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2004 Annual Progress Report for Ground Water Remedy Optimization

Office of Superfund Remediation and Technology Innovation

1.0. Introduction

1.1 Purpose

The purpose of this Annual Report is to provide a summary and analysis of progress toward implementation of optimization recommendations at Superfund-financed 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 optimization reviews funded by the Regional program 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 Annual Report generally represents the status of optimization efforts in the Superfund program at the end of calendar year 2004. However, as noted in the appendix, the information for a few sites is current as of June, 2005.

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 has 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 an annual summary of progress concerning the implementation of recommended system changes.

1.3 Sites Subject to Optimization Reviews

There are currently fewer than 100 Superfund-financed P&T systems operating nationwide. To date, the Superfund program has conducted an optimization evaluation at 33 sites, most of which address this universe of Fund-financed P&T systems. The name, location and review date for these sites are listed in *Exhibit 1*.

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. The appendix to this report represents the status of optimization efforts in the Superfund program at the end of calendar year 2004, based on the results of the most recent round of follow-up discussions. Additional information provided by site managers is also used to supplement the appendix, particularly at sites for which several months passed between the last follow-up call and the development of this report.

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 where OSRTI pursued an optimization evaluation

EPA Region	State	Site Name	Fiscal Year of Review [a]
1	MA	Baird & McGuire	2001
	NH	Savage Municipal Water Supply	2001
	MA	Silresim Chemical Corp.	2001
	MA	Groveland Wells	2002
2	NY	Mattiace Petrochemical Co., Inc.	2001
	NY	Claremont Polychmical	2001
	NY	Brewster Well Field	2002
	NJ	Bog Creek Farm	2002
	NY	SMS Instruments, Inc.	2003
	NJ	Higgins Farm	2003
	NY	Circuitron Corp. [b]	2004
3	PA	Hellertown Manufacturing	2001
	PA	Raymark	2001
	PA	Havertown PCP	2003
	VA	Greenwood Chemical Co.	2003
4	NC	FCX, Inc. (Statesville Plant)	2000
	SC	Elmore Waste Disposal	2000
	NC	Cape Fear Wood Preserving [b]	2004
5	MN	MacGillis and Gibbs Co./Bell Lumber & Pole Co.	2000
	WI	Oconomowoc Electroplating	2000
	MI	Ott/Story/Cordova Chemical Co.	2001
	IN	Douglas Road/Uniroyal, Inc., Landfill	2004
	IN	Reilly Tar & Chemical Corp. (Indianapolis Plant)	2004
6	AR	Midland Products	2001
	LA	Bayou Bonfouca	2001
7	NE	Cleburn Street Well	2001
8	CO	Summitville Mine	2002
9	CA	Modesto Ground Water Contamination	2001
	CA	Selma Treating Co.	2002
10	WA	Commencement Bay, South Tacoma Channel (Well 12A)	2001
	OR	McCormick & Baxter	2001
	WA	Boomsnub/Airco	2002
	WA	Wyckoff Co./Eagle Harbor	2004

(a) Date refers to date of site visit; RSE reports are typically finalized several months later, following multiple-party review.

(b) Streamlined reviews ("RSE-Lites"), utilizing a conference call instead of a site visit. These sites were reviewed in August, 2004 and have not yet been subject to formal followup discussions.

2.0 Summary of Implementation Progress

2.1 Overview

Each of the RSEs resulted in an improved understanding of the operating P&T systems 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 a discussion of the most common recommendations, an analysis of implementation progress, and highlights of site-specific progress. RPMs have made positive efforts to address a total of 89% of all recommendations made to date; only 11% of the RSE recommendations remain to be addressed.

Exhibit 2. Status of optimization recommendations

Types of Recommendations	Implementation Status					
	Implemented	**In progress**	**Planned**	**Considered, then Declined**	**Deferred to PRP/State**	**Under Consideration**
Remedy Effectiveness (98 total)	56.1% (55)	14.3% (14)	14.3% (14)	8.2% (8)	2% (2)	5.1% (5)
Cost Reduction (108 total)	46.3% (50)	10.2% (11)	7.4% (8)	17.6% (19)	5.5% (6)	13% (14)
Technical Improvement (89 total)	57% (51)	16% (14)	3% (3)	9% (8)	6% (5)	9% (8)
Site Closure (38 total)	21% (8)	32% (12)	5% (2)	13% (5)	5% (2)	24% (9)
Other Recommendations (9 total)	67% (6)	--	--	22% (2)	--	11% (1)
Overall Progress (342 total)	50% (170)	15% (51)	8% (27)	12% (42)	4% (15)	11% (37)

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

2.2 Implementation of Remedy Effectiveness Recommendations

A principal element of any optimization evaluation should be a review of remedy effectiveness, defined for purposes of this effort as the ability of a remedy to meet its stated objectives, contain contaminated ground water, and eliminate exposure pathways to potential receptors. 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 characterization or sampling, and improved data collection and/or reporting.

