EPA

Montrose Superfund Site
Los Angeles, California

U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • September 2014

Public Comment Period Extended until Feb 13th, 2015

EPA Requests Comments on Proposed DNAPL Cleanup Plan

The United States Environmental Protection Agency (EPA) is seeking public comments on this Proposed Plan for cleanup of dense non-aqueous phase liquid (DNAPL) at the Montrose Superfund Site. The DNAPL operable unit (OU) is one of seven OUs at the Montrose Superfund Site. This Proposed Plan presents the remedial actions designed to address DNAPL residing in soil and groundwater beneath the Montrose Superfund Site. These remedial actions will complement the groundwater cleanup action that was selected in 1999, because DNAPL acts as a source to groundwater contamination, and cleanup of this source will help ensure the groundwater remedy is successful.

What is DNAPL?

Dense Non-Aqueous Phase liquid is a technical way of describing pockets of pure contaminants within soil and groundwater.

EPA, as the lead agency for this cleanup, has prepared this Proposed Plan in consultation with the support agency, California Department of Toxic Substances Control (DTSC), and other stakeholders.

This Proposed Plan summarizes key information and results from EPA's Remedial Investigation and Feasibility Study reports. The EPA's preferred method for addressing the contaminants and an analysis of all cleanup alternatives are described in this Plan. Although EPA has identified a preferred alternative, EPA will not make a final decision until all the comments are considered. The public is encouraged to provide comments on any or all of the alternatives. For more detailed information, please see the Feasibility Study report, and other reports and documents within the administrative record, available at the locations specified on the back page.

EPA's primary objective for this Plan is to protect human health and the environment from contaminants found in DNAPL beneath the Montrose Superfund Site[1].

Public Comment Period

September 8th – February 13th, 2015

The EPA is interested in hearing from the public, and will accept public comments from early September to late November. EPA invites you to a Community Meeting where you can hear a presentation discussing the Proposed Plan and offer your oral and written comments. EPA will consider these comments and respond to them when selecting a remedy. EPA will document the comments and responses in a section of the final decision document, called the Record of Decision (ROD). There are several ways for the public to provide comments (written, oral, email or faxed comments). This information is listed on page 15.

Public Comment Meeting

Saturday, November 8, 2014
10 a.m. to 12:30 p.m.

Holiday Inn Torrance, 19800 Vermont Ave, Torrance, California

[1] *This Proposed Plan is being issued pursuant to CERCLA §117(a), 42 U.S.C. §9617(a), and the National Contingency Plan §300.430(f)(3), 40 C.F.R. §300.430(f)(3).*

Site Background

Montrose Chemical Corporation of California (Montrose) manufactured the technical grade of the pesticide dichlorodiphenyltrichloroethane (DDT) from 1947 until 1982 at a 13-acre plant located at 20201 Normandie Avenue, in Los Angeles, near the City of Torrance, California (see Figure 1).

Figure 1. Former Montrose Plant Property

The plant was dismantled and demolished by 1983, and the plant property was graded and covered with an asphalt cap. In its 35 years of operation, the Montrose plant released hazardous substances into the surrounding environment, including surface soil, groundwater, stormwater drainage ditches, sanitary sewers, and ultimately the Pacific Ocean.

Contaminants used at the plant entered the ground within the former Montrose plant property ("Montrose Property") through leaks from valves and clogged lines, and other elements of the DDT manufacturing process. Chlorobenzene, which is a colorless, flammable liquid and a common solvent, was one of the most widely encountered contaminants resulting from the plant operation.

Soil beneath the Montrose Property is also contaminated with DDT, which is a crystalline solid and not soluble in water. DDT sticks to soil particles and does not mix and/or travel with groundwater. Therefore, DDT by itself does not cause contamination of groundwater. However, DDT is soluble in chlorobenzene. At this site DDT dissolved in chlorobenzene, and formed a liquid mixture consisting of about 50 percent DDT and 50 percent chlorobenzene. This mixture is referred to as "Dense Non-Aqueous Phase Liquid," or "DNAPL." DNAPL contamination occurs in soil and groundwater beneath the Montrose Property. When DNAPL comes into contact with groundwater, chlorobenzene dissolves from the DNAPL. At the Montrose Superfund Site, the chlorobenzene has formed a groundwater plume that extends more than 1.5 miles downstream of the Montrose Property.

Montrose Superfund Site Operable Units

On- and Near-Property Soils OU: includes contamination in shallow soils and soil vapors that are present on and near the Montrose Property as a result of past activities there. For this OU, a human health risk assessment and feasibility study are currently being prepared.

Current Stormwater Pathway OU – Torrance Lateral to Consolidated Strip: includes locations where rainfall runoff may have carried contaminants from the Montrose Property.

Dual Site Groundwater OU: addresses groundwater contamination from both the Montrose and Del Amo Superfund Sites. The selected remedy for this OU includes extraction and treatment of contaminated groundwater, and reinjection of treated water back into groundwater aquifers. Construction activities for the treatment system started in March 2013, and are expected to be completed by the end of 2014. Once operational, the system will extract up to 700 gallons of water per minute, and inject cleaned treated water back into the ground. Because the DNAPL at the Montrose property is a source of groundwater contamination, the groundwater ROD requires removal of the DNAPL source to the extent practicable.

DNAPL OU: addresses the DNAPL source at the Montrose Property and is the subject of this Proposed Plan.

Historic Stormwater Pathway – Neighborhood OU: includes the Kenwood Avenue neighborhood, where EPA completed removal actions in 2002 and 2008 to address Montrose-related contamination.

Palos Verdes Shelf OU: includes contamination on the ocean floor off the Palos Verdes Peninsula.

Historic Stormwater Pathway – Royal Boulevard OU: includes portions of eight industrial and residential properties along Torrance Boulevard and Royal Boulevard, where runoff from the Montrose Property transported contaminants into the storm drainage channel.

Jones Chemicals OU: addresses contamination at the JCI Jones Chemicals, Inc. (Jones) property, which is immediately adjacent to the Montrose Property. Jones manufactures, stores, repackages, and distributes water treatment chemicals and other chemicals used by municipalities, the public, and industry. A variety of chlorinated solvents have been identified in the subsurface at the Jones property. A remedial investigation is currently underway.

The Del Amo Superfund Site, which includes the former site of a 280-acre synthetic rubber manufacturing plant, is located east of the Montrose Superfund Site (see Figure 2). During operations, chemicals such as benzene were released into soil and groundwater beneath the plant. The chlorobenzene plume from the Montrose Superfund Site is mixed with the benzene plume originating at the Del Amo Superfund Site.

EPA listed the Montrose Site on the Superfund National Priorities List (NPL) in 1989. In order to organize the investigation and cleanup activities, EPA divided the Montrose Superfund Site into several parts, which are called "Operable Units" (OUs). The OU that addresses the DNAPL source, as well as adjacent OUs for soil and groundwater at the Montrose Superfund Site, are briefly described on the opposite page.

Figure 2 shows the main areas of the Montrose and Del Amo Superfund Sites. As mentioned above, the DNAPL remedy will complement the Groundwater remedy from both Sites by removing DNAPL that serves as a source of groundwater contamination.

Site Characteristics

Current Land Use

The Montrose Property was regraded and capped with asphalt by Montrose in 1985. Within the property boundary, two large raised building pads and a total of six temporary soil and debris containment cells were constructed by EPA to temporarily store contaminated soils excavated from Kenwood Avenue (the Historic Stormwater Pathway-Neighborhood OU). In addition, Montrose is currently constructing the groundwater treatment facility for the Groundwater OU for both Sites at the Montrose Property. Extensive dust monitoring is being performed during construction activities to ensure public health and construction worker safety.

