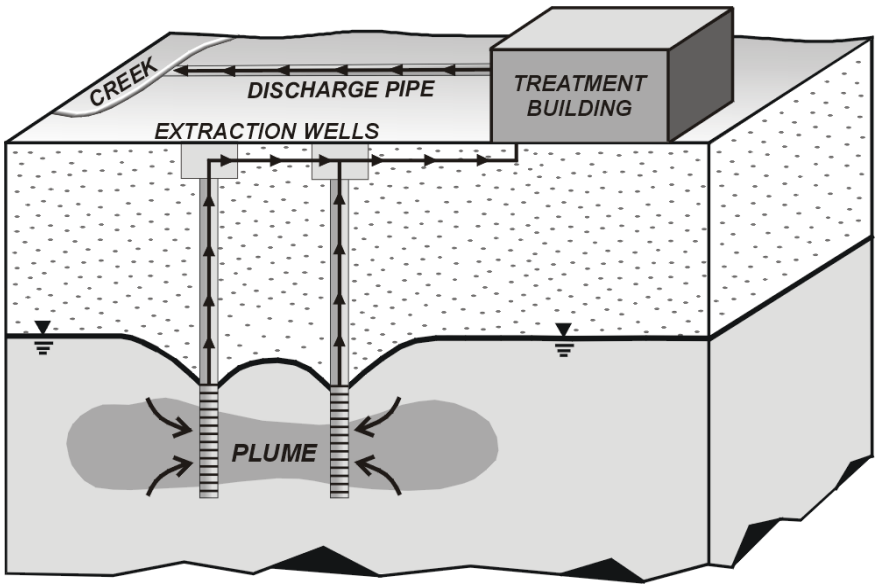
United States
Environmental Protection
Agency

Groundwater Pump and Treat Systems: Summary of Selected Cost and Performance Information at Superfund-financed Sites



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PREFACE

This report summarizes Phase 1 (the data collection phase) of the Nationwide Fund-lead Pump and Treat Optimization Project. This phase included contacting a project liaison for each of the EPA Regions, identifying the Fund-lead pump-and-treat (P&T) systems in each Region, collecting baseline information about each system through a web-based questionnaire or phone interview, and selecting a total of 20 Fund-lead systems to receive RSEs. Four of the 20 P&T systems (two in Region 4 and two in Region 5) were previously selected and evaluated as part of a demonstration project completed in 2000.

Data presented in this report reflect estimates provided by site Remedial Project Managers. These estimates may, in some cases, vary from actuality. In addition, the data—including the number, status, and costs of systems—may change over time.

ACKNOWLEDGMENTS

The project team is grateful for the help provided by the EPA Project Liaisons from each Region. They were vital in selecting the Fund-lead P&T systems to be evaluated and in facilitating communication between the project team and the Remedial Project Managers (RPMs). The authors also extend sincere thanks to the principal investigators from the U.S. EPA Technology Innovation Office (TIO) and U.S. EPA Office of Emergency and Remedial Response (OERR).

EXECUTIVE SUMMARY

This first phase of the Nationwide Fund-lead Pump and Treat Optimization Project successfully identified a total of 88 Fund-lead (EPA-lead and State-lead with Fund money) pump-and-treat (P&T) systems within the Superfund Program. Of the 88 systems identified, 67 are operational and 21 are pre-operational (i.e., the Records of Decisions for the pre-operational systems specify pump-and-treat, but these systems are in the design stage or some other stage prior to full operation). System identification was accomplished through use of online databases and discussions with project liaisons in each Region. The number of Fund-lead P&T systems in a Region ranged from zero in Region 8 to 22 in Region 2.

Remedial Project Managers (RPMs) of the identified systems submitted data and information on their systems through a web-based questionnaire. Phone interviews were utilized in a limited number of cases. A screening methodology using the collected data was applied to prioritize these systems with respect to potential life-cycle savings resulting from optimization. Based on this screening and discussions with the project liaison in each Region, specific systems in each Region were selected to receive Remediation System Evaluations (RSEs). The RSE process was developed by the United States Army Corps of Engineers (USACE) to evaluate a remediation system and provide recommendations to improve effectiveness and reduce costs. Including the demonstration optimization project conducted in 2000, a total of 20 Fund-lead P&T systems were selected to receive RSEs.

This report identifies the 88 Fund-lead P&T systems, summarizes the information submitted by the RPMs, and presents the screening and selection of those systems to receive RSEs.

Data presented in this report reflect estimates provided by site Remedial Project Managers. These estimates may, in some cases, vary from actuality. In addition, the data— including the number, status, and costs of systems—may change over time.

The following summaries result from the estimated cost data and system projections provided by the RPMs:

- The estimated average annual operation and maintenance (O&M) cost for a Fund-lead P&T system (based on those 79 systems providing cost data) is approximately $570,000 and the median cost is $350,000. The discrepancy between these two statistics is due to a small number of systems with relatively high O&M costs.

- Based on the 79 systems that provided cost information, the estimated total annual O&M cost for operating the Fund-lead P&T systems in 2002 is approximately $38 million, with EPA incurring approximately $32.5 million of the total annual cost and the associated States incurring the remaining $5.5 million.

- Based on the 79 systems that provided cost information, the estimated future cost for Long-term Remedial Action (LTRA) O&M for all of these systems exceeds $210 million with discounting (i.e., net present value)* and exceeds $270 million without discounting. LTRA refers to the first 10 years of operation of a groundwater or surface water restoration action. During this period,

*Net present value reflects the discounted or reduced cost of future expenditures due to interest gained between the present and the time of the expenditure. A discount rate of 5% is assumed. Please see Section 4.0 for more information on discounting and net present value as they apply to the presented costs.

EPA typically funds 90% of the cost and the associated State funds 10% of the costs. These percentages translate directly to the presented costs; therefore, the Superfund is expected to pay approximately $189 million ($243 million without discounting) and the States are expected to pay approximately $21 million ($27 million without discounting).

- Based on the 79 systems that provided cost information, the estimated future cost for O&M of Fund-lead P&T systems until remediation completion is achieved is approximately $470 million with discounting (net-present value) and $790 million without discounting. (These estimates of future O&M costs are based on the annual costs of systems and expected durations of systems as specified by the site managers. For some systems where expected system duration is unknown, a value of 30 years may have been used as a default value for this parameter. While the practice of using 30 years as a default was prevalent in the past, more recent EPA guidance on feasibility study preparation recommends that 30 years not be used as a default.)

- 13 of the 79 systems that provided costs account for approximately 50% of the total reported annual O&M costs.

A total of 26 States reportedly have Fund-lead P&T systems. Upon completion of the 10-year LTRA period each system will be transferred to its associated State and that State will assume 100% of the remaining O&M costs. For systems where restoration is not a goal (i.e., containment and water supply systems) the systems are typically transferred to the States after one year. The collected data suggest that the States will incur between approximately $250 million with discounting or $520 million without discounting in post-LTRA O&M costs for Fund-lead P&T systems that reported annual O&M costs. Furthermore, the data suggest that the following five States will likely incur 78% of these post-LTRA O&M costs:

- New Jersey (27.6%)

- Massachusetts (22.6%)

- New York (9.7%)

- Pennsylvania (9.6%)

- Michigan (8.4%)

In addition to cost information, the following statistics about the Fund-lead P&T systems were also gleaned from the information reported by the system RPMs:

- 40 of 67 operating systems are reported to be controlling plume migration.

- 60 of the 67 operating systems have groundwater restoration as a goal but 21 of that 60 do not have estimates of the progress toward that restoration. Of the 39 systems that have both groundwater restoration as a goal and an estimate of progress toward restoration, 7 are estimated to have made more than 80% progress toward restoration.

- 52 of the 88 systems have three or more primary contaminants of concern, and chlorinated solvents are the most prevalent contaminants as they are addressed by 56 of the 88 systems.

- 35 of the 88 Fund-lead P&T systems are associated with sites where non-aqueous phase liquid (NAPL) has either been observed or suspected.

- Carbon adsorption and air stripping are the most prevalent treatment processes (carbon adsorption is used at 50 of the 88 systems and air stripping is used at 41).

- Based on 64 of 88 systems where RPMs were able to determine costs specifically used for groundwater monitoring, Fund-lead P&T systems have, on average, 23 monitoring wells for groundwater sampling that are sampled three to four times per year for an average cost of $112,000 per year.

- 36 of the 67 operating systems have previously had performance and effectiveness evaluated and found "sufficient" while 7 had performance and effectiveness found "not sufficient" (the remaining systems are either being evaluated, have not been evaluated, or have not provided information regarding previous effectiveness evaluations).

Although the RSE selection process targeted systems in each Region that had effectiveness problems or relatively high operating costs, a number of systems with similar issues still remain, and additional RSEs are recommended to address these remaining systems.

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1.0 INTRODUCTION

1.1 BACKGROUND

As part of an overall commitment toward optimization, U.S. Environmental Protection Agency (EPA) Headquarters continually offers resources and support to the EPA Regions to improve their operating remedies. A large percentage of these remedies are pump-and-treat (P&T) systems designed to restore groundwater, contain contaminant sources, or supply water. Thus, the EPA Technology Innovation Office (TIO) and Office of Emergency and Remedial Response (OERR) have commissioned Remediation System Evaluations (RSEs) for Fund-lead P&T systems in each of the EPA Regions in an effort to optimize their performance.

The Remediation System Evaluation (RSE) concept was developed by the U.S. Army Corps of Engineers (USACE) to improve remedies already in place. An RSE begins with the formation of a team of experts including experienced engineers and hydrogeologists. Once a system has been selected for an RSE, the team reviews site-related documents, visits the site to tour the facility and interview the site managers, and compiles a report to document findings and any recommendations to improve the remedy. Recommendations typically fall into the following categories:

- recommendations to improve system effectiveness;
- recommendations to reduce operation and maintenance (O&M) costs;
- recommendations for technical improvement; and
- recommendations to gain site close out.

1.2 DEMONSTRATION FUND-LEAD PUMP AND TREAT OPTIMIZATION PROJECT

A demonstration optimization project of Fund-lead pump and treat systems conducted in Regions 4 and 5 identified a total of 28 planned or operating pump-and-treat (P&T) systems that are Fund-lead (or state-lead with Superfund financing). On average, those systems cost approximately $300,000 per year per site for operations and maintenance (O&M). Extrapolation of these results suggested that 140 such systems might exist through the nation at a total estimated O&M cost of $4 million per year. Many of these systems are anticipated to operate for decades with costs split between Superfund and the individual states. For the first 10 years of operation of most Fund-lead sites, the Superfund Program pays for 90% of the O&M costs and the State pays the remaining 10%. The State then assumes 100% of the costs incurred after the initial 10 year period.