Deficiencies with respect to plume delineation typically result in recommendations to conduct a capture zone analysis, develop updated plume maps, or initiate ground water flow or contaminant transport modeling. RPMs may install new monitoring wells or additional samples may be taken from existing wells. In order to investigate potential impacts from site contaminants, many RSEs result in recommendations to sample nearby surface water or sediments, or indoor air in nearby buildings.

Several RSEs identified deficiencies in routine site management reports, specifically insufficient information or analysis to adequately assess the effectiveness of the system. In some cases key data were not included in the report, and in other cases the reports were not being produced and/or reviewed in a timely manner.

Implementation of remedy effectiveness recommendations has helped confirm the effectiveness of some P&T systems and helped identify deficiencies in others. Approximately 56% of remedy effectiveness recommendations have been implemented and another 14% are in progress. The time required to consider or implement recommendations varies, and may be assessed by reviewing the detailed information in the appendix. RPMs have cited existing contract obligations and the programmatic budget cycle as rationale when delays have occurred in implementing these recommendations.

In response to these findings, OSRTI will continue to place a high priority on funding requests associated with optimization. The 2004 Action Plan outlined a process for Regions to formally request funding to implement RSE recommendations through the existing budget process. To further address RPM feedback on implementation, OSRTI also completed a fact sheet entitled “Effective Contracting Approaches for Operating Pump and Treat Systems” (OSWER 9283.1-21FS / EPA 542-R-05-009; April 2005), which provides helpful information on establishing flexible contracts with an appropriate scope and duration.

At some sites, further site characterization was conducted than was originally recommended in the RSE report with positive results (see highlight below for a site example). In general, these recommendations associated with further source-zone or plume delineation could benefit from OSRTI’s continuing effort to apply the Triad approach. Key Triad concepts include the use of systematic planning, dynamic work strategies, and real-time measurement tools. OSRTI will continue to encourage the use of the Triad through technical support (http://brownfieldstsc.org/request_support.cfm) and outreach (http://www.triadcentral.org).

The highlight below provides two examples of successful implementation of remedy effectiveness recommendations.

Highlights: Success with Remedy Effectiveness Recommendations

MacGillis & Gibbs Co. Site: The RSE report included recommendations to develop a target capture zone for the P&T system, then to evaluate whether the current system is achieving the intended capture. This effort would also serve to evaluate whether portions of the plume were being appropriately addressed through monitored natural attenuation (MNA).

Upon implementation of these recommendations, the site team determined that the current extraction well network was not providing adequate plume capture, and that conditions were not favorable for MNA. Two new extraction wells were installed and routine modeling now confirms plume capture. As a result of these optimization efforts, the site team is now confident that the P&T system is performing as intended and providing full protection of human health and the environment.

Elmore Waste Disposal Site: The RSE report included recommendations to install additional monitoring wells to define the extent of the contaminant plume and to perform a capture zone analysis to evaluate the adequacy of the ground water extraction network. These recommendations addressed uncertainty concerning the extent of the plume and the impact of the plume on a nearby creek.

The site team performed aquifer characterization and modeling, using data from newly installed monitoring wells and piezometers. Implementation costs were greater than anticipated because the site team installed 10 wells rather than the recommended 5 wells. However, the expanded effort provided information on a previously unknown source area. The team was able to use the additional data to determine that plume capture was highly dependent on the location of extraction wells with respect to fractures in the subsurface media. Based on the study, the extraction system was modified and now is routinely evaluated to ensure plume capture.

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. The most common recommendation for cost reduction typically calls for site managers to reduce or eliminate ground water or process monitoring that is no longer necessary once a system is operating at steady-state.

Some treatment components become inefficient or unnecessary as a result of changing site conditions or due to conservative estimates of influent contaminant concentrations in the design phase. By simplifying a treatment system and removing some components, reductions in material usage, utilities, and labor can often result. Implementing alternate discharge options for treated water may also result in cost savings.

A number of RSEs identified opportunities to reduce operator or onsite labor without sacrificing the effectiveness of the remedy. Such reductions should be expected following system shakedown, when a system is operating at steady-state. Additional cost savings may result from efforts to automate system operations (e.g., alarms, automatic shut-off, and on-call

operators). The implementation of other recommendations, such as removing treatment components and reducing monitoring, may also lead to reduced labor, materials, or utility costs.