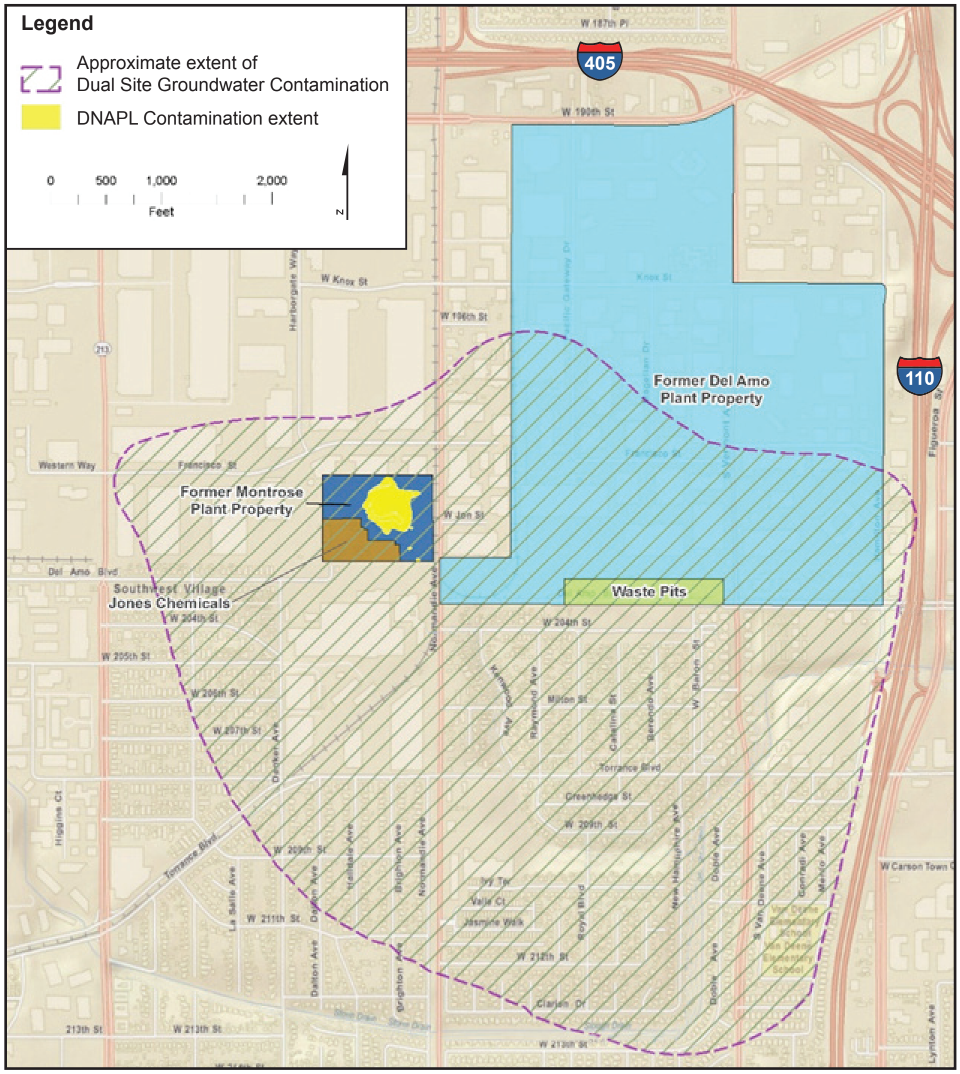


Figure 2. Main Areas of the Dual Site Groundwater Contamination

A 2004 study conducted by EPA concluded that the most likely reuse scenario for the Montrose Property would be industrial land use. The adjacent properties are also zoned industrial and commercial. Land use south and southeast of the Montrose Property is mixed manufacturing, commercial, and residential.

Although the State of California designates all of the water-bearing units beneath the Montrose property as having potential potable beneficial use, there are currently no known municipal or private potable production wells in use within the area of DNAPL distribution and/or dissolved groundwater contamination at the Montrose Superfund Site. The nearest municipal supply wells are located more than 2 miles from the Montrose Property, and about 0.5 to 1 mile southeast from the furthest extent of groundwater contamination related to the Montrose and Del Amo Superfund Sites.

Site Contamination

The remedial actions described in this Proposed Plan are focused on the DNAPL source. DNAPL has a density higher than water, so it sinks when put into water. As mentioned above, DNAPL at the Site consists of about 50 percent DDT and 50 percent chlorobenzene. Chlorobenzene is a volatile organic compound (VOC) that can volatilize (that is, can be emitted as gas) from solids or liquids into the atmosphere and cause vapor intrusion (VI). It is also soluble in water. In contact with groundwater, chlorobenzene dissolves from DNAPL and forms a plume of contaminated groundwater referred to as the "chlorobenzene plume." This dissolved clorobenzene plume is being addressed by the Dual Site Groundwater remedy. The potential VI from the DNAPL source and dissolved chlorobenzene plume is being currently evaluated by EPA.

DDT is not volatile and not soluble in water. Because it is not volatile, DDT does not pose a risk of VI. Also, as mentioned above, DDT sticks to soil particles and does not mix and/or travel with groundwater; therefore, the chlorobenzene plume includes little to no DDT.

Beneath the Montrose Property, DNAPL is found at depths ranging from 7 to 101.5 feet below ground surface (bgs). Depth to groundwater in this area is about 40 to 60 feet bgs. DNAPL, therefore, occurs in both the unsaturated zone (soils above groundwater) and the saturated zone (soils at the groundwater level). Site soils, in both the unsaturated and saturated zones, are composed of discontinuous layers of silt, sand, and clays.

Pools of DNAPL are perched on top of less-penetrable soils such as silt, and clay. Figure 3 is a diagram of typical vertical DNAPL distribution at a site like Montrose.

The full extent of DNAPL at the Site occurs beneath (and within the horizontal boundaries of) the Montrose Property, and well within the TI Waiver Zone established by EPA (see box above).

The estimated lateral extent of DNAPL, known as the "entire treatment area," is about 160,000 square feet (ft^2) (see Figure 5).

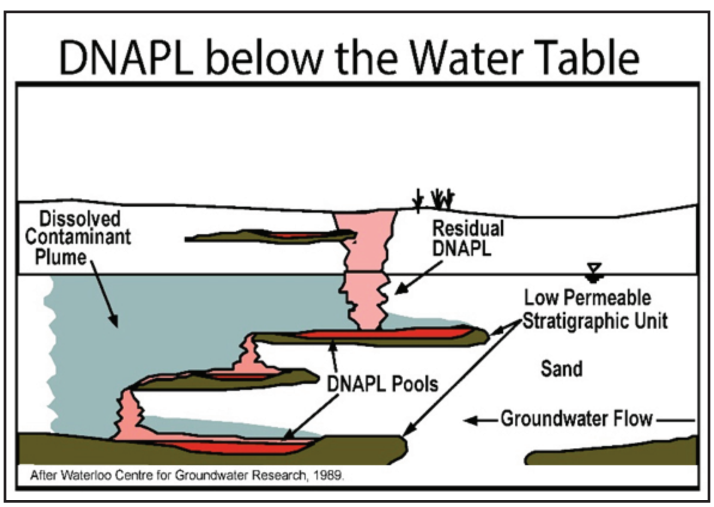


Figure 3. Sample Diagram of Vertical DNAPL Distribution

What is a TI Waiver Zone?

The groundwater remedy includes long-term hydraulic containment of the DNAPL-contaminated area and a buffer around this area referred to as the "Technical Impracticability (TI) Waiver Zone." The TI Waiver Zone was established because, as documented in the groundwater ROD, EPA determined that removal of all DNAPL was not practicable, given current technologies. This area will be evaluated for protection again in 2015.