In addition to identifying the Fund-lead P&T systems, the pilot optimization study also included Remediation System Evaluations (RSEs) of four P&T systems. These four evaluations resulted in a number of recommendations to improve effectiveness and/or reduce O&M costs for each of the systems. Thus, the results of this pilot study highlighted the benefits of optimizing Fund-lead systems.

1.3 NATIONWIDE FUND-LEAD PUMP AND TREAT OPTIMIZATION PROJECT

Based in part on the results of the demonstration project described above, *OSWER Directive No. 9200.0-33 (Transmittal of Final FY00 - FY01 Superfund Reforms Strategy, dated July 7,2000*)

http://www.epa.gov/superfund/programs/reforms/docs/strat00.pdf outlined a commitment to optimize the Fund-lead P&T systems. To achieve that goal, a Nationwide RSE Optimization Project was commissioned to accomplish the following tasks:

- identify the Fund-lead P&T systems in each of the EPA Regions;
- gather baseline data and information on these identified systems;
- prioritize the systems in terms of optimization potential;
- select 16 additional systems to receive RSEs;
- conduct these RSEs; and
- follow up with EPA project managers to track and facilitate implementation of resulting recommendations.

This report summarizes Phase 1 of this project, which entails the first four of these six elements.

2.0 SYSTEM IDENTIFICATION

The first step of the project involved determining the number of Fund-lead P&T systems in each EPA Region and identifying key aspects of those systems for assessing optimization potential. For this project, a Fund-lead P&T system must meet the following criteria:

- pump-and-treat (sometimes referred to as groundwater extraction and treatment) must be identified as a remedy in the Record of Decision (ROD) for the site;
- the system must be either EPA-lead or State-lead with funding from the Superfund Program; and
- the system must be operational or pre-operational (i.e., pre-design, design, being installed, or installed but not yet operating). It should be noted that, consistent with the first criteria, "pre-design" refers to systems that have RODs specifying pump and treat but that have not begun the design process.

Thus, this project does not include Fund-lead P&T systems that are no longer operating due to a change in remedy or Fund-lead P&T systems that have been fully transferred to States or responsible parties. In some cases, sites were identified where a P&T system will likely not be installed even though it is specified in the ROD. Such systems are included as Fund-lead P&T systems in this project unless the ROD already has been changed. In addition to systems not meeting the above criteria, Fund-lead well-head treatment systems in Region 9 and a Fund-lead NAPL (non-aqueous phase liquid) extraction system in Region 8 were not included in the project.

During the demonstration project in Region 4 and Region 5, it was initially hoped that the Fund-lead P&T systems could be easily identified by an on-line search of the Superfund Hazardous Waste Sites:

http://www.epa.gov/superfund/sites/query/advquery.htm

However, it was quickly determined that no set of search criteria would specifically yield the Fund-lead P&T systems. Therefore, an initial set of sites was developed with the following query:

Category	Entry	Display	Count
Site Name	"blank"	**T**	
State/Territory/EPA Region	Region 1 (example)	**T**	
Activity Type	Remedial Design Construction Completion Remedial Action		**T**
Activity Lead	EPA Fund-financed State, Fund-financed Tribal-lead, Fund-financed	**T**	
Contaminated Media	Groundwater		**T**
Site Listing Narrative		**T**	
Site Fact Sheet		**T**	
Site Cleanup Decision		**T**	

ROD abstracts for these sites were reviewed and those sites without existing or planned P&T systems were removed from the list.

During that process it became evident that isolating Fund-lead P&T systems was not straightforward. One complication is that the on-line databases are not completely up-to-date, and some systems that are Fund-lead at one point in time become "PRP-lead" once responsible parties are defined and/or consent decrees are put in place. As a result, the project liaisons for each Region were asked to identify the Fund-lead or Fund-financed P&T systems in their Regions, which they typically did by interviewing the branch chiefs and/or individual Remedial Project Managers (RPMs). The project liaisons were able to quickly remove sites from the initial list because there was no P&T system (existing or planned) or because the system was no longer Fund-lead. In some cases, the project liaisons also added systems that did not appear on the initial list. In rare cases the on-line databases identified Fund-lead P&T systems not identified by the EPA project liaison.

The identified systems are presented in table format in Section 4.0; however, the following table summarizes for each Region the number of operational and pre-operational (i.e., pre-design, design, being installed, or installed but not yet operating) Fund-lead P&T systems.

Table 2-1: Number of Identified Fund-lead P&T Systems in each Region

Region	# of Pre-operational Fund-lead P&T Systems	# of Operational Fund-lead P&T Systems	Total
Region 1	1	7	8
Region 2	4	18	22
Region 3	2	10	12
Region 4	3	7	10
Region 5	3	12	15
Region 6	3	6	9
Region 7	2	1	3
Region 8	0	0	0
Region 9	2	2	4
Region 10	1	4	5
Total	**21**	**67**	**88**

Presented data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of sites, may change over time.

Notes:

1. Fund-lead refers to systems where oversight is provided by the EPA or by a State with financial support from Superfund.
2. Pump-and-treat (P&T) systems are those systems in which the extraction of groundwater and subsequent treatment is specified in the Record of Decision (ROD). In this study, systems designed for water supply in Region 9 and a non-aqueous phase liquid (NAPL) extraction system in Region 8 were not included.
3. Pre-operational P&T systems refer to those systems that are pre-design, design, being installed, or installed but not yet operating. The systems must have RODs specifying P&T.
4. Operational P&T systems are those that currently are operating or have operated and are shutdown temporarily.
5. The demonstration project yielded 14 operational and 4 pre-operational P&T systems for Region 5. Information collected during the nationwide effort determined that site enforcement had changed for three sites in Region 5. The above chart reflects the updated information.

3.0 DATA COLLECTION

Once the Fund-lead P&T systems were identified, a web-based questionnaire, accessed from the EPA-TIO webpage, was completed for each system by the EPA or State project manager for the associated site. The questionnaire required responses to the following items or questions.

1. Site or system name, location, and CERCLIS number

2. Name and contact information of the individual that completed the questionnaire

3. Is the site Fund-lead (or State-lead and financed by Superfund) with a ROD and a P&T system that currently exists or is planned?
   Explanation: If the answer to this question is "no", then the system is no longer considered for this project.

4. EPA Remedial Project Manager (RPM) name and contact information

5. State Manager or Regulator name and contact information

6. Contractor name and contact information

7. Site lead or management (EPA/Fund-lead or State-lead financed by Superfund)

8. The date the Record of Decision (ROD) for the remedy was signed

9. The date of most recent ROD modification, if any

10. Type of ROD (for an interim remedy or for a final remedy)

11. Status of P&T system
    Explanation: One of the following responses could be selected:
    - pre-design
    - design
    - designed/not installed
    - being installed
    - installed
    - operational
    - completed

    It should be noted that a system classified as "pre-design" must have a ROD that specifies P&T. In addition, for the purposes of data analysis, "pre-operational" refers to those classifications in the above list that precede operational.

12. Primary goal of the P&T system
    Explanation: One of the following responses could be selected:
    - restoration
    - containment
    - both restoration and containment
    - water supply

13. Primary contaminants of concern

14. Presence or absence of contamination as a non-aqueous phase liquid (NAPL)

15. Approximate annual O&M costs
    Explanation: This is an approximate (i.e., plus or minus 25%) value of annual O&M costs ($/yr) including monitoring and analysis costs. Typical components of annual O&M costs include labor, electricity, materials, discharge fees, analytical costs, consulting costs, etc.

16. Portion of that cost used for monitoring
    Explanation: Of the approximate annual O&M cost ($/yr), this cost is the portion costs associated with long-term groundwater monitoring of the aquifer (labor associated with sample collection and data reduction, analytical costs, etc.). It should not include process monitoring of the above-ground treatment components, or monitoring associated with discharge of treated water.

17. An approximate representative pumping rate in gallons per minute (gpm)

18. Number of extraction wells (not including injection wells, drains, or trenches)

19. The date (month and year) when construction of the systems was completed

20. The date (month and year) when the system became operational and functional

21. The date (month and year) when the system is expected to be transitioned to the State
    Explanation: For Fund-lead remedies of surface or groundwater where restoration is the goal, EPA typically manages the site and funds 90% of the cost (versus 10% from the State) for the first 10 years after the site becomes operational and functional. This period is known as a Long-term Remedial Action (LTRA). After this 10-year period the site is fully transitioned to the State, and the State is responsible for site management and 100% of the funding.

22. The date (month and year) the remedial action is expected to be complete
    Explanation: This estimate for system shut-off date is subject to great uncertainty. An estimate of 30 years from the date the system became operational and functional is often used for financial reasons and may not represent operational projections. Other estimates may be taken directly from the Record of Decision (ROD), and given that a ROD is written before operation of a system, this estimate may not reflect operation data.

23. Approximate amount of system downtime per year
    Explanation: The estimated number of weeks per year that the system does not operate as anticipated.

24. Types of above-ground treatment processes

Explanation: This item includes above-ground treatment processes only. It does not include in-situ processes. One or more of the following processes could be selected.

metals precipitation	filtration
air stripping	ion exchange
biological treatment	reverse osmosis
UV oxidation	off-gas treatment
carbon adsorption	other/not sure

25. Number of groundwater monitoring wells regularly monitored

26. Frequency of groundwater monitoring (i.e., annually, semi-annually, quarterly, etc.)

27. Assessment of plume migration control

Explanation: Based on current information, if any portion of the plume is continuing to migrate beyond the current plume extent in a manner that is of concern, the answer is YES. If plume is migration is currently controlled, the answer is NO. If current information is not adequate to make this determination, the answer is DON'T KNOW. If plume migration beyond the current plume extent is not a concern, the answer is CONTROLLING PLUME MIGRATION IS NOT A GOAL OF THIS SYSTEM.

28. Progress toward cleanup

Explanation: The purpose of this item is to determine if the progress regarding plume restoration, in terms of plume area reduction, is known, and if so, how much progress in terms plume area reduction has been achieved. Note this question is not asking about mass removal, but instead is asking about plume area. One of the following descriptions could be chosen:

- A small portion (e.g., less than 20%) of the original plume area has been restored to required cleanup levels.
- A "significant" portion of the original plume area (e.g., more than about 20%) has been restored to required cleanup levels.
- Most of the original plume area (e.g., more than about 80%) has been restored to required cleanup levels.
- Don't know
- Aquifer restoration is not a goal of this system.

29. Result of previous (if any) evaluations of performance and effectiveness

Explanation: According to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP), a 5-year review must be conducted for all remedial actions that do not allow unlimited use and unrestricted exposure. The purpose of these reviews is to ensure that the remedies are protective of human health and the environment and therefore include a statement regarding the effectiveness and performance of the system. This item refers to 5-year reviews or other such evaluations but does not refer to the RSEs conducted as part of this project. One of three choices could be selected in response to this item:

- Performance/effectiveness has not been adequately evaluated.
- Performance/effectiveness has been evaluated, and is not sufficient.
- Performance/effectiveness is sufficient, further evaluation should be prioritized based on potential cost savings that maintain equivalent effectiveness.

