PRELIMINARY CLOSE OUT REPORT

Savage Municipal Water Supply Well Superfund Site
Milford, NH

September 2006

I. INTRODUCTION

This Preliminary Close Out Report (PCOR) documents the completion of all physical remedial construction activities for Operable Units (OU) 1 and 2, which were completed at the Savage Municipal Water Supply Well Superfund Site ("Site") in Milford, New Hampshire. The PCOR was prepared in accordance with *Close Out Procedures for National Priorities List Sites* (OSWER Directive 9320.2-09A-P).

EPA and the State of New Hampshire conducted a pre-final inspection at the Site on June 29, 2006, for Operable Unit 2, the last operable unit to be completed. The remedies at each Operable Unit were constructed in accordance with remedial design plans and specifications. No outstanding construction items were identified. Therefore, no additional substantial construction is anticipated at the Site.

II. SUMMARY OF SITE CONDITIONS

Background

The Savage Municipal Water Supply Well Superfund Site is located approximately two miles west of the center of the Town of Milford, New Hampshire. The Site encompasses an area of more than 50 acres and lies within the floodplain of the Souhegan River. The floodplain is a relatively flat land surface extending through most of the area of the Site. The Souhegan River flows from west to east the length of the Site area. At the eastern edge of the Site, the River takes a pronounced southward bend before resuming it's generally west to east orientation. (See Figure #1).

Residential, agricultural, heavy and light industrial, and commercial land uses are found within the Site. Residences are located along Elm Street and Old Wilton Road. A trailer park is located to the north of Elm Street. Agricultural uses including a cornfield and a former sod farm dominate the central and western portions of the Site between Elm Street and the Souhegan River. The heavy industrial uses are located between Elm Street and Old Wilton Road east of Route 101. Light industrial and commercial uses are generally found along Elm Street.

Four major industrial plants previously operated or are currently operating to the west of the Savage Municipal Well: Hendrix Wire and Cable Corporation, Hitchiner Manufacturing Company, New England Steel Fabricators, Inc. (NESFAB), and OK Tool Company. From the 1940's until the 1980's, process waters and wastes from those four industrial facilities were released, untreated to the ground or surface waters flowing through the Site.

As a result of these releases, a ground water plume extends from the intersection of Route 101 and Elm Street eastward approximately 6,000 feet. The plume is roughly bounded on the north and east by the Souhegan River and on the south by Elm Street and Tucker Brook.

The ground water aquifer underlying the Site is a high yield aquifer. From 1960 to 1983, the Town of Milford obtained about 40% of its water supply from the Savage Municipal Water Supply Well. The Savage Well is a gravel packed overburden production well which yielded approximately 500 gallons per minute. Since 1983, when the State of New Hampshire ordered the Town to cease use of the Savage Municipal Well due to the presence of volatile organic compounds (VOCs) above drinking water standards, the aquifer has not been used as a drinking water source.

The site was listed on the National Priorities List in September 1984. In 1994, EPA divided the Site into two operable units.

Initial Response Activities

At the request of the State of New Hampshire, EPA conducted an emergency removal action from March to May, 1983, at the Milford Mobile Home Trailer Park located east of the OK Tool Company. EPA's actions included supplying bottled water to the residents as an interim measure, connecting the manager's trailer to the trailer park water distribution system, and connecting the trailer park to the existing municipal water main. This action was completed following connection of the trailer park to the municipal water main.

In August 1984, soil removal activities were completed by a contractor for the OK Tool Company beneath the indoor degreasing tank. This removal involved the excavation of approximately 27 cubic yards of unconsolidated material from an area measuring approximately 9 feet by 9 feet and 10.5 feet deep. This area was identified as being the most significant source of VOCs found in the ground water at OK Tool.

Finally, in 1985, a pilot test was performed using contaminated soils from the OK Tool property. The on-site pilot test involved the use of natural aeration with mechanical mixing to treat the contaminated soils.

Basis for Remedial Action

The primary threat at the Site continues to be direct contact with and future ingestion of contaminated ground water. The ground water remedial action objectives established in the 1991 ROD require that the remedy minimize risk to human health from future consumption of and direct contact with ground water, and minimize migration of contaminated ground water so that it is not injurious to aquatic ecological systems in receiving water bodies.