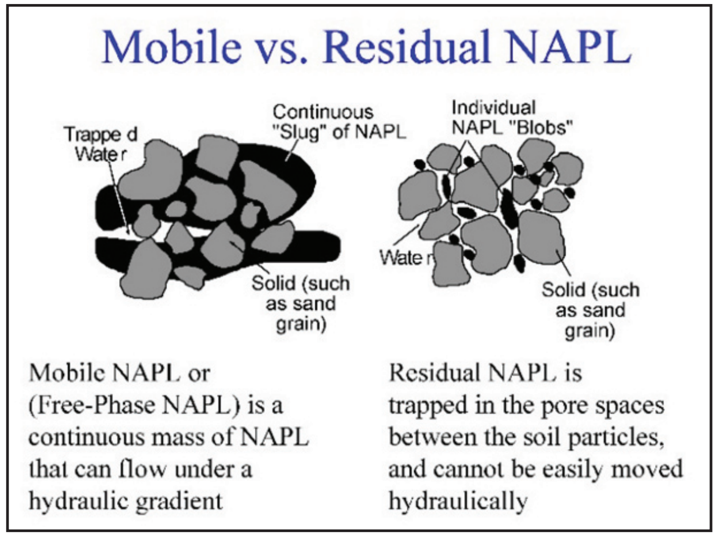


Figure 4. Mobile vs. Residual DNAPL

Mobile Vs. Residual DNAPL

DNAPL at the Montrose Property occurs in both "mobile" and "residual" forms. Mobile DNAPL is a continuous mass of DNAPL that can flow with groundwater and/or sink under gravitational forces.

Residual DNAPL is trapped in the pore spaces of soil particles and cannot move laterally and/or vertically under natural conditions (see Figure 4).

Mobile DNAPL is present beneath the Montrose Property within a much smaller area of approximately 26,000 ft^2. This area is known as the "focused treatment area" and was estimated based on the known occurrence of mobile DNAPL in wells in the source area and measured DNAPL concentrations above 53,000 milligrams per kilogram (mg/kg), which was determined to be a threshold, above which DNAPL was considered to be mobile. The area of mobile DNAPL is shown in Figure 5.

The extent of mobile DNAPL may be further refined, if needed, during the remedial design and remedial action phases of work, with input from the State.

Figure 5. Estimated Extent of Mobile DNAPL

Remediation Objectives

The remediation objectives for the DNAPL remedy are as follows:

- Prevent human exposure to DNAPL (via ingestion, inhalation, or dermal contact) that would pose an unacceptable health risk to on or off property receptors under industrial land uses of the Montrose Property and adjacent properties.
- To the extent practicable, limit uncontrolled lateral and vertical migration of mobile DNAPL under industrial land use and hydraulic conditions in groundwater.
- Increase the probability of achieving and maintaining containment of dissolved-phase contamination to the extent practicable, as required by the existing groundwater ROD, for the time period that such containment remains necessary.
- Reduce mobile DNAPL mass to the extent practicable.
- To the extent practicable, reduce the potential for recontamination of aquifers that have been restored by the groundwater remedial actions, as required by the groundwater ROD, in the event containment should fail.
- To the extent practicable, reduce the dissolved-phase concentrations within the containment zone over time.

Summary of Risk and Basis for Action

Based on the land and groundwater uses described above, the DNAPL at the Montrose Superfund Site does not currently pose an exposure risk to human or ecological receptors. However, DNAPL is the principal threat at the Montrose Superfund Site, because it continues to dissolve into the groundwater, and serves as a long-term source of chlorobenzene and, to a lesser degree, other contaminants to groundwater and soil vapor.

The Groundwater remedy for both Sites is designed to hydraulically contain and remediate the dissolved plume coming from the DNAPL source, and also hydraulically contain the TI Waiver Zone that surrounds DNAPL. Residual DNAPL is trapped in pore spaces between soil particles within the TI Waiver Zone and cannot migrate in the subsurface outside this zone under natural conditions. However, mobile DNAPL that is present at the former Montrose Plant Property remains a threat to groundwater and soil vapor, because it is capable of continued vertical and/or lateral migration outside the TI Waiver Zone. This potential migration of mobile DNAPL may result in failure of the Groundwater remedy. Removing mobile DNAPL, therefore, is a critical component in preserving the groundwater resource and ensuring protection of human health and the environment.

It is EPA's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or the welfare of the environment from actual or threatened releases of hazardous substances into the environment. The Preferred Alternative is focused on preventing uncontrolled migration and the spread of mobile DNAPL to ensure (1) protection of human health and the environment, and (2) the success of the groundwater remedy at the Montrose Superfund Site.

The objectives, methods, and technologies that are planned to accomplish these goals are discussed next.

Remediation Alternatives

Table 1 lists the alternatives and shows the technologies that were used to assemble each alternative.

The primary technologies used to assemble active remediation alternatives are:

- Institutional Controls
- Soil Vapor Extraction (SVE)
- Hydraulic Displacement
- In-Situ Soil Heating, including:
  - Steam Injection
  - Electrical Resistance Heating (ERH)

An overview of these technologies is provided after Table 1, followed by detailed descriptions of the nine remediation alternatives (Alternatives 1 through 6B).

Table 1. Remediation Alternatives

Remediation Alternative	Technology				
	Institutional Controls	Soil Vapor Extraction Unsaturated Zone	Hydraulic Displacement	Steam Injection	Electrical Resistance Heating
1. No Action					
2. Institutional Controls	X				
3. Institutional Controls and Soil Vapor Extraction (Unsaturated Zone)	X	X			
4A. Hydraulic Displacement with Untreated Water Injection	X	X	X		
4B. Hydraulic Displacement with Treated Water Injection	X	X	X		
5A. Steam Injection, Focused Treatment Area	X	X		X	
5B. Steam Injection, Entire Treatment Area	X	X		X	
6A. Electrical Resistance Heating, Focused Treatment Area*	X	X			X
6B. Electrical Resistance Heating, Entire Treatment Area	X	X			X

EPA's preferred alternative

ALTERNATIVE 1: No Action

Superfund regulations require that the "no action" alternative be evaluated in order to establish a baseline for comparison. Under this alternative, EPA would take no action to reduce DNAPL mass or mobility or to comply with the remediation objectives, other than those actions required by the groundwater and soil remedies.

ALTERNATIVE 2: Institutional Controls

Includes the following:

- A land use covenant would be established to prevent access to DNAPL-impacted soils and groundwater and to restrict future activities at the Montrose property for industrial use only. These land use and access restrictions would continue and be monitored as part of a formal site inspection and maintenance program. Institutional controls for DNAPL would be limited to DNAPL-impacted areas including the Montrose Property and potentially a small portion of the former aircraft manufacturing facility property to the north.

Cost ***$0.2 million***
(Net Present Value [NPV])

ALTERNATIVE 3: Soil Vapor Extraction

Includes the following:

- **Institutional Controls** (see Alternative 2).
- **Soil Vapor Extraction** (SVE) would be implemented to remove and treat VOCs at the site. SVE is a remedial technology for removing VOCs, such as chlorobenzene, from permeable unsaturated soils (zone above groundwater). VOCs occurring in the unsaturated zone, stuck to soil grains or as a component of DNAPL, will vaporize into soil gas (air-filled pore spaces) and can be extracted using SVE. This remedy will not address the contamination in the saturated soils. For this alternative, 23 vapor extraction wells would be installed throughout the DNAPL-impacted unsaturated zone, and a vacuum would be applied to wells to induce soil vapor flow through permeable soil layers into these wells. The soil vapors would be extracted from the wells using a vacuum blower and treated prior to atmospheric discharge, using one of the following technologies:
  - Disposable granular activated carbon (GAC)/resin (similar to a home water purifying pitcher)
  - Steam-regenerable GAC/resin
  - Thermal oxidation with acid-gas scrubbing

Duration ***7 years***
Cost ***$4.4 to $4.8 million NPV***
Capital Costs – $1.6 million
O&M Costs – $2.8- $3.2 million (depending on discount rates of 7% and 4%, respectively).