30. Degree of difficulty (socially or politically) in implementing recommendations

Explanation: Answers to this item could range from "little difficulty expected for minor or major changes" to "severe difficulty expected for minor or major changes".

31. Other comments

In cases where RPMs had technical difficulty with the questionnaire, information was gathered via a phone interview with the RPM or the State project manager. In addition, phone interviews were used for this nationwide project to confirm or update the information gathered during the demonstration project from RPMs in Regions 4 and 5. Information sheets with the information and data for each system are provided as Appendix A. Summary information and data for each Region were provided in the form of Region-specific summary reports, which are included as Appendix B.

4.0 SUMMARIES OF COLLECTED DATA

A note on discounting (net present value) as it applies to the reported estimates of future costs

Because funds not spent at present can be invested a rate that exceeds inflation, current funds can yield additional money for future expenditures thereby making present-day dollars worth more than future dollars. As a result, future costs are often discounted and reported in net present value (NPV).

The net present value of a series of annual future costs with discounting in all but the first year is determined with the following relationship:

$$C_{NPV} = \sum_{i=1}^{n} \frac{c_A}{(1+D)^{i-1}}$$

where:

C_{NPV}	=	NPV of all of the annual costs incurred between the present and *n* years from the present
c_A	=	annual costs incurred each year between the present and *n* years from the present
D	=	discount rate (e.g., use 0.05 for 5%)

The actual discount rate (D) is a function of inflation, investment rates, and other opportunity costs associated with present and future value of money. Complications in calculating net-present value can include formulation of the discount rate with or without inflation, variation in the discount rate over time, and a change in annual costs over time. A full explanation of the discount rate is beyond the scope of this document. The reader is referred to the following references for a detailed explanation.

- Damodaran, Aswath, 1994. *Damodaran on Valuation*, John Wiley & Sons.
- Ross, Stephen A., Randolf W. Westerfield, and Bradford D. Jordan, 1995. *Fundamentals of Corporate Finance, 3rd edition*, Irwin Publishing.

For the future cost estimates discussed herein, a discount rate of 5% is applied and assumed constant.

4.1 SUMMARIES OF SYSTEM COSTS AND PROJECTIONS

Tables 4-1 through 4-9 present the following summary information for each Region (except Region 8, which had no Fund-lead P&T systems):

- the result of previous evaluations with respect to performance and effectiveness (see item 29 in Section 3.0);
- the estimated time remaining in the LTRA period (see item 21 in Section 3.0);
- the estimated time remaining until remediation is complete (see item 22 in Section 3.0);
- the annual O&M cost for each system (see item 15 in Section 3.0);
- the expected future cost (in net present value) to be incurred by Superfund for LTRA O&M;

- the expected future cost (in net present value) of O&M remaining to be incurred until remediation is complete; and

- the systems selected for RSEs in **bold**.

In these tables, net-present value is calculated with a 5% discount rate, with no discounting in the first year. Compiling information from Table 4-1 through Table 4-9 yields the following results regarding system O&M costs:

- The estimated average annual O&M cost of a system (based on the 79 systems providing cost data) is approximately $570,000 and the median is $350,000. This discrepancy is due to a small number of systems with relatively high O&M costs.

- The estimated total annual O&M cost for operating the Fund-lead P&T systems in 2002 is approximately $38 million, with EPA incurring approximately $32.5 million of the total annual cost and the associated States incurring the remaining $5.5 million.

- The estimated future cost for LTRA O&M at all of these systems exceeds $210 million with discounting (i.e., net present value) and exceeds $270 million without discounting. For each system, Superfund is expected to pay 90% of the O&M cost and the associated State is expected to pay 10%. These percentages translate directly to the presented costs; therefore, the Superfund is expected to pay approximately $189 million ($243 million without discounting) and the States are expected to pay $21 million ($27 million without discounting).

- The estimated future cost to reach remediation completion for all Fund-lead P&T systems is approximately $470 million with discounting (i.e., net present value) and $790 million without discounting. (These estimates of future O&M costs are based on the annual costs of systems and expected durations of systems as specified by the site managers. For some systems where expected system duration is unknown, a value of 30 years may have been used as a default value for this parameter. While the practice of using 30 years as a default was prevalent in the past, more recent EPA guidance on feasibility study preparation recommends that 30 years not be used as a default.)

4.2 Summary of Cost Data as it Pertains to the States

Assuming no viable parties are found for these 88 Fund-lead P&T systems, the States will eventually assume both management and funding responsibility for the systems. Figures 4-1 and 4-2 show projected trends of agency financial responsibility and annual costs from 2001 through 2015. These trends are best estimates based on the data provided by the site RPMs. Furthermore, because the actual O&M costs and site enforcement may change with time, these projected trends may also change.

Figure 4-1 shows two projected trends between 2001 and 2015 for 78 Fund-lead P&T systems (the 10 systems with unknown costs or transition dates are excluded). The first trend is the number of Fund-lead P&T systems funded 90% by EPA and 10% by the States. The second trend is the number of Fund-lead P&T systems that are the full responsibility of the States. When counting the number of systems for a particular year, if the system transfer from the EPA to the State occurs before July, then the system is counted as a State system. If the system transfer from EPA to the State occurs after July, then the system is counted as an EPA system.

Figure 4-2 also shows two trends between 2001 and 2015 for the same 78 systems. The first trend is the

total annual cost of Fund-lead P&T systems assumed by the EPA. This cost is 90% of the O&M costs of the Fund-lead P&T systems. The second trend is the total annual cost of Fund-lead systems assumed by the States. This cost is 10% of the O&M costs of Fund-lead P&T systems before transition to the State and 100% of the cost subsequent to the transition. When calculating the costs of systems for a particular year, if the system transfer from the EPA to the State occurs before July, then the State assumes the cost for that year. If the system transfer from EPA to the State occurs after July, then the EPA assumes the cost for that year.

Table 4-10 provides a list of the States that currently have operational or pre-operational Fund-lead P&T systems. It also provides the number of Fund-lead P&T systems in each State and the expected future costs (based on the estimates provided) each State is likely to incur from future O&M of these systems. These future costs are provided both with discounting (net present value) and without discounting. Discounted costs assume a 5% discount rate with no discounting in the first year. The expected future costs are calculated based on the following information:

- the current annual O&M estimates for each system (see item 15 in Section 3.0);
- the estimated date of transition to the State (see item 21 in Section 3.0); and
- the estimated date the remedy will be complete (see item 22 in Section 3.0).

An analysis of the data in Table 4-10 shows that a total of 26 States currently have operational or pre-operational Fund-lead P&T systems. The estimated total post-LTRA O&M costs expected to be incurred by all of the States ranges from approximately $250 million with discounting to $520 million without discounting. Approximately 78% of these costs, however, will be incurred by the following five the States:

- New Jersey (27.6%)
- Massachusetts (22.6%)
- New York (9.7%)
- Pennsylvania (9.6%)
- Michigan (8.4%)

It should be noted that the expected future costs to be incurred by the States are only estimates and are subject to variation. This variation may result from a number of reasons:

- the estimated annual O&M costs will likely change in the future;
- the estimated dates, especially the dates the remedies are expected to be complete, may vary significantly from the actual dates;
- the expected future costs do not include the cost of aquifer monitoring subsequent to remedy completion. Additional Fund-lead P&T systems may arise in the future and eventually be transitioned to the States; and
- the responsible parties at some of the current Fund-lead P&T systems may assume the financial burden for their systems.

The Fund-lead P&T systems in each Region and the associated costs are listed according to State in Table 4-11 through Table 4-19. For each system, the table provides the date of transition to the State, the estimated annual O&M cost, and the expected future O&M cost (with and without discounting) to be assumed by the State.

4.3 Status and Progress of the Fund-lead P&T Systems

The collected data can be used to categorize the 88 Fund-lead P&T systems according to their status and/or progress. The status may range from the "pre-design" to "operational" as described in item 11 of Section 3.0, and the progress of systems with restoration as a goal may range from less than 20% progress toward restoration to more than 80% progress toward restoration as described in item 28 in Section 3.0.

Figure 4-3 groups the 88 Fund-lead systems according to their status (i.e., pre-design, design, designed/not installed, being installed, installed but not operational, or operational). Of the 88 systems, 67 are operational systems. As shown in Figure 4-4, 60 of the 67 operating systems are reported to have groundwater restoration as a goal, but 21 of that 60 do not have estimates of the progress toward that restoration. Of the 39 systems that have both groundwater restoration as a goal and an estimate of progress toward restoration, 20 are estimated to have made less than 20% progress toward restoration and 7 are estimated to have made more than 80% progress toward restoration. The remaining 12 systems are estimated to have made between 20% and 80% progress toward restoration. Those systems that report less than 20% restoration have operated, on average, for approximately 4 years. Those systems that report 20% to 80% restoration have operated, on average, for approximately 6 years. Finally, those systems that report more than 80% restoration have operated, on average, for 7 years.

In addition to progress toward restoration, the submitted information (not shown in a figure) indicate that 40 of the 67 operating systems are reportedly controlling migration of the plume.

4.4 System Goals

The majority of the systems have aquifer restoration specified in the ROD as a remedy objective. During data collection for this project, the remedy goal was not ascertained for two systems. Of the remaining systems, one has public water supply as a goal (restoration may also be a goal) and seven have containment as the only goal. Aquifer restoration is the primary goal for 22 of the systems and 56 of the systems have both containment and restoration as primary goals.

4.5 Contaminants of Concern, Treatment Processes, and Monitoring

The collected data show that more than three contaminants of concern are identified for 52 of the 88 Fund-lead P&T systems. The prevalence of certain categories of contaminants, as identified by the system RPMs, are highlighted in Table 4-20. Chlorinated solvents such as tetrachlorethylene (PCE) represent the most prevalent contaminant category identified by RPMs with this contaminant category addressed by 56 of the 88 systems.

Non-aqueous phase liquids (NAPLs) (see item 14 in Section 3.0), if present in the subsurface, will act as continuing sources of some contaminants. The collected data indicate that 35 of the 88 Fund-lead P&T systems are associated with sites where NAPL has either been observed or is suspected. The collected data also indicate that 38 of the Fund-lead P&T systems are associated with sites where NAPL is not present. The presence of NAPL at sites for the remaining 15 systems is not known.

Many of the P&T systems use multiple treatment processes to remove these contaminants from the extracted water. Of the 88 systems, 32 are reported to have three or more treatment processes. Figure 4-5 shows the number of systems that use each of the 10 treatment processes (see item 24 in Section 3.0). Carbon adsorption and air stripping are the most prevalent treatment processes. These two statistics correlate with the prevalence of chlorinated solvents as identified contaminants of concern, because these two treatment processes are commonly used to address those contaminants.

