

Jones Chemicals, Inc.

Soil Vapor Extraction—Pump and Treat—In Situ Chemical Oxidation—Monitored Natural Attenuation

Site Name: Jones Chemicals, Inc.

Site Location: Caledonia, New York

Technology Used:

- In Situ Soil Vapor Extraction (SVE)
- Pump and Treat (P&T)
- In Situ Chemical Oxidation (ISCO) (Sodium Permanganate)
- Monitored Natural Attenuation (MNA)

Regulatory Program: U.S. EPA Superfund NPL Site

Remediation Scale: Full

Project Duration: September 2003 to July 2008 (planned)

Site Information: Jones Chemical is a 10-acre chemical manufacturing and repackaging facility. From 1942 until 1960, the plant repackaged chlorine. In 1960, the plant began repackaging solvents, including trichloroethene (TCE), tetrachloroethene (PCE), and petroleum products. The plant also repackaged anhydrous ammonia and various acids and manufactured ammonium hydroxide (aqua ammonia). Chemicals associated with the repackaging were stored in aboveground and underground bulk storage tanks on the property. From 1971 until 1980, hazardous waste from other sites was handled and stored on site. Jones Chemicals stopped repackaging solvents in 1985.

The plant now produces sodium hypochlorite (bleach) solutions and sodium bisulfite. It also repackages chlorine, sulfur dioxide, inorganic mineral acids, ammonium hydroxide, caustic soda, and various inorganic water-treatment chemicals.

Contaminants: In 1986, the New York State Department of Health detected toluene, dichloroethene, methylene chloride, chloroform, PCE, and TCE in three onsite wells at concentrations above standards. The highest soil concentrations of PCE and TCE detected were under a 150 ft by

20 ft area known as the Former Solvent Tank Area (FSTA). There, PCE soil concentrations up to 330,000 µg/kg and TCE concentrations up to 320 µg/kg were found. A groundwater VOC plume that is about 1,500 ft long, 720 ft wide, and 48 ft deep, extends from the FSTA to the east and to the northeastern property boundary. The plume consists primarily of PCE and its degradation products TCE and 1,2-dichloroethene (1,2-DCE). Near the FSTA, PCE and TCE were detected in the bedrock aquifer at concentrations as high as 62,000 µg/L and 100 µg/L, respectively, indicating the presence of PCE dense non-aqueous phase liquids (DNAPL).

Hydrogeology: Two distinct stratigraphic zones, an upper overburden zone and a bedrock zone, underlie the site (Figure 1). The overburden zone consists of approximately 30 ft to 70 ft of glacial deposits, which are a mixture of gravel, sand, and silt. Groundwater is in this zone at approximately 15 ft below ground surface (bgs). Limestone is found below the glacial deposits.

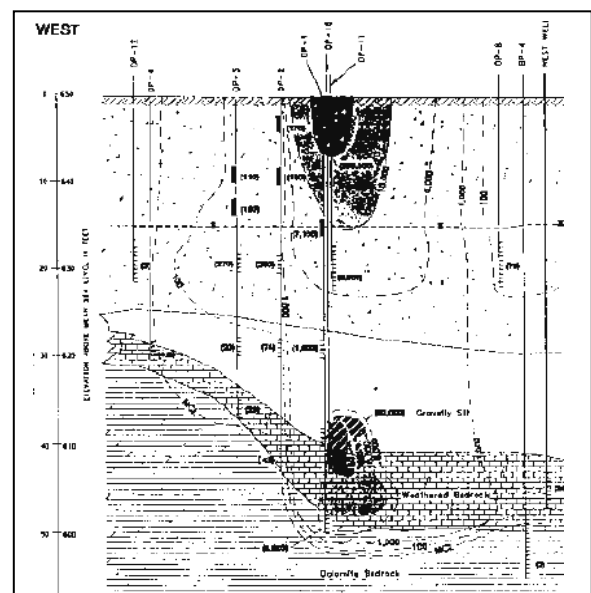


Figure 1: Stratigraphy and Site Conceptual Model

Source: U.S. EPA 2000

The surface of the bedrock slopes steeply to the west. Cores taken at the site indicate that the upper 10 ft of the limestone is highly weathered and fractured. The groundwater yield within the bedrock occurs primarily in the weathered portion and/or through fractures. Near the FSTA, the upper surface of the limestone is approximately 40 ft bgs. There also appears to be an upward vertical gradient indicating flow from the deeper to shallower water-bearing zones.