The Human Health Risk Assessment concluded that the risks at the Site are almost solely attributable to ingestion of ground water. The ground water at the Site is contaminated with organic compounds such as tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), vinyl chloride, 1,1-dichloroethylene (1,1-DCE), 1,2-dichloroethane (1,2-DCA), arsenic, beryllium, benzene and lead. Tetrachloroethylene comprised 85-90% of the total risk. Risks from exposure to other media were within EPA's risk range for carcinogenic compounds and met the hazard index goal of one for compounds with noncarcinogenic effects.

Selected Remedy

The Record of Decision for the entire site was signed in September 1991. The remedial actions identified in the ROD to address ground water contamination included:

- Installation of a ground water extraction and treatment system at the concentrated plume area. The system contains and removes highly contaminated ground water for treatment using air stripping and ultraviolet oxidation.

- Installation of a ground water extraction and treatment system within the extended plume area. The system removes contaminated ground water from two locations near the middle of the plume and two locations near the end of the plume for treatment using ultraviolet oxidation.

• Reliance on natural attenuation of contaminated ground water to lower contaminant concentrations through physical, chemical, and biological processes until ground water cleanup levels are met.

• Utilization of institutional controls to reduce the risk to public health from consumption of the ground water. Institutional controls may include deed restrictions and zoning ordinances to restrict the use of contaminated ground water. Institutional controls will be imposed where the risk to public health is outside EPA's acceptable risk range.

• Implementation of an environmental monitoring program initiated during remedial design and continuing for three years after attaining ground water cleanup levels to assess the effectiveness of remediation and to confirm that contaminant concentrations in the ground water have attained cleanup levels. This program would include monitoring of ground water, surface water, sediments, and existing households obtaining drinking water from the aquifer.

The remedy is being implemented through two consent decrees entered in federal court in New Hampshire in 1994. As part of the settlement agreements, the site was divided into two operable units. Operable Unit 1 – the concentrated plume area -- is known as the OK Tool Source Area (OKTSA) and is a fund-lead site. Operable Unit 2 is known as the Extended Plume Area and is being cleaned up by two of the settling parties.

A. Operable Unit 1

The New Hampshire Department of Environmental Services (NHDES) began the design of the pump and treat system in the OK Tool Source Area under EPA supervision through a Cooperative Agreement in 1994.

An Explanation of Significant Difference (ESD) to the ROD applying only to the OKTSA was issued on December 19, 1996. The ESD was issued following a public meeting held on November 19, 1996.

The ESD was based on new information and site restrictions identified during pre-design studies which resulted in a better understanding of the nature of the contamination at the OKTSA. However, the original ROD goal to clean up the aquifer did not change.

Most significantly, the discovery of a dense, non-aqueous phase liquid (DNAPL) in the subsurface at the OKTSA caused EPA and NHDES to conclude that the original ground water extraction remedy would not effectively remove the DNAPL mass or dissolved contaminant concentrations within a reasonable time frame. Therefore, a physical barrier, in combination with more aggressive contaminant removal technologies, would be the more cost-effective solution for managing the plume at the OKTSA.

The following changes to the ROD were identified in the ESD:

• Acquisition of property (the Milonas Restaurant property) upon which the treatment plant was to be built. The property was purchased because pre-design evaluations indicated that the property owned by the OK Tool Company was not suitable for the location of the treatment plant specified by the ROD.

• Addition of a slurry wall to significantly reduce the mobility of contaminants, reduce the volume of ground water to be pumped, and improve the long-term effectiveness of the remedial action.

• Addition of three extraction wells (bringing the total to four).

• Reduction of the pumping rate to 70 gpm.

• Construction of a soil vapor extraction (SVE) system with air sparging (AS) to remove the near surface contamination sources within the area encircled by slurry wall.

• Treatment of ground water by air stripping with carbon absorption. The off-gas treatment technology was also changed from a thermal oxidizing unit to carbon absorption to permit the use of only one treatment technology for both the air stripper and the SVE system.

• Discharge of treated ground water to the ground using two injection wells (changed to three injection wells during construction) and a recharge pit.

