



OSWER 9283.1-31
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Ground Water Remedy Optimization Progress Report: 2006 - 2007

Office of Superfund Remediation and Technology Innovation

1.0. Introduction

1.1 Purpose

The purpose of this report is to provide a summary and analysis of progress toward implementation of optimization recommendations at Superfund-financed ground water pump and treat (P&T) sites. The report summarizes successful implementation strategies, opportunities for improvement, barriers to implementation, and changes in project costs as a result of optimization. The report also identifies sites requiring no further follow-up and discusses related initiatives underway at Headquarters and in the Regional offices.

The main body of the report is accompanied by an appendix containing a summary of optimization recommendations by Region and site name. Regions are encouraged to review the appendix to assess progress in their respective programs. This summary report generally represents progress on optimization recommendations that were implemented during calendar years 2006 and 2007 at 29 sites. The report contains updated information for 20 sites where implementation has continued since the last summary report, as well as nine sites subject to more recent reviews which are being reported for the first time. The name, location and review date for these sites are listed in *Exhibit 1*.

1.2 Project Background

The Office of Solid Waste and Emergency Response (OSWER) developed the pilot Fund-lead P&T optimization initiative as part of the *FY2000-FY2001 Superfund Reforms Strategy* (OSWER 9200.0-33; July 7, 2000). Optimization is intended to facilitate systematic review and modification of existing P&T systems to promote continuous improvement, and to enhance overall remedy and cost effectiveness. In the Superfund program, optimization evaluations should be accomplished using the Remediation System Evaluation (RSE) process, a tool developed by the U.S. Army Corps of Engineers.

The pilot phase of the optimization initiative demonstrated that this effort offers measurable benefits in the form of cost savings and improved remediation systems. In August 2004, the Office of Superfund Remediation and Technology Innovation (OSRTI) developed the *Action Plan for Ground Water Remedy Optimization* ("2004 Action Plan") (OSWER 9283.1- 25; August 25, 2004) to further implement important lessons learned from the pilot phase and fully integrate optimization into the Superfund cleanup process where appropriate. Among other things, the Action Plan envisions the development of routine progress reports concerning the implementation of recommended system changes.

1.3 Sites Subject to Optimization Reviews

There are fewer than 75 Superfund-financed P&T systems operating nationwide. To date, the Superfund program has conducted an optimization evaluation at 52 sites, nearly all from this universe of Fund-financed P&T systems.

The approach for selecting sites to receive an optimization review typically includes a review of annual operating costs, the age of the system, and concerns for remedy effectiveness or system efficiency. Ground water remedies with the highest annual operating costs likely offer the greatest opportunities for cost savings and increased efficiency. RSEs may also be appropriate for systems that have been operating for two to four years, in order to maximize early opportunities for improvements and cost savings.

Regardless of annual operating costs or the age of the system, an optimization review may be valuable at sites where there are concerns about the effectiveness of the remedy or the efficiency of the P&T system. An RSE may also help address recommendations in Five-Year Reviews that identify similar concerns.

1.4 Monitoring Implementation Progress

Each site that receives an optimization review is subject to follow-up, typically in the form of annual conference calls between OSRTI and the Region, for at least two years after the RSE report is finalized. These follow-up discussions highlight the status of recommended changes and obstacles to implementation that require additional attention. Continuous oversight of progress at RSE sites helps maximize the benefits of optimization, identify lessons learned, and provide technical assistance.

RSEs generate a number of suggestions, ideas, and recommendations which should be discussed and evaluated. Regions should weigh many factors including, but not limited to, technical feasibility, short-term implementation issues, long-term benefits, public and State acceptance, contractual requirements, effectiveness and availability of funding, when determining whether to implement optimization recommendations. Disagreements regarding the implementation of a particular recommendation are possible, and may be elevated to management for resolution.

If RPMs have questions regarding implementation of complex RSE recommendations, technical assistance is available from many sources, including Regional technical support staff, OSRTI staff and the RSE team, the EPA laboratories through the Technical Support Project, and the U.S. Army Corps of Engineers.