Project Goals: The Record of Decision (ROD) required that the groundwater meet state and federal maximum contaminant levels within a reasonable time to mitigate the potential for chemicals to migrate from soil into groundwater, and to control the migration of affected groundwater into nearby drinking water wells (Table 1).

Contaminant	Soil (mg/kg)	Groundwater (µg/L)
Tetrachloroethene	1.4	5
Trichloroethene	0.7	5
<i>cis</i> -1,2-Dichloroethene	NA	5
<i>trans</i> -1,2-Dichloroethene	0.3	5
1,1-Dichloroethene	0.4	5
Vinyl Chloride	0.2	2

Source: U.S. EPA 2000

Cleanup Approach: In May 1996, the facility installed an air stripper to treat the noncontact cooling water from the two onsite production wells that were capturing contaminated groundwater. The air stripper has the capacity to treat up to 500 gallons of water per minute. Monitoring of the discharge water indicated that VOCs were below detection limits after treatment. This system was modified in 2004 with the addition of two new overburden extraction wells, and one new bedrock extraction well. All of the produced water is treated by the existing air stripper and routed to the plant for use as noncontact cooling water.

An in situ SVE system was installed in April 2004 to address soil VOCs in a treatment area of about 100 by 40 ft beneath the FSTA. Four 170-lb granular activated carbon vessels treated the SVE effluent.

In 2005, five overburden and one double-cased bedrock injection wells were installed for ISCO injections. The first sodium permanganate (NaMnO₄) injections occurred during the week of July 18. The NaMnO₄ solution was batch mixed in two 330-gallon mix tanks. A drum transfer pump transferred the solution into a mixing tank where the make-up water was added. An injection pressure below 15 psi was used to prevent soil fracturing. Oxidation potential readings taken immediately before the injections, three days after the injections, and one month after the injections indicate that oxidation is occurring in the majority of the sampled wells. In addition, the purple color of the samples from a number of wells indicated the presence of NaMnO₄. While VOC levels were reduced in several wells three days after the injections, several samples collected one month following the injections showed a rebound (increase). A second round of NaMnO₄ injections was performed during the week of May 1, 2006. Additional ISCO treatments were repeated in November 2006, May 2007, October 2007, November 2008, November 2009, and November 2010.

The ROD called for MNA of the low levels of PCE in groundwater located outside the FSTA and beyond the influence of the North Well. Sample results in these areas show the presence of natural attenuation indicator parameters (i.e., ferrous iron, sulfide, sulfate, alkalinity, nitrate/nitrite, chloride, and methane).

Project Results: The removal of underground and aboveground storage tanks and the installation of the pilot-scale air stripping system reduced the potential for further contamination at the site while investigations leading to the selection of a final cleanup remedy took place. The groundwater extraction and treatment system is fully operational. To date, the air stripper has

treated more than 500 million gallons of contaminated groundwater, and the SVE system has removed about 94 lbs of PCE and its breakdown products.

The ISCO treatments have resulted in an immediate reduction in contaminant concentrations followed some time later by rebound. Because DNAPL is suspected, EPA anticipates the need for additional applications to achieve cleanup goals.

Jones Chemical was not required to make cost information available. Cost estimates reported in the ROD in year 2000 dollars were \$844,000 for construction and \$237,000 for annual operation and maintenance.

Sources:

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U.S. EPA. 2000. Record of Decision: Jones Chemicals, Inc., EPA ID: NYD000813428, OU 01 Caledonia, NY, 09/27/2000, 208 pp.
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