The final design for the OK Tool Source Area was approved in 1997. In December 1997, NHDES awarded a contract for construction of the Remedial Action in the OKTSA. Construction of OU 1 was completed in March, 1999. The facility has been operated by NHDES under a cooperative agreement with EPA since this time.

Operable Unit 1 Aggressive Strategies to Address DNAPL

As EPA and the hazardous waste community (academia, scientists, and industry) learned about the practices and subsequent consequences of hazardous waste disposal, the particular treatment strategies for dense non-aqueous liquids (DNAPL) such as the chlorinated solvents found at OU 1 have evolved and improved. EPA and NHDES have committed to implementing new strategies and techniques to remove and destroy the DNAPL at OU 1. The first strategy was to use surfactant flushing at neutral buoyancy in the area below a floor drain where solvents used by the OK Tool Company were disposed. This strategy proved to be too costly and was abandoned after several subsurface tracer tests were completed to locate the DNAPL. A second strategy using the infrastructure from the surfactant strategy, involves in situ chemical oxidation. This strategy uses potassium permanganate injected into the subsurface to oxidize (destroy) dissolved chemicals, including chlorinated solvents such as tetrachloroethylene, into chlorides and water. Two series of injections, completed in 2003 and 2004, have resulted in significant reductions of DNAPL. Further work using this technology is planned.

B. Operable Unit 2

In November 1997, the settling parties submitted a draft Remedial Design Investigation Report (1997 draft RDI) which presented several pump and treat alternatives and compared them to natural attenuation for the Extended Plume Area. Pumping rates evaluated included 450, 600, 650, 800, and 1400 gallons per minute (gpm). The conclusion based on the settling parties' modeling was that "natural attenuation would be the most cost effective alternative comparable to active remediation."

Performing its own analysis of the settling parties' modeling, EPA found that the locations of the extraction and injection wells determined the aquifer cleanup times. EPA then developed its own model and used it to evaluate the 450 gpm pumping scenario. EPA demonstrated that by locating extraction and injection wells to improve the efficiency of the cleanup, it is possible to significantly reduce the time needed to remediate the contaminated plume. EPA also demonstrated the same conclusion using the settling parties' model.

During its review efforts on the 450 gpm pumping scenario, EPA also discovered that the settling parties' 3-D model contained an error which caused the cleanup times to be incorrectly estimated. This error was later acknowledged by the settling parties. Analysis with the corrected model concluded that the cleanup times were significantly less than the times used as the basis for the conclusions in the 1997 draft RDI.

EPA and NHDES presented their conclusions to the settling parties in a series of meetings from December 2000, to May 2001. In June 2001, the settling parties changed their consultant and project coordinator. The settling parties agreed to use the EPA model and believed that improvements could be made to the EPA model which would assure the construction of an optimum remedy.

As part of that effort the settling parties performed additional field work in 2001 which provided further information that confirmed EPA's earlier conclusions and provided new information used to improve the model's predictive output. The work included subsurface investigations which refined the bedrock contours used in the model. The work also included obtaining information on the geologic properties of the aquifer and ground water contamination information where needed.

In May 2002, the settling parties submitted a revised draft RDI (2002 draft RDI) which described the field work and the modifications made to the EPA model. The 2002 draft RDI recommended Configuration 4 which is a 450 gpm extraction - injection/recharge system with treatment of contaminated ground water with air stripping technology. That proposed system is briefly described as three extraction wells, a recharge gallery, and a treatment plant.

After review and comment by NHDES, EPA modified the 2002 draft RDI and approved the RDI report in September 2002. The modifications were based on additional modeling performed by the U.S. Geological Service and EPA's technical consultant. Based upon this modeling effort, EPA and NHDES modified the settling parties' recommendations for the locations of the extraction wells. No changes were made to the rates of extraction, recharge, or treatment. EPA and NHDES also decided against the use of a recharge gallery, and required that three injection wells be used for the recharge of treated ground water.

The final design consisted of the following elements:

- Three extraction wells and three injection wells;
- A water treatment plant to remove contaminants of concern from ground water prior to injection;
- Injection wells located at the southern flank of the plume to enhance flushing of contaminant zones;
- A monitoring network to monitor performance of the remedy on a periodic basis.