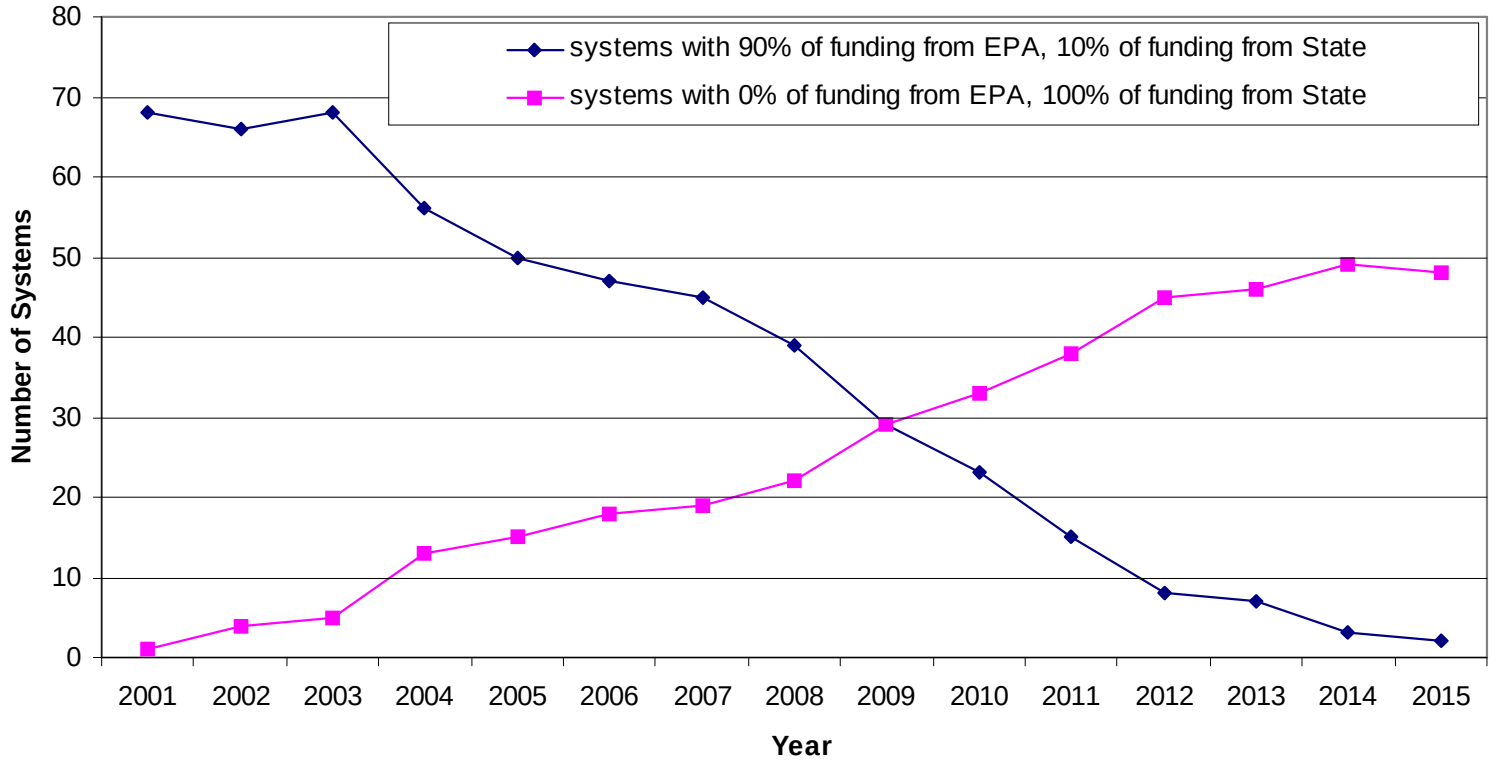
The collected data include the number of monitoring wells, the frequency of monitoring, and costs associated with monitoring (see items 25, 26, and 16 in Section 3.0). As identified in the collected data, the number of monitoring wells associated with a Fund-lead P&T system ranges from 3 to 80 with an average of approximately 23 wells per system (based on 79 of 88 systems where RPMs provided non-zero responses). The minimum sampling frequency (other than no sampling) is once per year whereas the maximum sampling frequency is once per week. On average, monitoring wells at the Fund-lead P&T systems are sampled between 3 and 4 times per year, and on average there are more than 80 samples of groundwater collected per Fund-lead P&T system in a year. As identified by the RPM, monitoring costs range from as little as $5,000 per year to as much as $800,000 per year with an average of approximately $112,000 per year (based on 64 of 88 systems where RPMs were able to determine costs specifically used for groundwater monitoring).

4.6 Summary of Previous Effectiveness Evaluations

According to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP), a 5-year review must be conducted for all remedial actions that do not allow unlimited use and unrestricted exposure. The purpose of these 5-year reviews is to ensure that the remedies are protective of human health and the environment. They therefore include a statement regarding the effectiveness and performance of the system. Tables 4-1 through 4-9 provide the results of 5-year reviews or other such evaluations, if they have been conducted, at each site. It should be emphasized that these are not the results of RSEs conducted as part of this project. They are the findings from 5-year reviews or similar evaluations that were conducted at these sites prior to this Nationwide Optimization Project and reported by the RPM as part of this survey. The following points summarize these results.

- 36 of the 67 operating systems are reported to have had performance and effectiveness evaluated and found to be sufficient;
- 7 of the 67 operating systems are reported to have had performance and effectiveness evaluated and found to be not sufficient;
- 22 of the 67 operating systems reportedly are either currently being evaluated or have not been evaluated with respect to effectiveness; and
- the evaluation status of two of the systems was not determined.

Figure 4-1: Trend of Financial Responsibility of Fund-lead P&T Systems

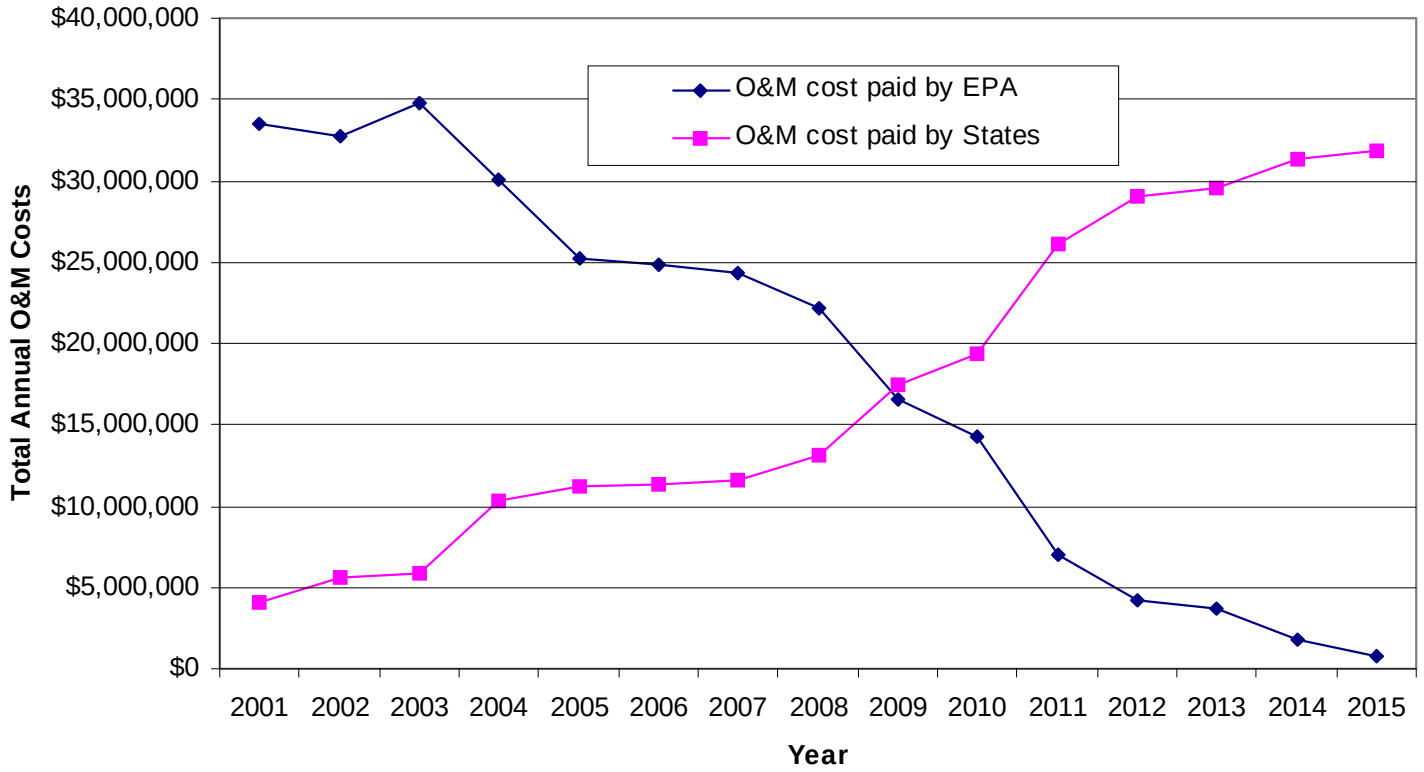


Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. This chart only shows the trends between 2001 and 2015. Existing systems and new systems are expected to operate beyond 2015.