A Description of Potential Technologies

What are Institutional Controls?

Legal and administrative controls applied to properties to minimize the potential for human exposure to contamination left on a property or to protect the remedy in place.

Land Use Covenant

Will prevent access to DNAPL-impacted soils and groundwater, and restrict future activities at the Montrose property for industrial use only. The effectiveness of the institutional controls will be monitored.

What is Soil Vapor Extraction (SVE)?

Removes chemicals in the form of vapors by vacuuming vapors out of soil, and treating them by an air treatment technology onsite. Final air emissions meet air pollution regulations.

Vapor Treatment Options (Typical, not all options apply to this Plan)

Adsorption

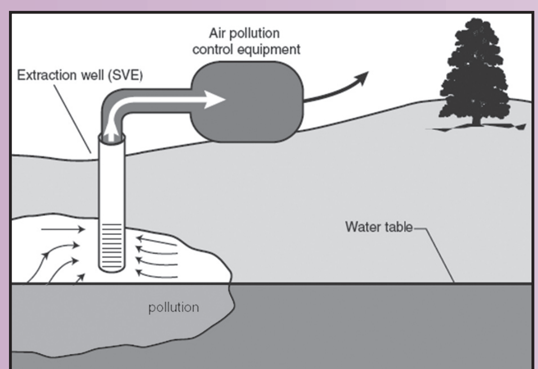
Adsorbent material like carbon and polymer resin adsorbs contaminants.

Condensation

Vapors are cooled until contaminants become liquid and are removed.

Thermal Oxidation

High heat (1400-1800°F) is used to destroy vapor contaminants.



At a Glance:

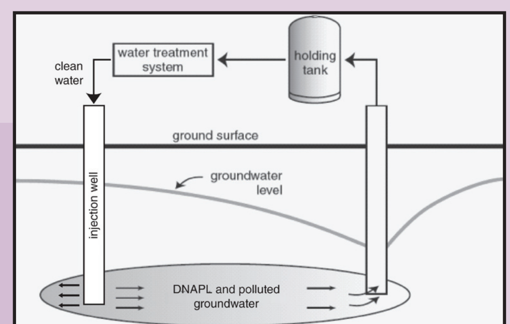
- Used since the 1970's
- Best uses for removing chemicals that evaporate easily (VOC's)
- Cost effective

What is Hydraulic Displacement?

Simultaneous extraction and injection of groundwater to mobilize DNAPL toward extraction wells. Extracted groundwater is separated from DNAPL and treated before reinjection (treatment is not included for Alternative 4a).

At a Glance:

- Removes moderate amount of contamination
- Moderately intrusive



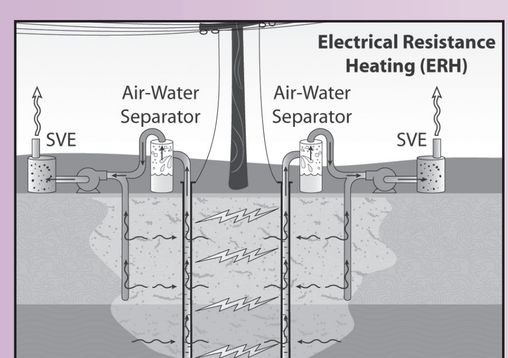
What is In-Situ Soil Heating?

Heating the soil in order to volatilize (vaporize) the contamination, then capturing and treating the vapors in a soil vapor extraction system.

Vapors will be treated using vapor treatment options described in the SVE section.

At a Glance:

- Removes large amount of contamination
- Requires large use of electricity
- Handles contaminated vapors above ground
- Intrusive



ALTERNATIVE 4A: Hydraulic Displacement with Untreated Water Injection

Includes the following:

- **Institutional Controls** (see Alternative 2).
- **SVE** (see Alternative 3).
- **Hydraulic Displacement (HD) with untreated water injection** would be implemented over a focused treatment area to remove mobile DNAPL. The HD system includes extraction and injection of groundwater at the same time to help control water flow and move DNAPL pools toward extraction wells. The HD system requires installation of extraction wells throughout the DNAPL-impacted zone and simultaneous pumping of groundwater and DNAPL. The extracted DNAPL/groundwater would be separated. DNAPL would be disposed off-site and groundwater would be reinjected. The HD system would include 23 extraction wells and 46 injection wells positioned in a five-spot type pattern using 50-foot well spacing, with four extraction wells surrounding one injection well. Injection wells would additionally be positioned around the perimeter of the treatment area to move mobile DNAPL inward, toward the recovery wells. Five additional containment wells will be located on the downgradient side of the DNAPL extent to hydraulically contain displaced groundwater. Dissolved-phase contaminants present in extracted groundwater would not be removed prior to reinjection. A combined groundwater extraction and reinjection rate of approximately 150 gallons per minute (gpm) is expected to be achieved under this alternative. DNAPL accumulated in the extraction wells will be removed using low-flow pneumatic bladder pumps and combined with DNAPL recovered in groundwater from the gravity separator. Separated DNAPL would be transferred to the collection tank for offsite disposal; separated groundwater would be transferred for subsequent filtration and reinjection.

Duration ***8 years***
Cost ***$11.0 to $12.2 million NPV***
Capital Costs – $5.2-$5.5 million,
O&M Costs – $5.8- $6.7 million (depending on discount rates of 7% and 4%, respectively).

ALTERNATIVE 4B: Hydraulic Displacement with Treated Water Injection

Includes the following:

- **Institutional Controls** (see Alternative 2).
- **SVE** (see Alternative 3).
- **HD with treated water injection** would be carried out over a focused treatment area similar to Alternative 4A, with the exception that groundwater would be treated before reinjection. After DNAPL separation, the extracted groundwater would be filtered and treated onsite using a combination of liquid-phase GAC to remove chlorobenzene and other VOCs by adsorption, and HiPOx advanced oxidation technology to destroy pCBSA (parachlorobenzene sulfonic acid) through oxidation processes. The effectiveness of these two technologies in treating the primary dissolved contaminants has been demonstrated by pilot testing.

Duration ***8 years***
Cost ***$18.0 to $20.1 million NPV***
Capital Costs – $6.0 -$6.4 million,
O&M Costs – $12.0 - $13.7 million (depending on discount rates of 7% and 4%, respectively)

ALTERNATIVE 5A: Steam Injection, Focused Treatment Area

Includes the following:

- **Institutional Controls** (see Alternative 2).
- **SVE** (see Alternative 3).
- **Steam injection over a focused treatment area** would be carried out to remove mobile DNAPL. Under this alternative, pressurized steam is injected below the surface using a gas-fired steam generator to vaporize contaminants from DNAPL. The vacuum blowers will then be used to collect the vapors from the subsurface into SVE recovery wells. The steam can additionally displace or flush DNAPL toward recovery wells. The increased heat will also cause a decrease in the DNAPL viscosity and interfacial tension (that is, make it more liquid), thereby increasing the mobility of DNAPL. Steam injection and multiphase extraction wells (groundwater, DNAPL, and soil vapors) would be installed throughout the focused treatment area in either a five-spot or seven-spot pattern. Wells would be spaced approximately 42 feet apart in a five-spot pattern, with a total of 14 steam injection wells and 27 multiphase extraction wells.