The extraction and injection wells were installed in the spring of 2003. The final design was approved in December 2003, and construction of the remediation system started in February 2004. Initial operation was started in October, 2004. Due to operational difficulties with the injection wells, operations were stopped in December 2004.

Operable Unit 2 Remedial System Modifications

A comprehensive data collection program indicated that:

- Injection wells IW 1 and IW 2 were fouled and had experienced significant reductions in specific capacity. Precipitation of iron in and near the wells was determined to be the cause of the fouling. Also the data indicated that the sequestering agent, which was intended to keep metals (primarily iron and manganese) in the dissolved form, was not performing adequately.

- IW-3 was not installed properly. Improper seal construction, in conjunction with iron precipitation at the well, led to the operational difficulties at this well.

As a result of remedy implementation issues noted at system start up, the following actions were taken:

- Injection wells IW 1 and IW 2 were redeveloped to restore injection capacities to the extent possible;

- A metals filtration system was constructed to replace the sequestering agent;

- A surface water discharge to the Souhegan River was installed to provide for alternate discharge of treated ground water.

During the fall of 2005, the system was operated using a temporary surface water discharge permit to allow for system evaluation and a determination that the proposed metals filtration system modifications could meet permanent discharge requirements for surface and subsurface discharge. A permanent surface water discharge permit was issued by NHDES in December, 2005, and full system operation began in January, 2006.

Three formal inspections of the OU 2 remedy were performed by EPA, NHDES and the EPA oversight contractor. The US Army Corp of Engineers also attended the April 20, 2006 inspection. The inspections are summarized below:

- November 19, 2004: Conducted within the initial 30-day start up period, all aspects of the remedy were reviewed. A punch list was reviewed. Before the end of the 30 day start up period the operational difficulties became known and the system was shutdown.

- April 20, 2006: Operation of the permanent surface water discharge was done. Minor modifications were requested and subsequently performed.

- June 29, 2006: A pre-final inspection was performed by EPA, NHDES, and the settling parties for the modified remedy. The punch list from the November 2004 inspection was reviewed and all items were addressed except for the final as built drawings that needed to be completed. Minor repairs to IW 3 to make it operational are to be done in the fall 2006.

Redevelopment Potential

The former OK Tool Company and Milonas Restaurant properties within the OU 1 area are currently owned by the State of New Hampshire. The redevelopment potential of OU 1 is significant due to its proximity to Route 101 which is a major east/west artery for southern New Hampshire. However, due to the infrastructure needed for the OU 1 treatment system, redevelopment is dependent on the completion of the remedial action in OU 1.

A small portion of OU 1 has recently been the subject of a request by the Milford Conservation Commission to allow public access to the Souhegan River. EPA and NHDES anticipated this potential and placed fencing appropriately on the OU 1 property enclosing the treatment plant and the slurry wall; therefore, EPA and NHDES are able to support this proposed public use.

All of the property within OU 2 is held by private interests. About 65 acres of farmland are subject to a development restriction which was purchased by the State to preserve the land's use for agricultural purposes. All other parcels are subject to Milford zoning law, which in general allows development to occur.

The Savage Municipal Well and its surrounding land are owned by one of the settling parties, Hitchiner Manufacturing Company, Inc. Hitchiner has proposed to use the land as part of a golf course. The Town of Milford has gone on record that one of its goals is to reacquire the Savage Municipal Well to ensure the town's future drinking water supply.

III DEMONSTRATION OF CLEANUP ACTIVITY QUALITY ASSURANCE AND QUALITY CONTROL

The methods, procedures, inspections and tests were performed in accordance with EPA approved designs for both operable units. For OU 1, NHDES was the primary regulatory agency providing oversight during the OU 1 construction activities. NHDES contracted for the construction and the engineering/inspection services during construction. The project plans and specifications prepared by the design contractor described the construction quality assurance and quality control monitoring and testing requirements for the OU 1 project.

The settling parties contracted for engineering and inspectional services for the construction of the OU 2 remedy. An Independent Quality Assurance Team (IQAT) was also responsible for ensuring that the contractor's Quality Control Plans were implemented and independently verified.