Figure 4-2: Trend of Estimated Annual O&M Costs of Fund-lead P&T Systems

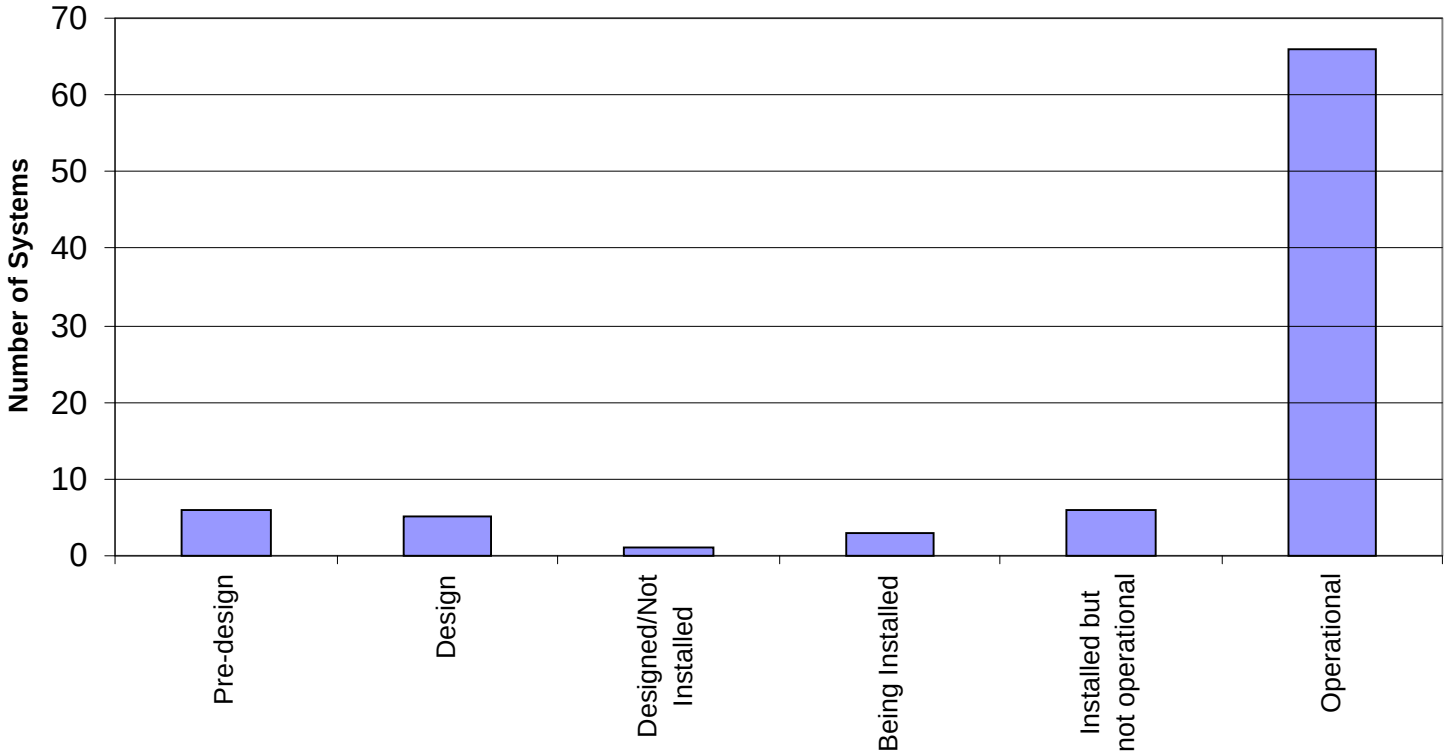


Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
3. This chart only shows the trends between 2001 and 2015. Existing systems and new systems are expected to operate beyond 2015.

Figure 4-3: Status of Fund-lead P&T Systems

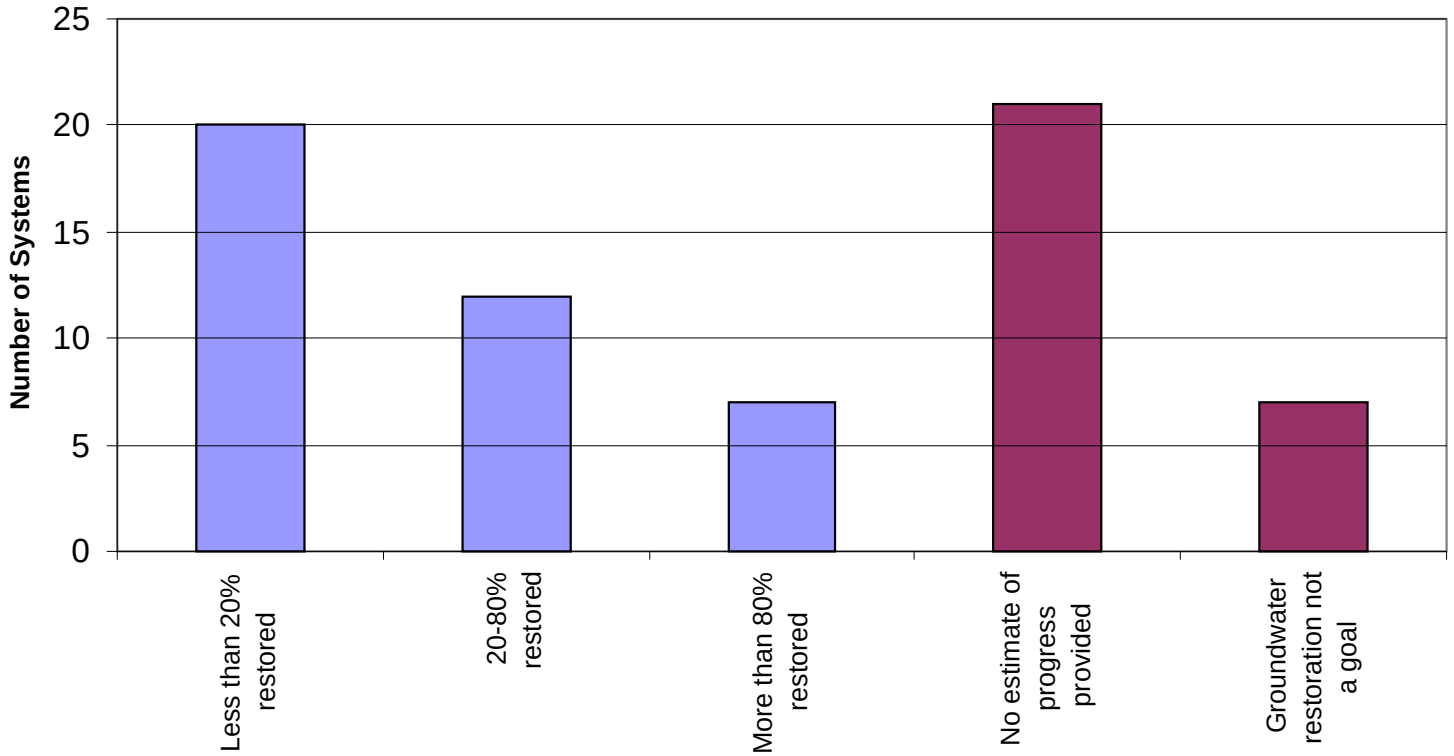


Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Pre-designed Fund-lead P&T systems refer to those systems that have P&T specified in the Record of Decision but are not yet in the design stage.

Figure 4-4: Progress of the 67 Operational Fund-lead P&T Systems

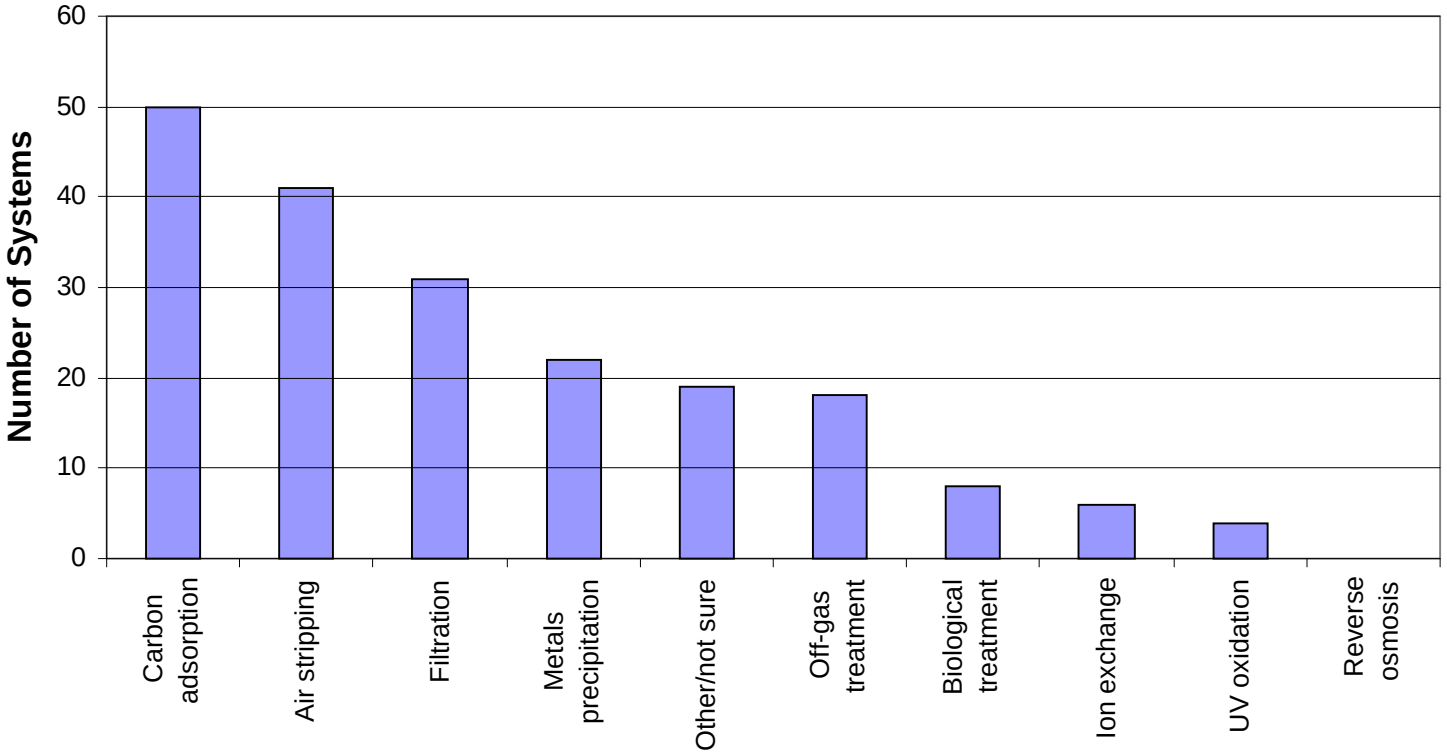


Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.

Figure 4-5: Distribution of Treatment Processes at Fund-lead P&T Systems



Data reflect information provided by site Remedial Project Managers between February and May 2001. This information—including the number of systems, system status, and types of treatment processes—may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Individual systems may have multiple treatment processes.
3. The treatment processes listed correspond to those shown in item 24 of Section 3.0.

Table 4-1: Region 1 Fund-lead P&T System Performance and Cost Information

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems						
Baird and McGuire	Sufficient	2.25	21.3	$3,500K	$7.6M	$47.5M
Charles George Landfill	Not Evaluated	7.7	26.7	$450K	$3.0M	$6.9M
Groveland Wells	Sufficient	9.3	29.3	$500K	$3.8M	$8.0M
Kearsarge Metallurgical	Sufficient	1.7	3.7	$250K	$0.4M	$0.9M
Keefe	Sufficient	1.7	1.7	$200K	$0.3M	$0.3M
Savage Well	Not Evaluated	7.2	7.2	$500K	$3.1M	$3.1M
Silresim Chemical	Not Sufficient	5.7	15.9	$1,400K	$7.1M	$15.9M
Pre-operational Systems						
Eastern Surplus	Not Evaluated	9.7	5.7	$200K	$1.0M	$1.0M
			Total	$7.0M	$26.3M	$83.6M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where pump and treat (groundwater extraction and treatment) is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results of previous evaluations such as the 5-year reviews and not from RSEs conducted as part of this project.
4. Long-term Remedial Action (LTRA): the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Reported annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are shown in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. For Eastern Surplus, collected data indicate that remedy completion is expected prior to the end of LTRA. Expected remaining costs for Superfund do not exceed the expected total remaining costs.