Exhibit 1. Sites subject to implementation monitoring in 2006 and/or 2007

EPA Region	State	Site Name	Fiscal Year of Review ^(a)	Reporting Status ^(b)
1	NH	Savage Municipal Water Supply	2001	updated
	MA	Groveland Wells	2002	updated
2	NY	Claremont Polychemical	2001	updated
	NY	Brewster Well Field	2002	updated
	NJ	Bog Creek Farm	2002	updated
	NJ	Higgins Farm	2003	updated
	NY	Circuitron Corp.	2004	updated
	NJ	Ellis Property	2006	new
	NY	GCL Tie & Treating	2006	new
3	PA	Havertown PCP	2003	updated
	VA	Greenwood Chemical Co.	2003	updated
4	NC	FCX, Inc. (Statesville Plant)	2000	updated
	SC	Elmore Waste Disposal	2000	updated
	NC	Cape Fear Wood Preserving	2004	updated
	FL	American Creosote Works, Inc. (Pensacola)	2006	new
5	WI	Oconomowoc Electroplating	2000	updated
	MI	Ott/Story/Cordova Chemical Co.	2001	updated
	IN	Douglas Road/Uniroyal, Inc., Landfill	2004	updated
	IN	Reilly Tar & Chemical Corp. (Indianapolis)	2004	updated
	MI	Peerless Plating Co. Inc.	2005	new
WI	Penta Wood Products	2006	new	
6	--	<i>No sites for this reporting period</i>	--	--
7	NE	Cleburn Street Well	2001	updated
	KS	57 th & North Broadway	2006	new
	KS	Ace Services	2007	new
8	CO	Central City, Clear Creek	2007	new
9	CA	Modesto Ground Water Contamination	2001	updated
10	WA	Boomsnub/Airco	2002	updated
	WA	Wyckoff Co./Eagle Harbor	2004	updated
	OR	Northwest Pipe & Casing	2007	new

(a) Date refers to date of review; RSE reports may be finalized months later, following multiple-party review. All RSE reports may be accessed online via <http://www.epa.gov/superfund/cleanup/postconstruction/optimize.htm>.

(b) *Updated* sites were included in previous progress reports; progress at *new* sites is being reported for the first time.

2.0 Summary of Implementation Progress

2.1 Overview

Each RSE results in an improved understanding of the operating P&T system and identified a number of opportunities for improvements in efficiency and effectiveness. The RSE reports specifically highlight recommendations in the following four categories:

- recommendations to improve remedy effectiveness,
- recommendations to reduce operating costs,
- recommendations for technical improvement, and
- recommendations to expedite site closure.

The annual follow-up discussions between OSRTI and the Remedial Project Manager (RPM) assess progress with the implementation of each recommendation contained in the RSE reports. *Exhibit 2* summarizes progress in each of the four categories of recommendations. The subsequent sections provide an analysis of implementation progress and highlights of site-specific progress. The data included in this report represents only the sites that are still subject to the follow-up process described above (all sites in *Exhibit 1*). Sites that completed the follow-up process, as documented in previous progress reports, are no longer included in the calculations.

Exhibit 2. Status of optimization recommendations

Types of Recommendations	Implementation Status					
	Implemented	In progress	Planned	Declined	Deferred to PRP/State	Under Consideration
Remedy Effectiveness (92 total)	73% (67)	12% (11)	5% (5)	4% (4)	1% (1)	4% (4)
Cost Reduction (112 total)	65% (73)	8% (9)	3.5% (4)	19% (21)	<1% (1)	3.5% (4)
Technical Improvement (89 total)	65% (58)	10% (9)	3% (3)	16% (14)	2% (2)	3% (3)
Site Closure (33 total)	45% (15)	18% (6)	9% (3)	9% (3)	6% (2)	12% (4)
Overall Progress (326 total)	65% (213)	11% (35)	4.5% (15)	13% (42)	2% (6)	4.5% (15)

Note: Numbers in parentheses represent actual number of recommendations, used to calculate rounded percentages.

RPMs have made positive efforts to address approximately 95% of all recommendations made to date; fewer than 5% of the RSE recommendations remain to be addressed. While the proportion of recommendations either *Declined* or *Deferred* to other parties has remained relatively consistent over time, there has been steady improvement in the percentage of recommendations moving from *Under consideration* to the *Implemented* or *In progress* categories.