Construction of both operable units has been completed in accordance with the 1991 ROD, the 1994 consent decree, and all remedial design plans and specifications.

IV ACTIVITIES SCHEDULED FOR SITE COMPLETION

It is estimated that all activities associated with site completion will be performed according to the schedule below:

Schedule for Site Completion

Task	Estimated Date	Responsible Organization
Operational and Functional Determination OU 1	April 2000	EPA (with NHDES concurrence)
Long-Term Remedial Action Start OU 1	April 2000	EPA/NHDES
Operational and Functional Determination OU 2	June 2006	EPA/NHDES
Long Term Response/Operation and Maintenance Start OU 2	June 2006	Settling Parties
Interim Remedial Action Report OU 2	Sept 2006	Settling Party with EPA approval
Operation and Maintenance Plan Approval OU 2	Jan 2007	EPA/NHDES
Long-Term Remedial Action Completion OU 1	March 2010	EPA/NHDES
Operations and Maintenance Start OU 1	April 2010	NHDES
First Policy Five-Year Review	Sept 2011	EPA/NHDES
Institutional Controls Implementation[1]	TBD	NHDES/Settling Parties
Final Site Inspection Entire Site[2]	TBD	EPA/NHDES
Final Close Out/Final Remedial Action Report Entire Site[2]	TBD	EPA/NHDES
NPL Site Deletion Entire Site[2]	TBD	EPA

[1]As noted on page 3, the ROD requires the utilization of institutional controls to reduce risk to public health from consumption of groundwater at the Site. These institutional controls may include deed restrictions and zoning ordinances. EPA Region I is currently in the process of determining the actual scope of the institutional controls for the Site with NHDES and the Settling Parties.

[2]The Final Site Inspection and Final Close Out/Final Remedial Action Report are contingent on the Site meeting the clean up standards and being eligible for NPL site deletion. At such time when ground water cleanup levels have been achieved, including meeting risk based standards, EPA, with review and comment by NHDES, will provide approvals/certifications as required by the Consent Decree for OU 2. Modeling performed during the design indicated that the clean up time for the site is about 20 years from the start of pump and treat activities in OU 2.

V. SUMMARY OF REMEDIATION COSTS

The original cost estimate in the ROD was for the entire site consisting of a pump and treat remedy in two areas of the site utilizing air stripping and UV oxidation. The capital cost was $2.4 million. The annual operation costs were estimated at $1.4 million per year for a 30 year period; which resulted in a present worth of $13.1 million for a total present worth cost of $15.5 million.

Once the site was divided into two operable units the ROD costs were no longer applicable. In addition the predesign studies at OU 1 identified the presence of DNAPL which changed the remedy as described earlier in this report. The costs for OU 1 were estimated during the OU 1 design to be $6.335 million with an annual operating cost to be $170,000 for a total present worth estimated cost of $9.751 million. The actual construction costs (1998) of OU 1 were $5.17 million (contract award amount was $ 4.755 million). The current average annual operating cost is $450,000.

The capital cost (2004) for OU 2 was $1.661 million for the original design before modifications were made. The cost of the modifications, undertaken in 2005, including temporary and permanent surface water discharge, redevelopment of injection wells, metals filtration system, and repair of injection well 3, is $1.47 million. Therefore, the estimated total capital cost for OU 2 is $3.131 million. Annual costs are estimated at $507,000. The costs of engineering and contract management have not been included here.

VI. FIVE-YEAR REVIEW

Upon completion of this remedy, no hazardous substances will remain at the Site above levels that prevent unlimited use and unrestricted exposure. However, because this remedy will require greater than five years to achieve these levels, pursuant to CERCLA §121(c) and as provided in the current guidance on Five-Year Reviews (OSWER Directive 9355.7-03B-P, June 2001), EPA must conduct a policy five-year review. The first Five-Year Review Report for the Savage Municipal Water Supply Well Site is scheduled for 2011.