To address the potential risk of downward DNAPL movement posed by a steam injection, a technology referred to as "hot floor" would be used. The hot floor technology involves heating the layer beneath the known depth of DNAPL occurrence. This creates a heat barrier at the base of the DNAPL treatment zone, which helps prevent vertical movement of DNAPL. Steam and heated soil vapors would be pulled from below the surface and treated onsite using steam-regenerable carbon/resin. Extracted groundwater would be treated by a combination of GAC to remove chlorobenzene and other VOCs, and HiPOx to destroy pCBSA through a chemical oxidation process. Treated groundwater will be piped to the treatment system for Dual Site Groundwater for subsequent reinjection.

Duration ***4 to 7 years***
Cost ***$ 22.3 million to $ 32.4 million NPV***
Capital Costs – $12.0 - $12.7 million,
O&M Costs – $10.3 - $19.7 million (depending on discount rates of 4% and 7% and assumptions related to the energy demand).

ALTERNATIVE 5B: Steam Injection, Entire Treatment Area

Includes the following:

- **Institutional Controls** (see Alternative 2).
- **SVE** (see Alternative 3).
- **Steam injection over the entire treatment area** (160,000 ft^2) would be implemented in the same manner as described for the focused treatment area (Alternative 5A), except that the target treatment volume would be considerably larger. This alternative would treat areas containing both mobile and residual DNAPL. Because the proposed steam treatment area is large and the volume of contamination is significantly greater than for Alternative 5A, a pilot test would be run in advance of full-scale steam injection to confirm design details required to install and operate a full-scale system. Steam injection and multiphase (groundwater and soil vapors) extraction wells would be installed throughout the entire DNAPL-impacted area using the same well pattern and spacing indicated for the focused treatment area. Assuming a five-spot pattern with 42-foot well spacing, a total of 61 steam injection and 53 multiphase extraction wells would be required. A "hot floor" also would be implemented for this alternative.

Duration ***7 to 9 years***
Cost ***$ 50.8 million to $ 84.0 million NPV***
Capital Costs – $23.5 - $26.1 million,
O&M Costs – $27.3 - $57.9 million (depending on discount rates of 4% and 7% and assumptions related to the energy demand).

EPA's Preferred Alternative

ALTERNATIVE 6A: Electrical Resistance Heating, Focused Treatment Area

Includes the following:

- **Institutional Controls** (see Alternative 2).
- **SVE** (see Alternative 3).
- **Electrical Resistance Heating (ERH) over a focused treatment area** would be implemented for vaporizing DNAPL. This would be done by installing electrodes throughout the treatment zone and transmitting an electric current between them to heat the soil by electrical resistance. The ERH process would remove chlorobenzene from the DNAPL by vaporizing it. The vapors generated by this process would then be recovered by SVE wells for above-ground vapor treatment. The DDT component of DNAPL will then precipitate out of DNAPL and will remain immobile and adsorbed to soil particles at depths exceeding 40 to 60 feet bgs. As discussed above, DDT is not soluble in water and will "stick" to soils deep below the surface and will therefore be immobilized. Therefore, DDT does not pose a risk to groundwater resources and/or human health and the environment. A total of 102 ERH electrodes for heating the subsurface and 66 multiphase extraction wells for removing DNAPL vapors and contaminated groundwater would be required for this alternative. Each location will include multiple electrode segments stacked in a common hole to allow heating at the bottom of the treatment zone, and then gradually heating upper intervals. This "bottom up" heating approach is similar to conditions in the "hot floor" methodology integrated into the steam injection alternatives; creating a heated soil barrier at the bottom of the DNAPL treatment zone to prevent DNAPL from moving into deeper zones. Heated soil vapors would be extracted from the multiphase extraction wells for onsite treatment using a regenerable carbon/resin system. Groundwater extracted from the multiphase extraction wells would be treated by a combination of GAC to remove chlorobenzene and other VOCs, and HiPOx to destroy pCBSA by oxidation. Treated groundwater would be transferred to the treatment system for the Dual Site Groundwater for reinjection. (A sample diagram of the ERH system is provided in Figure 7 on page 16).

Duration ***4 to 7 years***
Cost ***$ 18.6 million to $ 25.0 million NPV***
Capital Costs – $10.2 - $10.8 million,
O&M Costs – $8.4 - $14.2 million (depending on discount rates of 4% and 7% and assumptions related to the energy demand).

ALTERNATIVE 6B: Electrical Resistance Heating, Entire Treatment Area

Includes the following:

- **Institutional Controls** (see Alternative 2).
- **SVE** (see Alternative 3).
- **ERH over the entire treatment area** of 160,000 ft^2 would be implemented to vaporize DNAPL in the same manner as described for the focused treatment area (Alternative 6A), except that the target treatment volume would be considerably larger. This alternative would treat areas containing both mobile and residual DNAPL. Because the proposed thermal treatment area and volume are significant, a pilot test would be implemented in advance of full-scale ERH to confirm design parameters and assumptions. A total of 456 ERH electrodes and 203 multiphase extraction wells would be installed for thermal treatment of the entire DNAPL-impacted area.

Duration	*7 to 9 years*
Cost	***$46.2 million to $69.5 million NPV*** *Capital Costs – $24.7 - $27.3 million,* *O&M Costs – $21.5 - $42.2 million (depending on discount rates of 4% and 7% and assumptions related to the energy demand).*

Nine Criteria Evaluation

The nine criteria used in EPA's evaluation process are presented in Figure 6. A comparison of the active remediation alternatives (4A, 4B, 5A, 5B, 6A, and 6B) is provided in Table 2. All active remedial alternatives are also compared to Alternative 1 (No Action) as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) law. Alternatives 2 and 3 are not included in this evaluation because they do not include reduction of mobile DNAPL in the saturated zone and, therefore, do not meet the required threshold criteria for protection of human health and the environment.

Overall Protection of Human Health and the Environment

Alternative 1 (No Action) is not protective of human health and the environment. All six active alternatives listed in Table 2 (4A through 6B) will be protective of human health and the environment.

