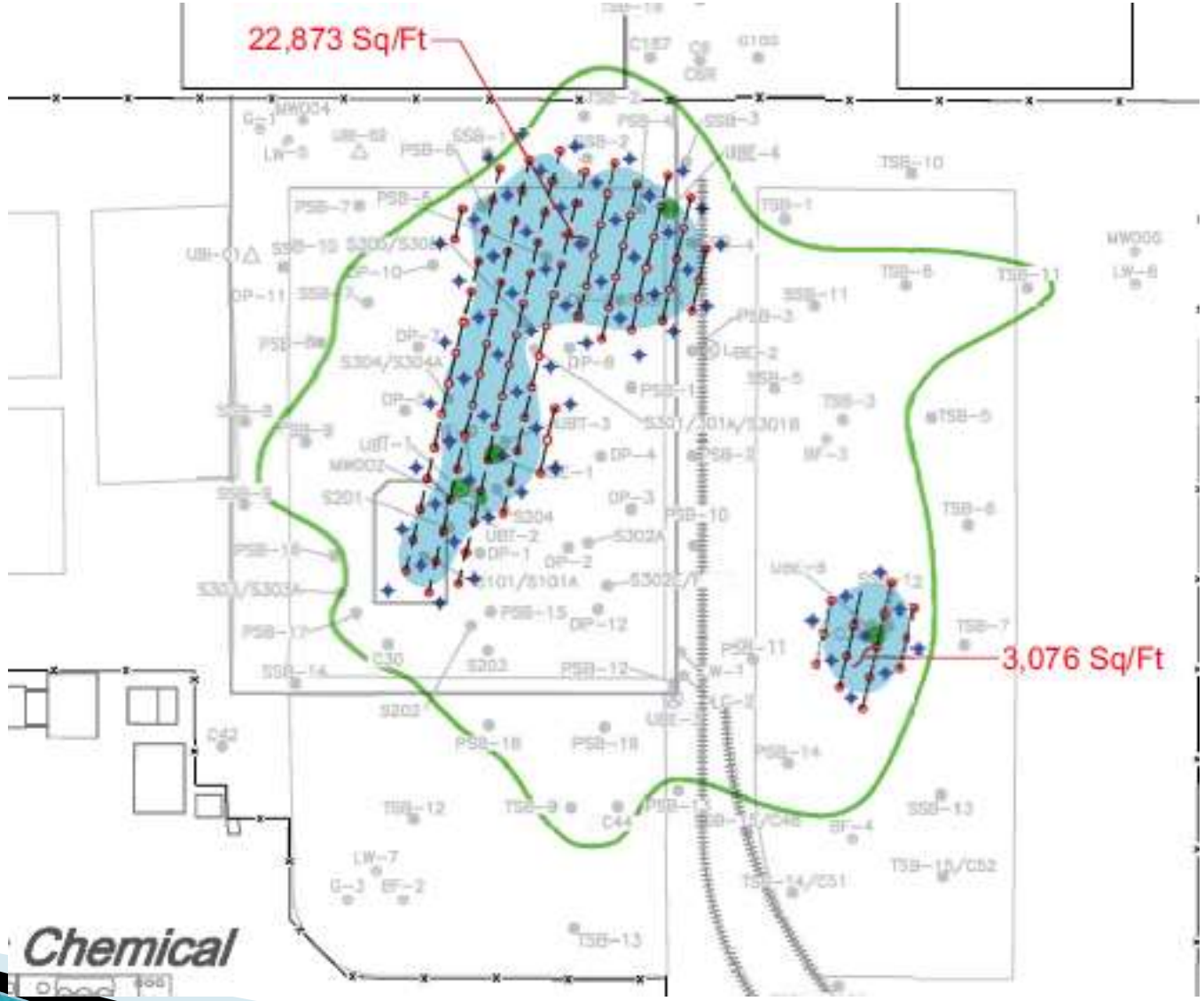
EPAs Preferred Alternative

NCP Criterion	RA 4A Hydraulic Displacement Untreated Water Injection	RA 4B Hydraulic Displacement with Treated Water Injection	RA 5A Steam Injection, Focused Treatment Area	RA 5B Steam Injection, Entire Treatment Area	RA 6A ERH, Focused Treatment Area	RA 6B ERH, Entire Treatment Area
Protective of Human Health and the Environment						
Compliance with ARARs						
Long-Term Effectiveness						
Mobility Reduction						
Vadose Zone Volume Reduction (1,000 gallons of chlorobenzene)						
Saturated Zone Volume Reduction (1,000 gallons of chlorobenzene)						
Short-Term Effectiveness						
Implementability						
Cost						

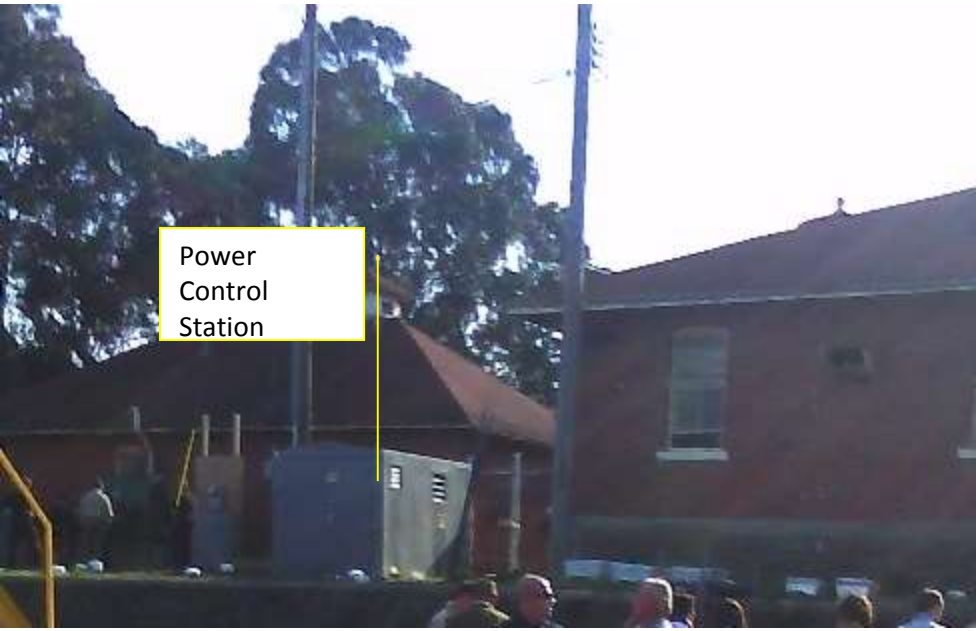
Electrical Resistance Heating, Focused Treatment Area (6A)

- **Duration: 4 years**
- **Cost: $20.1 million to $25 million.**
- **Effectiveness**: Offers the best balance of meeting the criteria defined in the NCP
- The most appropriate, aggressive approach for DNAPL removal
- ERH can reach DNAPL trapped in coarse-grained (e.g., sand) as well as fine-grained (silt or clay) subsurface media
- ERH is commonly implemented
- Vapor control for ERH would be easier to implement than for steam injection, especially since commercial buildings are very close by

Conceptual ERH Remedy



ERH @ San Francisco



Estimated Schedule

- Today – Proposed Plan Public Meeting
- Late 2015 – Record of Decision
- 2016 – Remedial Design/Remedial Construction & Cleanup Negotiation
- Late 2016 – Remedial Design
- 2018 – Remedial Construction & Cleanup

Comment Period through February 13th, 2015

- Record of Decision is the formal decision document for this DNAPL Cleanup Plan
- EPA will provide a response to all the comments submitted during the public comment period in the Record of Decision

Mail / *Correo*

Please submit your comments to the EPA Project Manager /
Por favor, envíe sus comentarios a la gerente del proyecto de la EPA:

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