Approximately 46% of cost-reduction recommendations have been implemented and 10% are in progress. Documenting cost savings and expenditures directly related to the RSE process has been challenging. In December 2004, an OSRTI analysis of costs available for 14 RSE sites concluded that nearly $1.2 million has been saved as a result of implementing RSE recommendations.[1]

Highlights: Success with Cost Reduction Recommendations

Wyckoff Co./Eagle Harbor Site: The RSE team recommended a simplified treatment system in order to reduce costs associated with upgrades and repairs, operator labor, and process monitoring. This effort would also assist the site team in designing a cost-effective treatment system to replace the aging system currently in operation.

The site team conducted a pilot test to treat effluent from the dissolved air flotation (DAF) unit with existing granular activated carbon (GAC) units, thereby bypassing the biological treatment phase of the current system. The pilot test was successful, and the site team expects to reduce operating costs by $30,000 per month ($360,000 per year). As a result, the biological treatment component has been excluded from the new treatment system design, resulting in a more cost-effective approach to long-term operation.

Ott/Story/Cordova Chemical Co.: The RSE report included recommendations to reduce aquifer and process monitoring and analysis. After discussions with the State, the recommendations were implemented. Process monitoring was reduced, and ground water monitoring was reduced for both water quality parameters and water elevations. Approximate cost savings total $250,000 per year ($150,000 annual savings in labor and support costs, and $100,000 annual savings in lab analysis).

MacGillis and Gibbs Site: The RSE report included a recommendation to reduce sampling and analysis of discharge points by combining the piping of multiple discharge points into a single discharge, and sampling the combined discharge less frequently and for fewer parameters.

After discussions with the Publicly Owned Treatment Works (POTW), an alternative was implemented with a similar effect. Analysis found contaminant levels well below POTW pre-treatment requirements. With local government acceptance, the permit was modified and the sampling frequency reduced. The project team also reduced sampling frequency within the treatment plant. Changes in performance monitoring and confirmation sampling resulted in total annual cost savings of approximately $98,000.

As a result of the implementation of cost reduction recommendations, both OSRTI and States have been able to realize cost savings and improved efficiencies associated with operating long-term P&T systems. Recommendations implemented earlier in the LTRA period tend to offer the greatest potential cost savings to both EPA and the States. Where implementation

[1] This figure represents gross savings, and does not take into account expenditures to implement RSE recommendations or increases in annual O&M costs.

occurs later, States may derive most of the benefits. 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.

The highlight above provides three examples of successful implementation of cost reduction recommendations.

2.4 Implementation of Technical Improvement Recommendations

Technical improvement recommendations cover a wide range of items to improve overall site operations. The RSE reports contain a total of 86 recommendations in this category. As *Exhibit 2* demonstrates, more than half of these recommendations have been fully implemented, and several are currently in progress. RPMs implemented the majority of these recommendations shortly after the RSE site visit highlighted opportunities for improvement. These types of recommendations are generally easy to implement, require little up front funding, and generally are not contingent on other recommendations. Examples of technical improvement recommendations include the following:

- Clean, repair or replace faulty equipment,
- Rehabilitate fouled extraction or injection wells,
- Improve or streamline data evaluation protocols,
- Reformat O&M reports, and
- Modify sampling protocols.

2.5 Implementation of Site Closure Recommendations

RSE reports typically contain recommendations 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.

An exit strategy usually details the specific steps for achieving closeout of the remedy or various components of the remedy. Developing an exit strategy typically involves establishing clear and valid cleanup goals, 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. An exit strategy generally involves setting milestones for the remedy and determining intermediate goals and metrics to measure progress. If the intermediate goals and milestones are not met, RPMs should then consider alternatives to the current system.

A number of RSEs include recommendations to consider alternate technologies to replace P&T, or to supplement it with more aggressive source removal. These recommendations are intended to address P&T systems that may take an exceptionally long time to meet established cleanup goals. Such recommendations are highly site-specific and may range from increased pumping in source areas to the potential use of chemical oxidation, air sparging, or *in situ* thermal remediation to address additional source material. The selection of a particular technology may depend on site hydrogeology, the nature and extent of contamination, the

proximity to receptors, and other factors. Implementation of these recommendations may require additional site characterization work or pilot treatability tests.

Approximately 21% of recommendations associated with site closure have been implemented and 32% are in progress. Exit strategy recommendations, while valuable in the long-term, often are considered after effectiveness and cost reduction recommendations are implemented. In addition, consideration of supplemental or alternative remedial technologies generally requires higher expenditures than what is expected for routine O&M, and may require changes to site decision documents (e.g., an amended Record of Decision). For these reasons, a lower percentage of these recommendations have been implemented, and many are in the planning stage.

The RSE teams recommended shutting down a P&T system in favor of monitored natural attenuation (MNA) or another remedial approach in very few instances. Two examples where site teams are pursuing such recommendations are the Midland Products site and the SMS Instruments site.

