CASCADE THERMAL

Steam Enhanced Extraction at the Beede Waste Oil Superfund Site:

Phase 1, Former Lagoon Area, Plaistow, NH

CASE STUDY

SITE INFORMATION

Site Background

The property is comprised of two parcels occupying a total of approximately 41 acres (17 hectares) within a predominantly residential area. The Site was the location of several oil-related operations, including waste oil processing and re-sale, fuel oil sale, contaminated soil processing into cold-mix asphalt, anti-freeze recycling, and other related industries. These activities were reportedly conducted from the 1920's until operations ceased in August 1994.

When operations ceased in 1994 various materials were abandoned at the site including: aboveground storage tanks containing hazardous and non-hazardous oils; several large piles of soil containing varying levels of contamination, and drums of oil product, some containing hazardous materials, which were stored in an open-sided structure. Polychlorinated biphenyls (PCBs) were detected in some of the oil product in some tanks and drums.

Over 90,000 gallons (340,000 liters) of oil were recovered between 2000 and 2005 by a vacuum-enhanced LNAPL recovery system installed as a Non-Time Critical Removal Action (NTCRA). However, pooled and residual LNAPL, consisting of a mixture of a variety of oil types, including motor oil, lubricating oil, diesel and kerosene, remained over much of the treatment area across a smear zone created by water table depression and fluctuation.

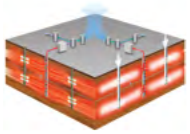
Geology and Hydrogeology

Soils across the thermal treatment zone consist of gravelly sand, sand, and silty sand and generally grade from coarse to fine moving from top to bottom. Notable soil heterogeneities exist in the former Lagoon area vadose zone, including a layer of wet, oil-stained fill material typically found between 8 and 10 ft bgs, and a thin clay lens found between 16 and 22 ft bgs. The water table is present at depths ranging from 20 to 23 ft bgs across most of the thermal treatment zone.

Contaminants of Concern (COCs): Trichloroethene (TCE), cis-1,2-dichlorothene (cis-1,2-DCE), benzene, ethylbenzene, tetrachloroethene, 1,1,1-trichloroethane, total alkylbenzenes and naphthalene.

OBJECTIVES

The goal of the SEE remedy was to reduce VOC levels in subsurface soils deeper than 10 ft (3 m) bgs to below the soil leachability clean-up goals specified in the Record of Decision (ROD), as well as the New Hampshire Department of Environmental Services (NHDES) Ambient Groundwater Quality Standards (AGQS). However, it was anticipated that the chemical properties of naphthalene may have prevented short-term (i.e., immediately after the SEE remedy) attainment of the low clean-up goal of 4 mg/Kg.

TECHNOLOGY	TIMEFRAME	LOCATION
	8/2014 to 3/2016	
SEE		New Hampshire

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APPROACH

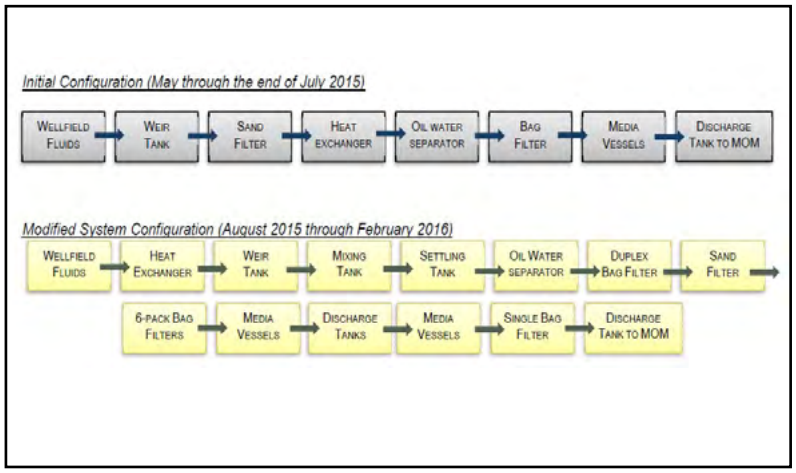
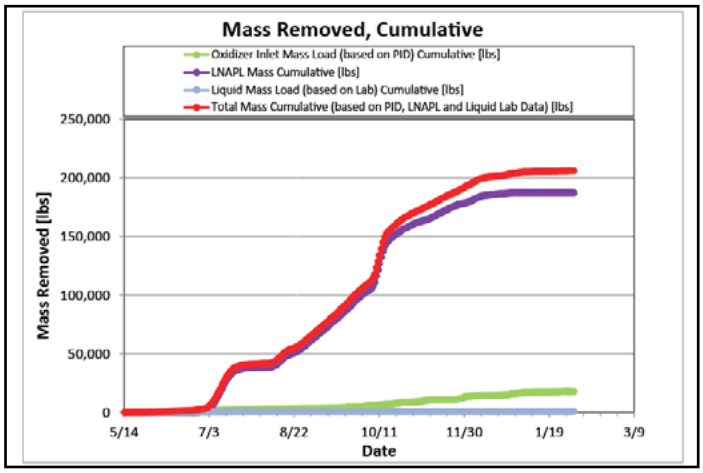
- Steam Enhanced Extraction
- Target Treatment Zone (TTZ):
  - ◊ Area = 34,930 ft^2
  - ◊ Volume = 13,270 cy
  - ◊ Average depth = 16-26 ft below ground surface (bgs) with a smaller footprint where treatment was from 10-26 ft bgs
- 88 steam injection well clusters
- 31 multi-phase extraction wells
- 38 temperature monitoring strings with 8 points at varying depths

RESULTS

- Approx. 17,278 gallons of oily NAPL removed
- Approx. 150,066 lbs of contaminant mass removed
- Post-treatment soil samples showed that all remedial goals were achieved in soil
- The Steam Enhanced Extraction (SEE) treatment is expected to significantly decrease the time needed for operation of the existing groundwater treatment system

PROJECT SUMMARY

An in-situ thermal remedy, specifically Steam Enhanced Extraction (SEE), was selected to remediate a former waste oil processing Superfund site. The thermal treatment project is being undertaken in two phases. The Phase 1 SEE treatment zone targeted soils in a former waste lagoon area from 10 to 26 ft bgs and had a target treatment volume of 13,270 cubic yards. The primary Constituents of Concern (COCs) included trichloroethene (TCE), cis-1,2-dichlorothene (cis-1,2-DCE), Benzene, Ethylbenzene, Tetrachloroethene, 1,1,1-Trichloroethane, Total Alkylbenzenes and Naphthalene. In addition, a significant amount of oily non-aqueous phase liquids were present in the SEE treatment zone.

The Phase 1 SEE system operated from May 2015 - February 2016. Post-treatment sampling revealed that the SEE remediation met the ROD clean-up standards for the target VOCs as well as Naphthalene. The SEE system removed approximately 17,278 gallons (65,400 liters) of LNAPL and over 150,000 pounds (68,000 kg) of COC mass from the site. SEE remediation of the Phase 2 area is ongoing.

LIQUID PRE-TREATMENT SYSTEM MODIFICATION SUMMARY