DNAPL area on the Former Montrose Property

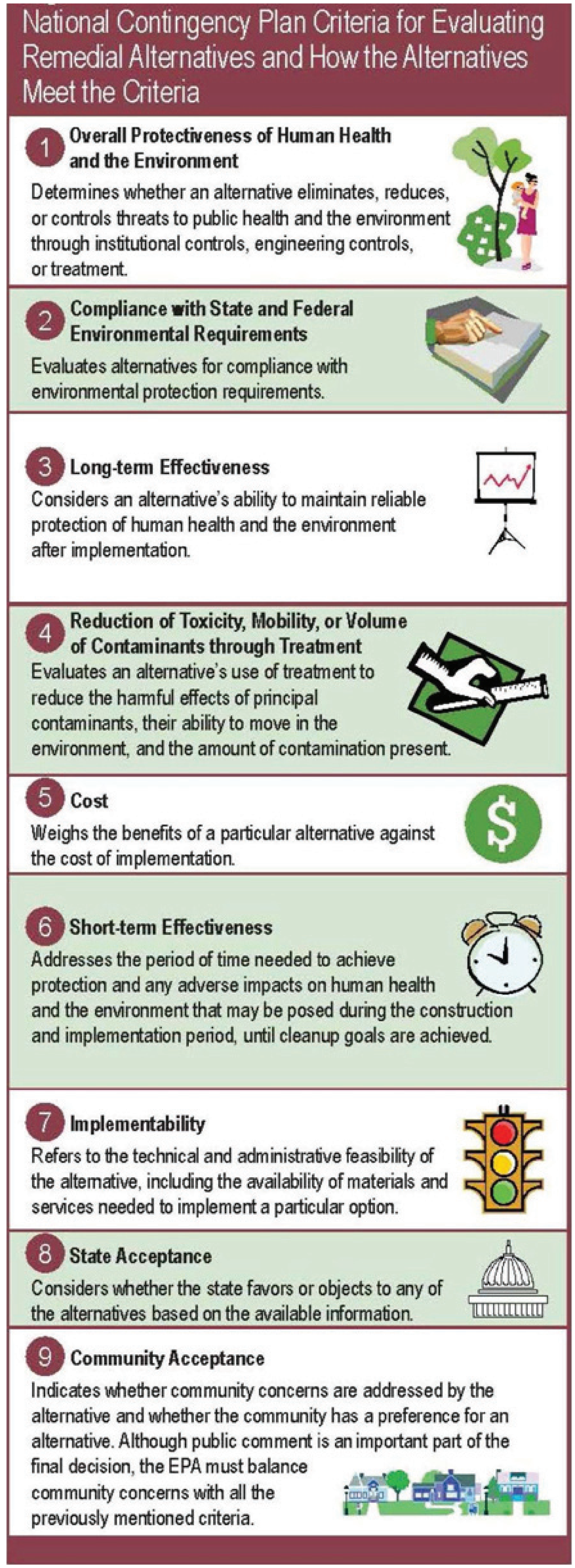


Figure 6. EPA's Nine Criteria Evaluation Process

Alternatives 4A and 4B protect the environment by removing mobile DNAPL mass from the saturated zone by HD, thereby reducing the risk of mobile DNAPL migration either laterally or downward. Although Alternatives 4A and 4B will not likely be able to remove all mobile DNAPL, the mobility of the remaining DNAPL will be reduced and less likely to pose a significant threat to the environment or a risk of uncontrolled migration under normal hydrologic conditions.

Alternatives 5A and 6A protect the environment by removing most or all mobile DNAPL and some residual DNAPL mass from the saturated zone by thermal treatment. Alternatives 5B and 6B will remove all mobile and most residual DNAPL. Thermal alternatives (5A through 6B) are more protective of human health and the environment because they would remove all mobile DNAPL, and some or most of the residual DNAPL from the subsurface. However, each of the candidate alternatives can potentially cause adverse migration of DNAPL during the remedy implementation. The risk of adverse migration is slightly higher under thermal alternatives than under HD alternatives, but the risks for adverse DNAPL migration could be managed and effectively mitigated by using a "hot floor" approach for steam injection alternatives, and "bottom up" heating for the ERH alternatives.

Based on the above, all six alternatives were ranked to be equally protective of human health and the environment (see Table 2).

Compliance with ARARs

Alternative 1 (No Action) does not comply with ARARs. All six active alternatives listed in Table 2 (4A through 6B) include SVE with ex-situ vapor treatment, which will comply with air emission ARARs including the Clean Air Act and South Coast Air Quality Management District (SCAQMD) Regulations IV, X, XI, XIII, and XIV.

These alternatives will also comply with wastewater discharge ARARs under Code of Federal Regulations Title 40 Section 122 (40 CFR 122) and California Code of Regulations (CCR) Title 23 Chapter 9, which regulate discharge of treated groundwater to the storm water system under a Waste Discharge Requirements/NPDES permit. Construction activities would also meet the substantive storm water protection requirements of State Water Resources Control Board General Order 2009-009-DWQ.

Temporary on-Site accumulation of DNAPL would be required for alternatives 4A through 6B. The DNAPL is expected to be a hazardous waste and would be managed according to the substantive requirements of 22 CCR 66262-268 for hazardous waste management and disposal. The aboveground collection tank for DNAPL will comply with the hazardous waste storage regulations under 22 CCR 66262-66265, including the tank design requirements.

Alternatives 4B through 6B include treatment of the dissolved-phase concentrations in groundwater prior to re-injection and would also comply with the 1999 Groundwater ROD in-situ groundwater standards. However, Alternative 4A entails the reinjection of untreated groundwater, and will not meet State and Federal maximum contaminant levels for water, which are the ARARs for reinjection, as described in the 1999 ROD requirement. The other five alternatives (4B, 5A, 5B, 6A, and 6B) comply with all ARARs.

Long-Term Effectiveness and Permanence

The long-term effectiveness of the candidate alternatives is determined by their ability to reduce mobile DNAPL mass, ensure that mobile DNAPL does not migrate laterally and vertically outside the TI Waiver Zone, and increase the certainty of the success of the groundwater remedy. Alternative 1 (No Action) is not an effective remedy, in the short term or the long term, and therefore does not comply with this criterion. The long-term effectiveness of thermal alternatives (5A, 5B, 6A, and 6B) is greater than that for the HD alternatives (4A and 4B), because the thermal alternatives are more effective in removing mobile DNAPL.

Thermal treatment is the most appropriate and aggressive approach for DNAPL removal beneath the Montrose Property, because the effectiveness of thermal treatment does not depend on soil characteristics and/or distribution of DNAPL below the surface. Thermal treatment can reach DNAPL that occurs in coarse-grained soils such as sand, as well as in fine-grained soils such as silts and clays. In comparison, the effectiveness of HD is severely impacted by the low-permeability layers of silt and clay beneath the Montrose property. HD can only reach DNAPL in the most permeable sandy layers, but will likely fail to reach it in less-permeable silts and clays.

Therefore, HD is far less effective in conditions like those beneath the Montrose property, where DNAPL lies in various/diverse soil types, including fine-grained silts and clays, and so are ranked "partially effective" (see Table 2).

While more aggressive thermal Alternatives 5B and 6B would remove the greatest mobile and residual DNAPL mass, even these alternatives cannot remove all DNAPL and/or sufficient DNAPL mass to meaningfully reduce the time required for long-term hydraulic containment that will be performed as part of the OU-3 Groundwater remedy. Therefore, treatment of the entire area by thermal alternatives (5B and 6B) offers little advantage over the focused treatment area alternatives (5A and 6A) in terms of the long-term effectiveness and permanence. Because mobile DNAPL occurs within the focused treatment area, Alternatives 5B and 6B are similar to focused treatment area alternatives 5A and 6A with regard to their ability to reduce the mobile DNAPL mass, limit uncontrolled migration of DNAPL, and reduce the possibility of recontamination of the groundwater areas outside the TI Waiver Zone.

Therefore, all four thermal alternatives (5A, 5B, 6A, and 6B) are ranked "effective" (see Table 2).

Reduction of Toxicity, Mobility, and/or Volume of Hazardous Constituents through Treatment

Alternative 1 (No Action) does not comply with this criterion, because it does not reduce the toxicity, volume, and mobility of the DNAPL. All active alternatives reduce the toxicity, volume, and mobility of the DNAPL through treatment (see Table 2). However, HD alternatives (4A and 4B) would remove less chlorobenzene mass and would be less effective in reducing DNAPL volume in the saturated zone compared to the thermal alternatives. Alternatives 5A and 6A are expected to remove mobile and some residual DNAPL, so that only immobile DNAPL present below residual saturations (i.e., DNAPL that is trapped in pore spaces between soil particles as shown in Figure 4) remains below the surface. Since Alternatives 5B and 6B treat larger volumes, these alternatives would remove the greatest volume of mobile and residual DNAPL from below the surface, and achieve the greatest volume reduction.