Susan Studlien, Director
Office of Site Remediation and Restoration

9-12-06
Date

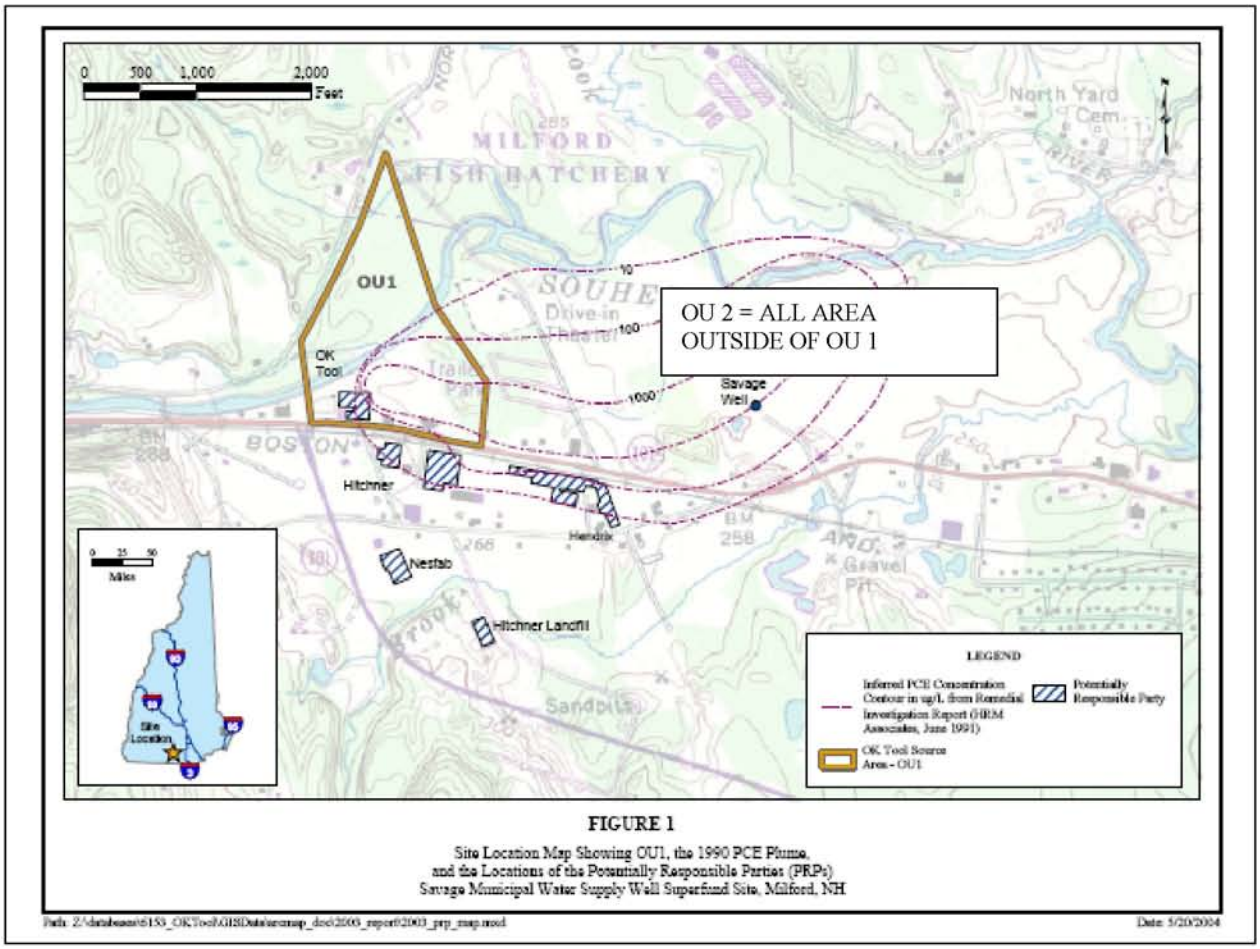

FIGURE 1

Site Location Map Showing OU1, the 1990 PCE Plume,
and the Locations of the Potentially Responsible Parties (PRPs)
Savage Municipal Water Supply Well Superfund Site, Milford, NH

Path: Z:\databases\6153_OKTool\GIS\Data\coverage_docs\2005_report\2003_prp_map.mxd Date: 5/20/2004