2.2 Implementation of Remedy Effectiveness Recommendations

A thorough review of remedy effectiveness is a principal element of OSRTI's optimization initiative. Recommendations to improve effectiveness predominantly suggest more rigorous evaluation of the extraction and subsurface portions of the remedy rather than the above-ground treatment portion. The most common recommendations in this category generally relate to plume delineation, additional source area characterization, and improved data collection and/or reporting. More recent evaluations have increasingly identified issues related to institutional controls and vapor intrusion.

Nearly three-quarters (73%) of remedy effectiveness recommendations have been implemented and another 17% are in progress or planned for the near-term. The implementation of remedy effectiveness recommendations continues to be a high priority for RPMs; this category has consistently had the greatest proportion of recommendations implemented since national reporting began.

Highlight: Success with Remedy Effectiveness Recommendations

Ace Services Site (Colby, KS): The RSE recommended that the site team modify the method of evaluating the capture zone of the P&T system. Since the RSE, the site team has improved potentiometric surface maps by eliminating measurements from operating extraction wells, monitored concentration trends at downgradient locations, and conducted a flow budget analysis. All lines of evidence suggest complete capture of the contaminated plume.

57th and North Broadway Site (Wichita, KS): The RSE recommended that the site team pursue characterization of an additional source area utilizing direct push sampling techniques. The site team conducted three sampling events and successfully identified a new PCE source area. As a result, EPA is working with a newly identified PRP to implement a combined soil vapor extraction (SVE)/air sparging removal action within the next year. The site team was able to conduct the characterization work for less than half the estimated cost provided in the RSE report.

2.3 Implementation of Cost Reduction Recommendations

RSE recommendations pertaining to cost reduction may cover many aspects of system operation, including the selection of treatment technologies, operator and laboratory labor, and project management. A common recommendation for cost reduction typically calls for site managers to streamline ground water or process monitoring once a system is operating at steady-state.

RSEs continue to identify opportunities to reduce onsite labor without sacrificing remedy effectiveness. Such reductions may be expected following system shakedown or automation, when a remedy is operating at steady-state. Furthermore, some treatment components become inefficient or unnecessary as a result of changing site conditions, or due to conservative estimates during the design phase. Simplifying a treatment system under such conditions has resulted in cost savings associated with reduced material usage, utilities, and labor. More recent evaluations have increasingly recommended modifications to the extraction well network, such as reducing pumping rates or terminating pumping in select wells.

Approximately 65% of cost reduction recommendations were implemented during this reporting period. This demonstrates a significant improvement over the previous reporting period (53.5% implemented in 2005). Of the four categories of recommendations, the cost reduction category is characterized by the greatest percentage of recommendations declined; one common rationale for not pursuing a potential cost savings opportunity is State or local resistance to altering the method or location of discharging plant effluent.

While OSRTI and the States continue to report reduced operating costs and improved efficiencies, documenting precise cost savings and expenditures as a direct result of RSE implementation continues to pose a challenge. To maximize cost savings for EPA, it may be beneficial to implement recommendations that offer the greatest potential reduction in annual operating costs as early as possible during the LTRA phase.

Highlight: Success with Cost Reduction Recommendations

Boomsnub/Airco Site (Hazel Dell, WA): The RSE team recommended that the site team and responsible party consider at least partial reinjection of treated ground water at the site, to improve system effectiveness and reduce operating costs.

The site team first confirmed that reinjection would not spread the contaminated plume or otherwise degrade ground water quality. The site team then began to work with the responsible party to design and construct an infiltration gallery to accept treated water. The infiltration gallery will eliminate the fees associated with discharging to the local POTW. Operating costs have been reduced by \$350,000 per year (50%); over the life of the remedy, the new discharge scheme is expected to save \$3.5 million.

2.4 Implementation of Technical Improvement Recommendations

Technical improvement recommendations cover a wide range of items to improve overall site operations. As *Exhibit 2* demonstrates, nearly two-thirds (65%) of these recommendations have been fully implemented. RPMs continue to implement the majority of these recommendations shortly after the RSE site visit highlights the opportunity for improvement. These recommendations are generally easy to implement, require little up front funding, and are not typically contingent on other recommendations.