However, although the potential reduction in DNAPL volume from these entire-treatment-area thermal alternatives is the largest, it is not significantly greater than the potential volume reduction of mobile DNAPL under the focused-treatment-area alternatives (5A and 6A).). This is because most of the DNAPL (including all known mobile DNAPL) occurs within the focused treatment area. As a result, the entire-treatment-area alternatives would likely remove only a slightly greater volume of residual DNAPL from the area outside the focused treatment area. Additionally, the entire-treatment-area alternatives do not eliminate more mobile DNAPL, when compared to Alternatives 5A and 6A, because all known mobile DNAPL is within the focused treatment area. As a result, all thermal treatment alternatives (5A, 5B, 6A, and 6B) are ranked similarly "effective" (see Table 2).

Short-Term Effectiveness

As noted above, Alternative 1 (No Action) is not effective and therefore does not comply with this criterion. All active alternatives (4A, 4B, 5A, 5B, 6A, and 6B) would be "effective" in protecting human health and the environment in the short-term (Table 2). As discussed above, each of these alternatives can potentially cause some unfavorable migration of DNAPL during implementation. The risk of unfavorable migration is slightly higher under thermal alternatives than HD alternatives, although these risks could be managed and effectively mitigated using a "hot floor" approach for steam injection alternatives, and "bottom up" heating for the ERH alternatives.

Thermal alternatives for the entire treatment area (Alternatives 5B and 6B) would also require a large amount of infrastructure for subsurface heating, contaminant recovery, and treatment of extracted fluids, which increases the potential for upset conditions or fugitive emissions to occur in the short-term. While fugitive emissions will be mitigated and likely contained by the SVE, this would pose increased short-term risks to adjacent property owners, including commercial buildings north of the Montrose Property, and a chlorine gas plant at Jones. In addition, Alternatives 5B and 6B have the largest carbon footprints of the remedial alternatives and would consume a significant amount of electricity and natural gas. Based on the above, Alternatives 5B and 6B were ranked lower for short-term effectiveness.

Implementability

Alternative 1 (No Action) is not implementable because it does not meet ARARs and other criteria and therefore does not comply with this criterion. In light of the ARAR waiver required for Alternative 4A, there is also a significant uncertainty regarding both acceptance and implementation of this alternative based on the administrative challenges, which must be mutually resolved among project stakeholders. Based on preliminary feedback from the California Regional Water Quality Control Board (RWQCB), which indicated that injection of untreated water is not acceptable, Alternative 4A is ranked as "not implementable" (see Table 2).

Alternative 4B is ranked "implementable." The implementability of HD has already been demonstrated through field pilot testing, and the technologies proposed for treating extracted groundwater under Alternative 4B have a proven record of success. Furthermore, the efficacy of water treatment operations proposed for Alternative 4B has been demonstrated specifically for groundwater extracted from wells at the Montrose Superfund Site.

Alternative 5A is ranked lower under this criterion than Alternative 6A, because effective capture of DNAPL vapors during steam injection is more difficult to implement than for ERH. This is because contaminated steam can escape to surface through previously drilled borings or wells. The ability to effectively capture DNAPL vapors is especially important given the proximity of commercial warehouse buildings located north of the Montrose property, and an active chlorine gas plant located at Jones. Because of this factor and the small number (2) of available commercial providers capable of providing steam injection services, it is considered "moderately implementable."

2011 EPA booth at the Del Amo Street Fair

Table 2. Comparative Analysis of Active Remediation Alternatives

National Contingency Plan (NCP) Criterion	1 No Action	4A Hydraulic Displacement with Untreated Water Injection	4B Hydraulic Displacement with Treated Water Injection	5A Steam Injection, Focused Treatment Area	5B Steam Injection, Entire Treatment Area	6A ERH, Focused Treatment Area (Preferred Alternative)	6B ERH, Entire Treatment Area
Protective of Human Health and the Environment		Protective	Protective	Protective	Protective	Protective	Protective
Compliance with ARARs		Injection of untreated water does not meet ARARs	Meets ARARs	Meets ARARs	Meets ARARs	Meets ARARs	Meets ARARs
Long-Term Effectiveness		Partially effective in removing mobile DNAPL	Partially effective in removing mobile DNAPL	Effective	Effective	Effective	Effective
Reduction of Toxicity, Mobility, and Volume		Removes less chlorobenzene mass and would be less effective in reducing DNAPL volume	Removes less chlorobenzene mass and would be less effective in reducing DNAPL volume	Effective	Effective	Effective	Effective
Short-Term Effectiveness		Effective	Effective	Effective – has slightly higher risk of unfavorable DNAPL migration, but it could be managed using a "hot floor"	Partially Effective – has higher risk of unfavorable DNAPL migration, and large carbon footprint	Effective – has slightly higher risk of unfavorable DNAPL migration, but it could be managed using "bottom up" heating	Partially Effective – has higher risk of unfavorable DNAPL migration, and large carbon footprint
Implementability		Not Implementable Injection of untreated water does not meet ARARs	Implementable	Moderately Implementable – requires complex infrastructure and specialized technology vendors	Moderately Implementable – large scale, requires complex infrastructure and specialized technology vendors	Implementable	Moderately Implementable – large scale, requires complex infrastructure and specialized technology vendors
Cost ($ million NPV)	$0	$11.0-$12.2	$18.0-$20.1	$22.3-$32.4	$50.8-$84.0	$18.6 - $25.0	$46.2-$69.5
Capital Cost	$0	$5.2- $5.5	$6.0-$6.4	$12.0-$12.7	$23.5-$26.1	$10.2-$10.8	$24.7-$27.3
O&M Cost	$0	$5.8-$6.7	$12.0-$13.7	$10.3-$19.7	$27.3-$57.9	$8.4-$14.2	$21.5-$42.2
State Acceptance	DTSC concurs with EPA's preferred alternative						
Public Acceptance	Community acceptance of the preferred alternative will be evaluated after the public comment period						
Relative Ranking	= Meets Criterion	=Partially meets criterion	= Does not meet criterion				

Alternative 6A proposes the use of ERH, which is more frequently used than steam injection; thus, a broader range of experience and knowledge exists with this heating method. In addition, the risks of fugitive emissions are lower under this alternative. ERH is also easier to implement because a source of electrical power (two substations) is located adjacent to the Montrose Property, and steam boilers are not required for this technology. Therefore, this alternative is ranked "implementable."

Alternatives 5B and 6B, if implemented, would be some of the largest and most complex thermal remedies ever conducted. A significant amount of infrastructure would be required for these entire-treatment-area thermal alternatives, increasing the difficulty of implementing the project. In addition, these alternatives pose higher risks of uncontrolled DNAPL migration and fugitive emissions, which need to be controlled due to the proximity of commercial buildings. Because of the installation challenges associated with the increased scale and size of the remedy, Alternatives 5B and 6B are ranked to be "moderately implementable."

Cost

There is no cost associated with Alternative 1 (No Action). Of the active alternatives considered, Alternative 4A has the lowest cost ($11.0 to $12.2 million NPV). Alternatives 4B, 5A, and 6A all have similar costs to remove DNAPL mass over the focused treatment area. Alternative 4B includes treatment of groundwater prior to reinjection, which increases the cost of this remedy ($18.0 to $20.1 million NPV) relative to that of 4A, but does not offer the additional mass removal advantages of the thermal alternatives. Alternative 6A, ERH over a focused treatment area ($18.6 to $25.0 million NPV), is less costly than the equivalent steam injection Alternative 5A ($22.3 to $32.4 million NPV). However, both alternatives offer generally similar performance with regard to removal of mobile and some residual DNAPL.

Alternatives 5B and 6B are the highest cost remediation alternatives, with costs ranging from $46.2 to $84.0 million NPV. However, as discussed above, treating a significantly larger area as proposed by these alternatives will not likely remove more mobile DNAPL compared to Alternatives 5A and 6A, because all known mobile DNAPL occurs within the focused treatment area.