The highlight below provides an example of successful implementation of a supplemental technology for source removal that could allow earlier shutdown of the P&T system.

Highlight: Success with Recommendations to Expedite Site Closure

SMS Instruments Site: The RSE report included a recommendation to develop an exit strategy for this site in order to determine if or when the P&T system can be discontinued. The RSE team suggested a variety of approaches from discontinuing the P&T system to piloting an alternate technology (with appropriate monitoring for each approach).

The site team acted quickly to delineate residual contamination at the site and has implemented a strategy to aggressively remediate the area with a pilot air/bio sparging system. The site team expects this system to operate for only 4-6 months, reducing contaminant concentrations more rapidly than with the current P&T system alone. The State will take responsibility for operation and maintenance of the P&T system in 2005, and the pilot air/bio sparging effort is expected to significantly reduce the amount of time that the State will need to operate the P&T system.

2.6 Sites Requiring No Further Follow-Up

As shown in *Exhibit 2*, RPMs have made significant progress with 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. Included here are 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* provides a full list of sites (11 in total) that completed the follow-up process.

Exhibit 3. Sites requiring no further follow-up

Rationale	Site Name
Successful implementation and/or thorough consideration of all RSE recommendations	Hellertown Manufacturing MacGillis & Gibbs Co. Mattiace Petrochemical Co., Inc. Midland Products McCormick & Baxter Selma Treating Co. Silresim Chemical Corp. Summitville Mine
Long-Term Response Action (LTRA) is complete; State is now responsible for operation and maintenance (O&M)	Baird & McGuire Raymark Bayou Bonfouca

3.0 Related Initiatives

3.1 Region 3 "Regional Optimization Evaluation Team"

EPA Region 3, with assistance from OSRTI, is currently piloting a Regional-based optimization program referred to as the "Regional Optimization Evaluation (ROE) team." The team members include representatives from Regional management and technical staff, OSRTI staff, and a private contractor with optimization expertise. The ROE team is conducting streamlined optimization evaluations (reduced in cost and scope relative to a full optimization evaluations) at the Region's Fund-lead P&T sites, beginning with four reviews in 2004. Subsequent to the site reviews, the ROE team will undertake the following efforts:

- Develop a formal follow-up/tracking program to monitor progress at each site to receive an evaluation,
- Provide technical assistance based on requests of the RPMs and findings during follow-up, and
- Demonstrate a systematic approach to capture zone analysis at two sites.

3.2 Infrastructure Assessment of Water Treatment Plant

At the *Summitville Mine site* (Summitville, CO), EPA Region 8 and the site contractor applied infrastructure assessment software. Each component of the existing older treatment plant was reviewed to assure continued operation of the aging plant. Results of the software evaluation were also used to prioritize maintenance and make recommendations for capital equipment improvements or replacement.

3.3 Optimization Evaluations Led by Regions

In November 2004, a team comprised of two engineers and two geologists from EPA Region 2 and the Army Corps of Engineers conducted an RSE site visit at the *Mohonk Road Industrial Plant site* (High Falls, NY). The site was evaluated due to its expected long-term operation and overall cost. Recommendations outlined in the draft report include characterizing the potential for indoor air exposures, conducting additional source characterization, reducing the amount of reporting, salvaging an unused filter, using an alternative sampling method for some contaminants, upgrading the acid delivery system, eliminating the use of some treatment components, and automating the water level monitoring in wells. Although the RSE report is still in draft phase, a few of these modifications have already commenced at the site.

In July 2004, a representative from EPA's Environmental Response Team (ERT) visited the *Palmetto Wood Preserving Site* (Cayce, SC) to assess the current P&T system which had been shutdown based on an earlier ERT recommendation. The visit also intended to gather information for optimization of the system or evaluating MNA as a possible alternative. The RPM, system operators, and State representatives also participated in the effort.

4.0 Future Plans

OSRTI expects to fund independent, technical experts to conduct RSEs at 5-8 Fund-lead sites each year, depending on available resources. A streamlined evaluation (referred to as an "RSE-Lite") may be used at less complex sites in order to conserve resources. 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.

The "Action Plan for Ground Water Remedy Optimization" (OSWER 9283.1-25; August 2004) introduced a new strategy to pursue optimization reviews at the Regional level, not just through OSRTI efforts. Each Region should pursue an RSE at a minimum of one site each year, where suitable candidate sites exist. Contractual access to OSRTI's RSE experts may be made available to the Regions for this purpose, if needed.

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. This assistance may include a variety of efforts by the RSE team, such as an independent review of a work plan for implementing recommendations, an evaluation of the outcome of recommended changes, or justification of cost estimates provided in the RSE report.

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/action/postconstruction/index.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/library/guide/rsechk/rsechk.html

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

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

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)