Examples of technical improvement recommendations include the following:

- Reconfigure components of the treatment train,
- Clean, repair or replace faulty equipment,
- Rehabilitate fouled extraction or injection wells,
- Improve or streamline data evaluation protocols, and
- Reformat O&M reports.

2.5 Implementation of Site Closure Recommendations

RSEs continue to identify opportunities to accelerate progress toward achieving final cleanup goals and eventual site closure. These recommendations most commonly involve developing a clear and comprehensive exit strategy and/or evaluating alternate remedial approaches. Developing an exit strategy typically involves confirming that clear and appropriate cleanup goals were established in the Record of Decision, then determining the specific data and criteria to be used to evaluate if goals are met such that some or all of the system can be shut down. If the intermediate goals and milestones are not met, RPMs should then consider alternatives to the current system. This may include alternate technologies to replace P&T, or to supplement it with more aggressive source removal.

Nearly half (45%) of recommendations associated with site closure have been implemented, which is a substantial improvement over the last progress report (at which time only 26% percent of these recommendations were complete). As demonstrated in previous progress reports, exit strategy recommendations are often considered after effectiveness and cost reduction recommendations are implemented. The use of a supplemental or alternative remedial approach may require funding that was not previously budgeted, revised contracts, and updated decision documents (e.g., an amended Record of Decision). For these reasons, the data continue to show a lower percentage of these recommendations implemented, and a larger percentage still under consideration.

Highlight: Success with Recommendations to Expedite Site Closure

Circuitron Site (East Farmingdale, NY): The RSE team recommended that a previously unidentified source area be identified and remediated in order to accelerate progress toward site closure. The RSE team suggested that air sparging and SVE would be more cost effective than other approaches that would require pilot testing (such as nutrient injection or chemical oxidation).

EPA's Environmental Response Team (ERT) provided support at the site, successfully identifying two storm drains that served as ongoing sources near the monitoring well with the highest contaminant concentrations. An in-well vapor stripping unit began operation in early 2008 and is expected to operate for approximately one year in order to reach cleanup goals. The ground water P&T system has been shutdown in the interim, to avoid interference with the source remedy.

2.6 Sites Requiring No Further Follow-Up

As shown in *Exhibit 2*, RPMs continue to demonstrate a commitment to the implementation of RSE recommendations. In fact, the optimization process is complete at a number of sites as a result of the successful implementation or thorough consideration of all RSE recommendations. OSRTI is no longer conducting annual follow-up discussions at these particular sites, though assistance is still available to site managers in the event that any optimization-related issues arise.

OSRTI has also completed the follow-up process for a number of sites where EPA is no longer responsible for operating or optimizing the P&T system. This includes sites where the State now has responsibility for operation and maintenance of the remedy, or where the P&T system is no longer operating. *Exhibit 3* highlights the 11 sites that completed the follow-up process in 2006 or 2007.

Exhibit 3. Sites requiring no further follow-up

Rationale	Site Name
Successful implementation and/or thorough consideration of all RSE recommendations	Bog Creek Farm Circuitron Corp. Claremont Polychemical Cleburn Street Well Elmore Waste Disposal Greenwood Chemical Co. Groveland Wells Penta Wood Products
Fund-lead Long-Term Response Action (LTRA) is complete	Brewster Well Field
P&T system is no longer operational	FCX, Inc. (Statesville Plant) Oconomowoc Electroplating

3.0 **Related Initiatives**

3.1 Long Term Monitoring Optimization

OSRTI continues to provide technical support and training on the topic of long-term monitoring optimization (LTMO) for ground water. Site-specific technical support has been provided to five regions and training on the theory and application of LTMO has occurred in nine Regions. Typically the scope of technical assistance involves compiling historical groundwater monitoring data and performing statistical and geostatistical analyses, using a variety of methods to determine if samples are being collected in the optimal locations (spatial analysis) and at the optimal frequencies (temporal analysis).

At most of the sites evaluated, increases and decreases in temporal and spatial sampling are recommended based on changing site conditions, changes in the plume dimensions, discovery of new source terms or high uncertainty areas, and changes to the regulatory requirements. Generally, RPMs have found the analyses very helpful in providing a thorough evaluation of the monitoring network in support of Five Year Reviews, negotiations with responsible parties, or to justify changes to the monitoring program. Additional technical support and completion of trainings in all ten Regions are anticipated through calendar year 2008.