State Acceptance

DTSC has indicated that it is in general agreement with the proposed remedy.

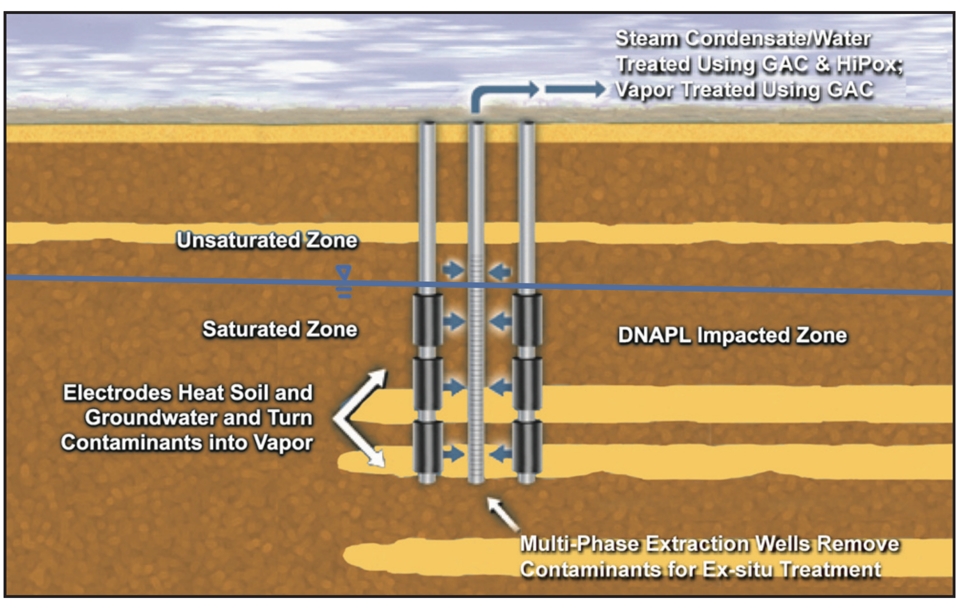


Figure 7. Diagram of the Conceptual ERH Remedial System

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period.

Preferred Alternative – 6A

EPA's Preferred Alternative to address DNAPL at the Montrose Superfund Site is **Alternative 6A–ERH, Focused Treatment Area.** EPA believes that this alternative presents the most reasonable and cost-effective approach for removal of mobile DNAPL at the Montrose Superfund site. This alternative includes:

- A land use covenant.
- SVE in the DNAPL-impacted unsaturated zone.
- ERH in the focused treatment area of approximately 26,000 ft^2 in the saturated zone.

The proposed diagrams of this alternative are shown in Figures 7 and 8.

Duration. The projected duration of the preferred remediation alternative is expected to be **4 years.**

Cost. The estimated cost of the preferred alternative ranges from **$18.6 – $25.0 million.** Based on the comparative analysis of the remediation alternatives, this cost is considered moderate, and is comparable to the cost of Alternatives 4B and 5A.

Effectiveness. ERH is the most appropriate and aggressive approach for DNAPL removal beneath the Montrose property, because thermal heating can reach DNAPL trapped in coarse-grained (sand) as well as finegrained (silt or clay) subsurface soils. Regardless of the types of soils where DNAPL occurs and/or levels of saturation, ERH will effectively treat the mobile DNAPL within its zone of heating.

Based on the evaluation of cleanup alternatives, Alternative 6A meets all threshold and balancing criteria. This alternative appears to be more cost-effective and easier to implement than steam injection thermal alternatives. In addition, the risks of uncontrolled DNAPL migration and fugitive emissions are lower for ERH than steam injection alternatives. This issue is especially important as EPA is seeking to minimize the potential for contaminants moving off-site, toward commercial warehouse buildings north of the Montrose property (at the former Boeing Realty Corporation property), and an active chlorine gas plant along the southern property boundary at Jones.

Alternative 6B, ERH treatment of the entire treatment area, was ranked lower because it is more difficult to implement due to the larger treatment volume, and because of the considerably higher cost of this alternative compared to Alternative 6A. Furthermore, the effectiveness of Alternatives 5B and 6B, which propose thermal treatment of the entire treatment area, is expected to be similar to that of Alternative 6A with regard to removal of mobile DNAPL. Based on the above, Alternative 6A best meets the criteria set forth in the Superfund regulations, which can be found in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 CFR §300.430(f)(2).

As the lead agency, EPA requests public comments on its Proposed Plan to address DNAPL at the Montrose Superfund Site. All public comments will be considered, and may modify or change EPA's decision. The comment period is from September 8th, 2014, through February 13th, 2015. There are several ways to provide comments:

Postmarked Mail Received no later than Feb. 13, 2015

U.S. Environmental Protection Agency
ATTN: Yarissa Martinez
600 Wilshire Blvd., Suite 1460
Los Angeles, CA 90017

Fax

Fax: (213) 244-1850
ATTN: Yarissa Martinez

E-mail

Martinez.Yarissa@epa.gov

In Person at the EPA Public Meeting

Conclusion

Based on the information available at this time, EPA believes the Preferred Alternative (Alternative 6A) for the DNAPL OU meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. EPA expects that, in accordance with CERCLA §121(b), the Preferred Alternative would satisfy the following requirements: protect human health and the environment, comply with ARARs, be cost-effective, and utilize the most appropriate, aggressive, and superior treatment technologies to the maximum extent practicable. Because it would treat the source materials constituting principal threats, the remedy also would meet the statutory preference for the selection of a remedy that involves treatment as a principal element. A comprehensive performance monitoring plan for the DNAPL remedy will ensure that the remedy meets the performance goals and objectives.

Figure 8. ERH in the Focused Treatment Area

Community Participation

EPA is committed to involving the public in the decision making process for the cleanup activities. Its Community Involvement Program focuses on providing information to the community about site activities, answering the community's questions about the cleanup effort, and incorporating community issues and concerns into agency decisions, especially when a cleanup remedy is proposed.

To learn more about the Montrose Superfund Site, you will find an extensive amount of information at EPA's Information Repositories (see last page). One convenient place to find select site documents is to go to EPA's Web site at: **www.epa.gov/region9/montrose.**

Montrose Superfund Site
Los Angeles, California

EPA Requests Comments on Proposed DNAPL Cleanup Plan

Public Comment Meeting

Saturday, November 8, 2014, 10 a.m. to 12:30 p.m.

Holiday Inn Torrance, 19800 South Vermont Avenue, Torrance, California

Public Comment Period Sep 8, 2014 – Feb 13, 2015

EPA DNAPL Workshop

EPA will host a public workshop to discuss contaminants and potential health impacts, technologies and help understand DNAPL at the Site.

Monday, October 27, 2014, 6:30 p.m. to 8:30 p.m.

Holiday Inn Torrance, 19800 South Vermont Avenue, Torrance, California

Technical Assistance Services for Communities (TASC)

TASC is a national program that provides independent technical assistance to communities. A hydrogeologist has been hired to help community members express their technical concerns to EPA staff. Please contact Miranda Maupin *mmaupin@skeo.com* to learn more or attend the TASC sponsored workshop for this DNAPL Proposed Plan during the public comment period (meeting to be determined).

Information Repositories

Pertinent documents related to the Montrose Superfund Site can be found at the locations below.

Katy Geissert Civic Center Library
3301 Torrance Boulevard
Telephone: (310) 618-5959
CDs available for check-out.

Carson Public Library
151 East Carson Street
Telephone: (310) 830-0901
CDs available for check-out and key documents available in paper copy.

EPA Superfund Records Center
95 Hawthorne Street
San Francisco, CA 94105
Telephone: (415) 536-2000