

**Savage Municipal Well Site
Milford
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The Savage Municipal Water Supply Well Superfund site is located in the town of Milford approximately two miles west of the center of town. The contaminated plume at the site extends approximately 6,000 feet eastward from the intersection of Route 101 and Elm Street.

The Savage Municipal Water Supply Well was a water supply for Milford from 1960 to 1983. In February 1983, the New Hampshire Department of Environmental Services (NHDES) detected concentrations of volatile organic compounds (VOCs) in the Savage Well that were above drinking water standards, and the well was shut down. The site received Superfund emergency monies to temporarily provide bottled water to residents of a nearby trailer park whose water supply well was also affected. The trailer park was subsequently connected to the town's public water supply. The site was added to the National Priorities List in September 1984.

In 1985, NHDES completed a hydrogeological evaluation of the site and identified four manufacturing facilities as potentially responsible parties (PRPs).

In August 1987, the Environmental Protection Agency (EPA) and the PRPs signed a Consent Decree in which the PRPs agreed to conduct the Remedial Investigation/Feasibility Study (RI/FS). The PRPs began fieldwork in the summer of 1988. EPA accepted the RI/FS in 1991, and EPA's Record of Decision (ROD) was issued in September 1991.

In subsequent negotiations, the site was divided into two areas of remedial responsibility. EPA and the State are undertaking the cleanup of the OK Tool Source Area (OU-1) where VOCs were released into the subsurface from the now-closed OK Tool manufacturing facility. The PRPs are responsible for the cleanup of the second area (OU-2), which includes the extended plume of contaminated groundwater in the Milford-Souhegan aquifer.

The remedial action for OU-1, the OK Tool source area includes a physical barrier to contain the overburden source area, in conjunction with pumping and treating the groundwater. Also, air sparging and soil vapor extraction were included in the remedy.

Construction of the 1,500-foot circumference slurry wall/barrier (containment area) and the treatment plant began in 1997 and was completed in March of 1999.

Since plant operations began in 1999, monitoring well sampling of the overburden aquifer indicate significant contaminant reductions outside of the slurry wall containment area. This trend demonstrates that the remediation system is functioning as intended in cleaning up the sand and gravel aquifer.

After extensive investigations to characterize and delineate source areas inside the containment area, EPA and NHDES performed an in-situ chemical oxidation (ISCO) pilot test in September of 2003 and 2004. The ISCO test included injection of potassium permanganate into the subsurface. Potassium permanganate destroys dissolved chlorinated solvents such as PCE using oxidizing reactions.

Additional investigations to characterize and delineate potential source areas, and their relationship to former waste handling facilities in the western part of the containment area were conducted in 2007 and 2008. The investigations included vertical profiling of suspected DNAPL release areas and included groundwater, soil gas and soil sampling. These investigations aided in designing follow-up ISCO injections and vadose zone excavation and treatment as described below.

In 2008 the treatment system at OU-1 was modified. Modifications consisted of the removal of the SVE blower and air sparge compressor, and replacement of two low pressure steam boilers with two high efficiency water boilers. The small energy efficient boilers have significantly reduced fuel consumption at the OU-1 treatment plant.

During 2008/2009, approximately 2,000 cubic yards of vadose zone soils from the former leach field area at OU-1 were excavated and treated on-site using soil vapor extraction and chemical oxidation using ozone and peroxide. Following post treatment soil sampling which indicated the soils met cleanup standards, the soil was backfilled.

After evaluating the effectiveness of the ISCO pilot injections, three follow-up ISCO injections were performed at OU-1 in the saturated zone to reduce the mass of contamination inside the wall. These ISCO injections used sodium permanganate. The injections occurred in fall 2008, fall 2009 and late winter 2010. A total of approximately 300,000 pounds of 40 percent sodium permanganate were diluted and injected during the three injection events.

At OU-2, in accordance with the requirements of the Consent Decree, the PRPs completed construction of a 450-gallon per minute groundwater treatment plant in late fall 2004 to cleanup the extended plume of contaminated. The OU-2 groundwater remediation system has operated at an average rate of approximately 400 gpm with treated water being discharged to the subsurface and Souhegan River. The metals treatment system is effectively treating metals, being compliant with both surface water effluent discharge limits established by NHDES and design requirements of the system. A suspension test and remedy optimization evaluation is currently underway at OU-2. The OU-2 pump and treat system went off-line in December 2015 and remains off during the suspension test and remedy optimization evaluation.

The first Five Year Review was completed for the site in September 2011. Recommended actions include performing a shallow groundwater investigation to evaluate potential vapor intrusion risk at residential receptors in OU-2. Conduct evaluation of the OU-1 extraction system performance due to fouling from residual permanganate. Implement institutional controls; establish GMZ, Town Ordinance, Zoning and/or Deed Restriction.

Establish interim cleanup levels and prepare a decision document for 1,4-dioxane, vinyl chloride, cis-1,2-DCE and manganese, and modify arsenic to 10 ppb. The vapor intrusion assessment of residential receptors in OU-2 has been completed. The OU-1 residual permanganate fouling issues have been addressed.

Deep bedrock investigations were initiated at the site in 2010. A Remedial Investigation Report was completed in Spring 2014. Analytical data from deep bedrock monitoring wells, located beneath the OK Tool Source Area, indicate high levels of chlorinated hydrocarbons indicating the possible presence of DNAPL in bedrock. Concentrations of contaminants in deep bedrock drop 3 orders of magnitude with in approximately 700 feet of the slurry wall near the OK Tool Source area.

A Feasibility Study which looks at various technologies and alternatives available to address the risks posed by the deep bedrock contamination was completed in July 2015. EPA's Proposed Plan to address the current remedy at OU-1 was presented to the public in August 2015. EPA issued an Amended Record of Decision (AROD) in 2016 to modify the remedy at OU-1. The changes include establishing a technical impracticability zone, implementation of in-situ chemical oxidation, installation of a permeable reactive barrier, institutional controls and monitoring.

EPA completed the Site's second 5 Year Review in September 2016. Institutional controls need to be implemented at both OU-1 and OU-2. The ARARs and cleanup standards for OU-2 need to be revised, and OU-2 will need to implement additional monitoring to assess the extent of natural attenuation of contaminants in bedrock. The remedy at OU-1 needs to be revised based on the AROD issued by EPA in 2016.

The pre-remedial design investigation for the revised remedy at OU-1 was initiated in 2017 and to date has included the installation of 15 deep bedrock wells, borehole geophysics and packer sampling and pump testing to evaluate final design parameters for the in-situ chemical oxidation portion of the revised remedy. Preliminary design work for the permeable reactive barrier has been conducted including, computer modeling, bench scale testing and a conceptual design document.