Table 4-2: Region 2 Fund-lead P&T System Performance and Cost Information (Page 1 of 3)

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems						
American Thermostat	Sufficient	6.8	26.7	$1,175K	$6.9M	$18.0M
Bog Creek	Sufficient	2.7	22.9	$460K	$1.2M	$6.5M
Brewster Well Field	Not Evaluated	5.8	5.8	$400K	$2.1M	$2.1M
Circuitron	Sufficient	8.4	1.4	$480K	$0.7M	$0.7M
Claremont Polychemical	Not Evaluated	8.1	18.1	$740K	$5.1M	$9.1M
Combe Fill South	Not Sufficient	6.7	26.7	$920K	$5.4M	$14.1M
Garden State Cleaners	Not Evaluated	7.8	27.8	$500K	$3.3M	$7.8M
Higgins Farm	Not Evaluated	7.0	26.7	$1,000K	$6.1M	$15.3M
Islip Municipal Landfill	Sufficient	4.7	1.0	$225K	$0.2M	$0.2M
Lang Property	Sufficient	3.75	2.75	$700K	$1.9M	$1.9M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where pump and treat (groundwater extraction and treatment) is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results of previous evaluations such as the 5-year reviews and not from RSEs conducted as part of this project.
4. Long-term Remedial Action (LTRA): the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Reported annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are shown in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. For Circuitron, Islip Municipal Landfill, Lang Property, and SMS Instruments, collected data indicate that remedy completion is expected prior to the end of LTRA. Expected remaining costs for Superfund do not exceed the expected total remaining costs.
9. The Army Corps of Engineers conducted an RSE of Lipari Landfill prior to this project.
10. The "Estimated Time Remaining in LTRA" exceeds 10 years for Lipari Landfill because this remedy is part of a source control action.

Table 4-2: Region 2 Fund-lead P&T System Performance and Cost Information (Page 2 of 3)

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems (continued)						
Lipari Landfill	Sufficient	17.8	2.9	$2,500K	$7.0M	$7.0M
Mattiace Petrochemical	Sufficient	7.2	27.6	$700K	$4.3M	$10.9M
Mohonk Road	Not Evaluated	9.5	29.5	Unknown	Unknown	Unknown
SMS Instruments	Sufficient	3.4	2.2	$400K	$1.3M	$0.8M
Syncon Resins	Not Sufficient	0.0	26.7	$350K	$0.0M	$5.4M
Vestal Water Supply	Sufficient	3.2	13.2	$180K	$0.5M	$1.8M
Vineland Chemical	Not Evaluated	9.4	29.4	$4,000K	$30.9M	$64.0M
Williams Property	Sufficient	0.0	0.0	$350K	$0.0M	$0.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where pump and treat (groundwater extraction and treatment) is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results of previous evaluations such as the 5-year reviews and not from RSEs conducted as part of this project.
4. Long-term Remedial Action (LTRA): the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Reported annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are shown in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. For Circuitron, Islip Municipal Landfill, Lang Property, and SMS Instruments, collected data indicate that remedy completion is expected prior to the end of LTRA. Expected remaining costs for Superfund do not exceed the expected total remaining costs.
9. The Army Corps of Engineers conducted an RSE of Lipari Landfill prior to this project.
10. The "Estimated Time Remaining in LTRA" exceeds 10 years for Lipari Landfill because this remedy is part of a source control action.

Table 4-2: Region 2 Fund-lead P&T System Performance and Cost Information (Page 3 of 3)

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Pre-operational Systems						
Dover Municipal Well 4	Not Evaluated	10.0	Unknown	Unknown	Unknown	Unknown
Metal TEC/Aerosystems	Not Evaluated	Unknown	Unknown	Unknown	Unknown	Unknown
Montgomery Township/Rocky Hill	Not Evaluated	10.0	30.0	$400K	$2.6M	$5.8M
Stanton Cleaners	Not Evaluated	9.7	19.7	$270K	$2.1M	$3.5M
			Total	>$17.5M	>$81.1M	>$174.9M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where pump and treat (groundwater extraction and treatment) is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results of previous evaluations such as the 5-year reviews and not from RSEs conducted as part of this project.
4. Long-term Remedial Action (LTRA): the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Reported annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are shown in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. For Circuitron, Islip Municipal Landfill, Lang Property, and SMS Instruments, collected data indicate that remedy completion is expected prior to the end of LTRA. Expected remaining costs for Superfund do not exceed the expected total remaining costs.
9. The Army Corps of Engineers conducted an RSE of Lipari Landfill prior to this project.
10. The "Estimated Time Remaining in LTRA" exceeds 10 years for Lipari Landfill because this remedy is part of a source control action.

Table 4-3: Region 3 Fund-lead P&T System Performance and Cost Information

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems						
AIW Frank	Sufficient	9.7	29.7	$180K	$1.4M	$2.9M
Berks Sand Pit	Sufficient	3.1	1.1	$150K	$0.2M	$0.2M
Butz Landfill	Not Evaluated	9.3	29.3	$250K	$1.9M	$4.0M
Croydon TCE	Sufficient	3.2	23.2	$200K	$0.6M	$2.8M
CryoChem	Sufficient	6.4	8.4	$125K	$0.7M	$0.9M
Greenwood Chemical	Not Evaluated	9.8	18.9	$400K	$3.2M	$5.1M
Hellertown Manufacturing	Not Sufficient	4.7	24.7	$350K	$1.5M	$5.1M
North Penn Area 1	Not Evaluated	6.7	16.7	$100K	$0.6M	$1.2M
Raymark	Not Evaluated	2.0	12.0	$156K	$0.3M	$1.4M
Saunders Supply	Not Evaluated	7.3	6.3	$80K	$0.4M	$0.4M
Pre-operational Systems						
Havertown PCP	Not Evaluated	10.0	31.0	$1,000K	$7.9M	$16.1M
North Penn Area 6	Not Evaluated	10.0	30.0	$592K	$4.0M	$8.7M
			Total	$3.6M	$22.7M	$48.8M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where pump and treat (groundwater extraction and treatment) is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results of previous evaluations such as the 5-year reviews and not from RSEs conducted as part of this project.
4. Long-term Remedial Action (LTRA): the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Reported annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are shown in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. For Berks Sand Pit and Saunders Supply, collected data indicate that remedy completion is expected prior to the end of LTRA. Expected remaining costs for Superfund do not exceed the expected total remaining costs.

Table 4-4: Region 4 Fund-lead P&T System Performance and Cost Information

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems						
ABC Cleaners	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
American Creosote Works (DNAPL)	Not Evaluated	1.3	1.3	$300K	$0.4M	$0.4M
Benfield Industries	Not Evaluated	9.3	19.3	$30K	$0.2M	$0.4M
Elmore Waste Disposal	Sufficient	6.7	16.7	$180K	$1.1M	$2.1M
FCX Statesville	Sufficient	6.3	6.3	$150K	$0.8M	$0.8M
Miami Drum	Unknown	0.7	Unknown	$1,000K	$0.7M	Unknown
Palmetto Wood	Sufficient	6.3	6.3	$300K	$1.7M	$1.7M
Pre-operational Systems						
American Creosote Works (solute)	Not Evaluated	10.0	5.0	$452K	$0.9M	$0.9M
Cape Fear Wood Preserving	Not Evaluated	9.8	7.3	$40K	$0.2M	$0.2M
Coleman Evans Wood Preserving	Not Evaluated	Unknown	Unknown	Unknown	Unknown	Unknown
			Total	>$2.5M	>$6.0M	$7.2M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where pump and treat (groundwater extraction and treatment) is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results of previous evaluations such as the 5-year reviews and not from RSEs conducted as part of this project.
4. Long-term Remedial Action (LTRA): the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Reported annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are shown in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. For American Creosote Works (solute) and Cape Fear Wood Preserving, collected data indicate that remedy completion is expected by the end of LTRA. Expected remaining costs for Superfund do not exceed the expected total remaining costs.
9. The sum of the "Total Expected Remaining Costs" includes the LTRA cost for Miami Drum as it is expected that O&M will continue beyond LTRA.

Table 4-5: Region 5 Fund-lead P&T System Performance and Cost Information (Page 1 of 2)

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems						
Arrowhead Refinery	Sufficient	1.5	2.2	$70K	$0.1M	$0.2M
Better Brite	Sufficient	4.4	28.3	$36K	$0.1M	$0.6M
Eau Claire	Sufficient	Unknown	Unknown	$175K	Unknown	Unknown
La Salle	Sufficient	2.2	3.2	$230K	$0.5M	$0.7M
Long Prairie	Not Evaluated	5.8	13.8	$300K	$1.5M	$3.1M
MacGillis & Gibbs	Not Evaluated	7.8	27.8	$300K	$2.0M	$4.7M
Oconomowoc	Sufficient	4.7	24.7	$471K	$2.0M	$6.9M
Onalaska	Sufficient	2.4	0.5	$200K	$0.1M	$0.1M
Ott/Story	Not Evaluated	8.6	28.6	$2,400K	$17.2M	$37.9M
U.S. Aviex	Sufficient	1.7	1.7	$300K	$0.5M	$0.5M
Verona Well Field	Not Evaluated	4.4	Indefinite	$225K	$0.9M	Indefinite
Wash King	Not Evaluated	9.3	19.3	$75K	$0.6M	$1.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual value. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where pump and treat (groundwater extraction and treatment) is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results of previous evaluations such as the 5-year reviews and not from RSEs conducted as part of this project.
4. Long-term Remedial Action (LTRA): the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Reported annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are shown in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. For Onalaska, collected data indicate that remedy completion is expected prior to the end of LTRA. Expected remaining costs for Superfund do not exceed the expected total remaining costs.
9. The sum of "Total Expected Remaining Cost" includes the LTRA cost for Verona Well Field as it is expected that O&M will continue at this system beyond LTRA.

Table 4-5: Region 5 Fund-lead P&T System Performance and Cost Information (Page 2 of 2)

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Pre-operational Systems						
Douglass Road	Not Evaluated	8.7	28.3	$120K	$0.9M	$1.9M
Duell and Gardner	Not Evaluated	9.5	5.5	Unknow	Unknown	Unknown
Peerless Plating	Sufficient	Unknown	Unknown	$400K	Unknown	Unknown
			Total	>$5.3M	>$26.4M	>$58.5M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where pump and treat (groundwater extraction and treatment) is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results of previous evaluations such as the 5-year reviews and not from RSEs conducted as part of this project.
4. Long-term Remedial Action (LTRA): the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Reported annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are shown in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. For Onalaska, collected data indicate that remedy completion is expected prior to the end of LTRA. Expected remaining costs for Superfund do not exceed the expected total remaining costs.
9. The sum of "Total Expected Remaining Cost" includes the LTRA cost for Verona Well Field as it is expected that O&M will continue at this system beyond LTRA.