3.2 Training

OSRTI developed a training course for site managers related to the optimization process and its many fiscal and environmental benefits. The training also provides an overview of the roles and responsibilities of RPMs, technical support staff and State project managers in all phases of optimization, from site selection to implementation of recommended system improvements. In 2006 and 2007, this training was delivered in five Regional offices, at each of the annual National Association of Remedial Project Managers (NARPM) training conferences, and at the 2006 Association of State and Territorial Solid Waste Management Officials (ASTSWMO) conference.

4.0 **Future Plans**

OSRTI expects to continue to fund independent, technical experts to conduct additional RSEs and streamlined RSE-Lites each year. OSRTI will continue to select sites for future reviews based on annual operating costs, the age of the system, and concerns for remedy effectiveness and system efficiency. Regions should contact OSRTI to recommend any sites that may benefit from an optimization review.

OSRTI will continue to utilize the existing process for follow-up discussions in order to monitor progress with the implementation of RSE recommendations. Follow-up will continue at all sites, with the exception of those identified in Section 2.6 of this report. RPMs may request technical assistance to aid in the implementation of system changes.

5.0 **References**

5.1 Internet Resources

OSRTI, Post-Construction Program Area

- Guidance for post-construction completion activities, with optimization project updates
- <http://www.epa.gov/superfund/cleanup/postconstruction/optimize.htm>

OSRTI, Hazardous Waste Clean-Up Information (CLU-IN) web site

- Site-specific RSE reports and recommendations
- <http://www.clu-in.org/optimization>

U.S. Army Corps of Engineers, Hazardous, Toxic and Radioactive Waste Center of Expertise

- RSE checklists and scope of work, provided by developers of the RSE tool
- http://www.environmental.usace.army.mil/lrm_rse.htm

Federal Remediation Technologies Roundtable

- Case studies, conference materials and more, compiled by an inter-agency workgroup
- <http://www.frtr.gov/optimization.htm>

5.2 Guidance and Fact Sheets

A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems (EPA 600-R-08-003; January 2008)

A Cost Comparison Framework for Use in Optimizing Ground Water Pump and Treat Systems (EPA 542-R-07-005; May 2007)

Optimization Strategies for Long-Term Ground Water Remedies (with Particular Emphasis on Pump and Treat Systems) (EPA 542-R-07-007; May 2007)

Options for Discharging Treated Water from Pump and Treat Systems (EPA 542-R-07-006; May 2007)

Effective Contracting Approaches for Operating Pump and Treat Systems (OSWER 9283.1-21FS / EPA 542-R-05-009; April 2005)

O&M Report Template for Ground Water Remedies (With Emphasis on Pump and Treat Systems) (OSWER 9283.1-22FS / EPA 542-R-05-010; April 2005)

Cost-Effective Design of Pump and Treat Systems (OSWER 9283.1-20FS / EPA 542-R-05-008; April 2005)

Action Plan for Ground Water Remedy Optimization (OSWER 9283.1-25; August 25, 2004)

Pilot Project to Optimize Superfund-financed Pump and Treat Systems: Summary Report and Lessons Learned (OSWER 9283.1-18; November 2002)

Elements for Effective Management of Operating Pump and Treat Systems (OSWER 9355.4-27FS-A; November 2002)

Implementation of RSE Recommendations: Technical Assistance Resources Available to RPMs (January 2002)

5.3 General Project Documentation

2005 Annual Progress Report for Ground Water Remedy Optimization (OSWER 9283.1-28; December 2006)

2004 Annual Progress Report for Ground Water Remedy Optimization (OSWER 9283.1-27; August 2005)

Groundwater Pump and Treat Systems: Summary of Selected Cost and Performance Information at Superfund-financed Sites (EPA 542-R-01-021a; December 2001)

Superfund Reform Strategy, Implementation Memorandum: Optimization of Fund-lead Ground Water Pump and Treat (P&T) Systems (OSWER 9283.1-13; October 31, 2000)