Table 4-6: Region 6 Fund-lead P&T System Performance and Cost Information

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems						
American Creosote Works	Sufficient	25.1	25.1	$360K	$5.3M	$5.3M
Bayou Bonfouca	Sufficient	1.5	19.5	$402K	$0.6M	$5.1M
Cimarron Mining	Not Sufficient	2.8	Indefinite	$1,000K	$2.6M	Indefinite
Geneva Industries	Sufficient	2.0	2.0	$240K	$0.5M	$0.5M
Midland Products	Sufficient	2.0	32.0	$180K	$0.4M	$3.0M
Odessa Chromium #1	Sufficient	0.0	0.0	$500K	$0M	$0M
Pre-operational Systems						
City of Perryton Well #2	Not Evaluated	10.0	20.0	$37K	$0.2M	$0.4M
North Cavalcade	Not Evaluated	0.0	5.0	Unknown	Unknown	Unknown
Sprague Road	Not Evaluated	10.0	25.2	$1,200K	$7.8M	$15.8M
			Total	>$3.9M	>$17.4M	>$32.7M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results from previous evaluations such as 5-year reviews and not from RSEs conducted as part of this project.
4. LTRA refers to Long-term Remedial Action, the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are presented in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. The sum of "Total Expected Remaining Cost" includes the LTRA cost for Cimarron Mining as it is expected that O&M will continue at this system beyond LTRA.
9. The "Estimated Time Remaining in LTRA" exceeds 10 years for American Creosote Works because this remedy is part of a source control action.

Table 4-7: Region 7 Fund-lead P&T System Performance and Cost Information

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems						
Cleburn Street Well Site/OU2	Not Evaluated	7.9	17.9	$100K	$0.7M	$1.2M
Pre-operational Systems						
Ace Services	Not Evaluated	10.0	12.1	$500K	$3.2M	$3.8M
Valley Park TCE/OU2	Not Evaluated	0.0	10.0	Unknown	Unknown	Unknown
			Total	>$0.6M	>$3.9M	>$5.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results from previous evaluations such as 5-year reviews and not from RSEs conducted as part of this project.
4. LTRA refers to Long-term Remedial Action, the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are presented in net present value, calculated with a 5% discount rate with no discounting in the first year.

Table 4-8: Region 9 Fund-lead P&T System Performance and Cost Information

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems						
Newmark	Not Evaluated	6.8	26.8	$900K	$5.3M	$13.8M
Selma Treating Co.	Sufficient	6.8	6.8	$300K	$1.8M	$1.8M
Pre-operational Systems						
Modesto	Not Evaluated	10.0	20.0	$300K	$2.3M	$3.8M
Muscoy	Not Evaluated	10.0	20.0	$1,100K	$6.0M	$11.5M
			Total	$2.6M	$15.4M	$30.9M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results from previous evaluations such as 5-year reviews and not from RSEs conducted as part of this project.
4. LTRA refers to Long-term Remedial Action, the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are presented in net present value, calculated with a 5% discount rate with no discounting in the first year.

Table 4-9: Region 10 Fund-lead P&T System Performance and Cost Information

Site	Performance & Effectiveness	Estimated Remaining Time in LTRA (yrs)	Estimated Duration (yrs)	Annual O&M ($/yr)	Expected Remaining Cost for LTRA O&M	Expected Total Remaining O&M Cost
Operational Systems						
Boomsnub/Airco	Sufficient	9.9	28.8	$1,000K	$8.1M	$15.8M
Commencement Bay/ South Tacoma Channel, Well 12A	Not Sufficient	2.0	9.0	$300K	$0.6M	$2.2M
McCormick & Baxter	Sufficient	4.2	Indefinite	$250K	$1.0M	Indefinite
Wyckoff/Eagle Harbor	Not Sufficient	22.0	Indefinite	$500K	$6.9M	Indefinite
Pre-operational Systems						
Bunker Hill	Not Evaluated	10.0	30.0	Unknown	Unknown	Unknown
			Total	>$2.1M	>$16.6M	>$25.9M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems: systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Descriptions of "Performance and Effectiveness" refer to results from previous evaluations such as 5-year reviews and not from RSEs conducted as part of this project.
4. LTRA refers to Long-term Remedial Action, the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. "Estimated Time Remaining in LTRA" and "Expected Duration" are calculated by determining the number of years between January 1, 2002 and time frame estimates provided by the site Remedial Project Managers. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.
6. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
7. Expected costs are presented in net present value, calculated with a 5% discount rate with no discounting in the first year.
8. The sum of "Total Expected Remaining Cost" includes the LTRA costs for McCormick & Baxter and Wyckoff/Eagle Harbor as it is expected that O&M will continue at this system beyond LTRA.
9. The "Estimated Time Remaining in LTRA" exceeds 10 years for Wyckoff/Eagle Harbor because this remedy is part of a source control action.

Table 4-10: Future O&M Costs of Fund-lead P&T Systems Expected to be Incurred by each State after LTRA

State	Number of Systems	Total O&M Cost Expected to be Incurred by State after LTRA	
		NPV (Discount Rate of 5%)	No Discounting
Arkansas	1	$2.6M	$5.4M
California	4	$15.5M	$32.0M
Florida	4	Unknown	Unknown
Idaho	1	Unknown	Unknown
Illinois	1	$0.2M	$0.2M
Indiana	1	$1.0M	$2.4M
Kansas	1	$0.6M	$1.0M
Louisiana	2	$4.5M	$7.2M
Maine	1	$0.0M	$0.0M
Massachusetts	4	$56.8M	$99.6M
Michigan	6	> $21.1M	> $48.8M
Minnesota	3	$4.4M	$8.4M
Missouri	1	Unknown	Unknown
Nebraska	1	$0.5M	$1.0M
New Hampshire	3	$0.5M	$0.5M
New Jersey	12	$69.4M	$154.7M
New Mexico	1	Unknown	Unknown
New York	10	$24.4M	$49.6M
North Carolina	4	>$0.2M	>$0.3M
Oregon	1	Unknown	Unknown
Pennsylvania	10	$24.2M	$56.5M
South Carolina	2	$1.0M	$1.8M
Texas	5	> $8.2M	> $18.4M
Virginia	2	$1.9M	$3.6M
Washington	3	> $9.3M	> $21.0M
Wisconsin	4	> $5.4M	> $10.3M
Total	88	> $251.7M	> $522.7M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
3. "Total O&M Cost Expected to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
4. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL.

Table 4-11: Region 1 Fund-lead P&T System O&M Costs According to State

Site	Expected date of Transition	Annual O&M Cost ($/yr)	Expected Cost to be Incurred by State after LTRA	
			NPV (Discount Rate of 5%)	No Discounting
Maine				
Eastern Surplus	9/2011	$200K	$0.0M	$0.0M
Massachusetts				
Baird and McGuire	4/2004	$3,500K	$39.9M	$66.5M
Charles George Landfill	9/2009	$450K	$3.9M	$8.6M
Groveland Wells	4/2011	$500K	$4.2M	$10.0M
Silresim Chemical	9/2007	$1,400K	$8.8M	$14.4M
New Hampshire				
Kearsarge Metallurgical	9/2003	$250K	$0.5M	$0.5M
Keefe	9/2003	$200K	$0.0M	$0.0M
Savage Well	3/2009	$500K	$0.0M	$0.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
4. "Expected Cost to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. For systems where site Remedial Project Managers estimated remedy completion earlier than the end of LTRA, expected costs after LTRA appear as $0.0M.
6. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, total future cost estimates for some sites could be underestimated.

Table 4-12: Region 2 Fund-lead P&T System O&M Costs According to State

Site	Expected date of Transition	Annual O&M Cost ($/yr)	Expected Cost to be Incurred by State after LTRA	
			NPV (Discount Rate of 5%)	No Discounting
New Jersey				
Bog Creek	9/2004	$460K	$5.3M	$9.3M
Combe Fill South	9/2008	$920K	$8.7M	$18.4M
Dover Municipal Well 4	Unknown	Unknown	$0.0M	$0.0M
Garden State Cleaners	10/2009	$500K	$4.5M	$10.0M
Higgins Farm	1/2009	$1,000K	$9.2M	$19.7M
Lang Property	10/2005	$700K	$0.0M	$0.0M
Lipari Landfill	10/2019	$2,500K	$0.0M	$0.0M
Metal TEC/Aerosystems	Unknown	Unknown	$0.0M	$0.0M
Montgomery Township/Rocky Hill	9/2013	$400K	$3.2M	$8.0M
Syncon Resins	4/2001	$350K	$5.4M	$9.3M
Vineland Chemical	6/2011	$4,000K	$33.1M	$80.0M
Williams Property	6/2001	$350K	$0.0M	$0.0M
New York				
American Thermostat	10/2008	$1,175K	$11.1M	$23.4M
Brewster Well Field	10/2007	$400K	$0.0M	$0.0M
Circuitron	6/2010	$480K	$0.0M	$0.0M
Claremont Polychemical	2/2010	$740K	$4.0M	$7.4M
Islip Municipal Landfill	9/2006	$225K	$0.0M	$0.0M
Mattiace Petrochemical	3/2009	$700K	$6.6M	$14.3M
Mohonk Road	7/2011	Unknown	$0.0M	$0.0M
SMS Instruments	6/2005	$400K	$0.0M	$0.0M
Stanton Cleaners	9/2011	$270K	$1.4M	$2.7M
Vestal Water Supply	3/2005	$180K	$1.3M	$1.8M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
4. "Expected Cost to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. For systems where site Remedial Project Managers estimated remedy completion earlier than the end of LTRA, expected costs after LTRA appear as $0.0M.
6. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, total future cost estimates for some sites could be underestimated.

Table 4-13: Region 3 Fund-lead P&T System O&M Costs According to State

Site	Expected date of Transition	Annual O&M Cost ($/yr)	Expected Cost to be Incurred by State after LTRA	
			NPV (Discount Rate of 5%)	No Discounting
Pennsylvania				
AIW Frank	9/2011	$180K	$1.5M	$3.6M
Berks Sand Pit	2/2005	$150K	$0.0M	$0.0M
Butz Landfill	4/2011	$250K	$2.1M	$5.0M
Croydon TCE	3/2005	$200K	$2.2M	$4.0M
CryoChem	6/2008	$125K	$0.2M	$0.3M
Hellertown Manufacturing	9/2006	$350K	$3.6M	$7.0M
North Penn Area 1	9/2008	$100K	$0.6M	$1.0M
Raymark	1/2004	$156K	$1.1M	$1.6M
Havertown PCP	4/2012	$1,000K	$8.2M	$21.0M
North Penn Area 6	6/2013	$592K	$4.7M	$11.9M
Virginia				
Greenwood Chemical	11/2011	$400K	$1.9M	$3.6M
Saunders Supply	5/2009	$80K	$0.0M	$0.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
4. "Expected Cost to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. For systems where site Remedial Project Managers estimated remedy completion earlier than the end of LTRA, expected costs after LTRA appear as $0.0M.
6. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, total future cost estimates for some sites could be underestimated.

Table 4-14: Region 4 Fund-lead P&T System O&M Costs According to State

Site	Expected date of Transition	Annual O&M Cost ($/yr)	Expected Cost to be Incurred by State after LTRA	
			NPV (Discount Rate of 5%)	No Discounting
Florida				
American Creosote Works (DNAPL)	5/2003	$300K	$0.0M	$0.0M
American Creosote Works (solute)	9/2014	$452K	$0.0M	$0.0M
Coleman Evans Wood Preserving	Unknown	Unknown	Unknown	Unknown
Miami Drum	9/2002	$1,000K	Unknown	Unknown
North Carolina				
ABC Cleaners	Unknown	Unknown	Unknown	Unknown
Benfield Industries	5/2011	$30K	$0.2M	$0.3M
Cape Fear Wood Preserving	10/2011	$40K	$0.0M	$0.0M
FCX Statesville	5/2008	$150K	$0.0M	$0.0M
South Carolina				
Elmore Waste Disposal	9/2008	$180K	$1.0M	$1.8M
Palmetto Wood	5/2008	$300K	$0.0M	$0.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
4. "Expected Cost to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. For systems where site Remedial Project Managers estimated remedy completion earlier than the end of LTRA, expected costs after LTRA appear as $0.0M.
6. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, total future cost estimates for some sites could be underestimated.

Table 4-15: Region 5 Fund-lead P&T System O&M Costs According to State

Site	Expected date of Transition	Annual O&M Cost ($/yr)	Expected Cost to be Incurred by State after LTRA	
			NPV (Discount Rate of 5%)	No Discounting
Illinois				
La Salle	3/2004	$230K	$0.2M	$0.2M
Indiana				
Douglass Road	9/2010	$120K	$1.0M	$2.4M
Michigan				
Duell and Gardner	7/2011	Unknown	Unknown	$0.0M
Ott/Story	8/2010	$2,400K	$20.7M	$48.0M
Peerless Plating	Unknown	$400K	Unknown	$0.0M
U.S. Aviex	9/2003	$300K	$0.0M	$0.0M
Verona	6/2006	$225K	Unknown	Unknown
Wash King	4/2011	$75K	$0.4M	$0.8M
Minnesota				
Arrowhead Refinery	7/2003	$70K	$0.1M	$0.1M
Long Prairie	10/2007	$300K	$1.6M	$2.4M
MacGillis & Gibbs	10/2009	$300K	$2.7M	$6.0M
Wisconsin				
Better Brite	6/2006	$36K	$0.5M	$0.9M
Eau Claire	Unknown	$175K	Unknown	Unknown
Oconomowoc	9/2006	$471K	$4.9M	$9.4M
Onalaska	6/2004	$200K	$0.0M	$0.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
4. "Expected Cost to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. For systems where site Remedial Project Managers estimated remedy completion earlier than the end of LTRA, expected costs after LTRA appear as $0.0M.
6. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, total future cost estimates for some sites could be underestimated.

Table 4-16: Region 6 Fund-lead P&T System O&M Costs According to State

Site	Expected date of Transition	Annual O&M Cost ($/yr)	Expected Cost to be Incurred by State after LTRA	
			NPV (Discount Rate of 5%)	No Discounting
Arkansas				
Midland Products	1/2004	$180K	$2.6M	$5.4M
Louisiana				
American Creosote Works	2/2027	$360K	$0.0M	$0.0M
Bayou Bonfouca	7/2003	$402K	$4.5M	$7.2M
New Mexico				
Cimarron Mining	10/2004	$1,000K	Unknown	Unknown
Texas				
City of Perryton Well #2	8/2013	$37K	$0.2M	$0.4M
Geneva Industries	1/2004	$240K	$0.0M	$0.0M
North Cavalcade	12/2005	Unknown	Unknown	Unknown
Odessa Chromium #1	12/2001	$500K	$0.0M	$0.0M
Sprague Road	9/2013	$1,200K	$8.0M	$18.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
4. "Expected Cost to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. For systems where site Remedial Project Managers estimated remedy completion earlier than the end of LTRA, expected costs after LTRA appear as $0.0M.
6. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, total future cost estimates for some sites could be underestimated.

Table 4-17: Region 7 Fund-lead P&T System O&M Costs According to State

Site	Expected date of Transition	Annual O&M Cost ($/yr)	Expected Cost to be Incurred by State after LTRA	
			NPV (Discount Rate of 5%)	No Discounting
Kansas				
Ace Services	9/2013	$500K	$0.6M	$1.0M
Missouri				
Valley Park TCE/OU2	1/2006	Unknown	Unknown	Unknown
Nebraska				
Cleburn Street Well Site/OU2	12/2009	$100K	$0.5M	$1.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
4. "Expected Cost to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. For systems where site Remedial Project Managers estimated remedy completion earlier than the end of LTRA, expected costs after LTRA appear as $0.0M.
6. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, total future cost estimates for some sites could be underestimated.

Table 4-18: Region 9 Fund-lead P&T System O&M Costs According to State

Site	Expected date of Transition	Annual O&M Cost ($/yr)	Expected Cost to be Incurred by State after LTRA	
			NPV (Discount Rate of 5%)	No Discounting
California				
Modesto	5/2012	$300K	$1.5M	$3.0M
Muscoy	10/2014	$1,100K	$5.5M	$11.0M
Newmark	10/2008	$900K	$8.5M	$18.0M
Selma Treating Co.	10/2008	$300K	$0.0M	$0.0M

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
4. "Expected Cost to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. For systems where site Remedial Project Managers estimated remedy completion earlier than the end of LTRA, expected costs after LTRA appear as $0.0M.
6. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, total future cost estimates for some sites could be underestimated.

Table 4-19: Region 10 Fund-lead P&T System O&M Costs According to State

Site	Expected date of Transition	Annual O&M Cost ($/yr)	Expected Cost to be Incurred by State after LTRA	
			NPV (Discount Rate of 5%)	No Discounting
Idaho				
Bunker Hill	12/2030	Unknown	Unknown	Unknown
Oregon				
McCormick & Baxter	3/2006	$250K	Unknown	Unknown
Washington				
Boomsnub/Airco	12/2011	$1,000K	$7.7M	$18.9M
Commencement Bay/South Tacoma Channel, Well 12A	1/2004	$300K	$1.6M	$2.1M
Wyckoff/Eagle Harbor	1/2024	$500K	Unknown	Unknown

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Systems that appear in bold were selected for Remediation System Evaluations (RSEs).
3. Annual O&M costs are estimates and include such components as labor, utilities, materials, analytical costs, etc.
4. "Expected Cost to be Incurred by State" refers to those costs incurred by the State after the Long-term Remedial Action (LTRA). LTRA is the first 10 years of operation and function of a Superfund restoration action for surface or groundwater. Operation and maintenance costs of the remedy are 90% funded by Superfund and 10% funded by the associated State during this time period. Thereafter, 100% of the costs are assumed by the States.
5. For systems where site Remedial Project Managers estimated remedy completion earlier than the end of LTRA, expected costs after LTRA appear as $0.0M.
6. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, total future cost estimates for some sites could be underestimated.

Table 4-20: Categories of Contaminants Prevalent at Sites with Fund-lead P&T Systems

Contaminant Category	Number of Systems that Address that Contaminant Category
Chlorinated solvents and degradation products: • tetrachloroethylene (PCE) • trichloroethylene (TCE) • dichloroethlyene (DCE) • trichloroethane (TCA) • dichloroethane (DCA) • methylene chloride • vinyl chloride	56 of 88 systems
BTEX (one or more of the following): • benzene • toluene • ethylbenze • xylene	19 of 88 systems
Metals • Arsenic • Cadmium • Chromium • other metals	22 of 88 systems
Polyaromatic hydrocarbons (PAHs): • anthracene • benzo(a)pyrene • benzo(k)fluoranthene • fluoranthene • napthalene • other PAHs	17 of 88 systems

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actuality. Data, including the number and status of systems and contaminants of concern, may change over time.

Notes:

1. Fund-lead P&T systems are those systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Individual systems may address more than one contaminant.
3. Presented data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates, including the number and status of systems and contaminants of concern, may change over time.

5.0 SYSTEM SCREENING AND PRIORITIZATION WITH RESPECT TO OPTIMIZATION POTENTIAL

A simple spreadsheet screening process was developed and implemented by the project team for assessing the optimization potential of each Fund-lead P&T system. The screening process consists of the following steps:

- calculate the "Baseline Present Value ($)" of the system by multiplying the annual cost by the estimated system duration, and including a discount rate (5%) to account for the future value of money;
- assume that a typical RSE will save 20% of the annual cost of the system;
- determine site-specific "Estimated Potential Reduction in Life-cycle Costs (%)" from an RSE by adjusting the assumed 20% savings according to site-specific factors that increase or decrease the likelihood that savings will be identified by the RSE process; and
- determine "Estimated Potential Life-cycle Savings ($)" from an RSE by multiplying the "Baseline Present Value ($)" by the "Estimated Potential Reduction in Life Cycle Costs (%)", and subtracting the approximate cost of a RSE evaluation ($25,000).

The factors that were used to calculate the site-specific "Estimated Potential Reduction in Life-cycle Costs (%)" (starting from the assumed 20% value) are listed in Table 5-1. The base savings value of 20%, and the subsequent adjustment factors, were determined by consensus of the project team based on the assumption that, on average, all systems can benefit from optimization and more complex systems would have greater opportunity for improvement. For each item, a "blank" response was allowed, and did not impact the calculations. A positive adjustment was made to "Estimated Potential Reduction in Life-cycle Costs (%)" for items that would increase the optimization potential (e.g., many wells, high pumping rate, many above-ground treatment processes), and a negative adjustment was made to "Estimated Potential Reduction in Life-cycle Costs (%)" for items that would decrease the optimization potential (e.g., few pumping wells, short system duration). The "Estimated Potential Reduction in Life-cycle Costs (%)" was not allowed to be less than 5%, and not allowed to be greater than 45%. The purpose of this step was to identify systems with the highest potential for cost reduction and those most likely to benefit from optimization. All potential cost savings are estimates and are intended to be used primarily for prioritizing systems.

Summaries of the screening calculations are included in the screening summary reports for each Region, which are provided as Appendix B. The actual screening calculations for each system are presented in Appendix C. Note that these calculation are all based on estimates provided by the RPMs, and in some cases the "Estimated Potential Savings ($)" is negative, indicating that the estimated potential savings from an RSE are not anticipated to offset the cost of the RSE itself.

Table 5-1: Site-Specific Criteria Used to Calculate the "Estimated Potential Life-cycle Savings (%)" from Optimization of each of the Identified Fund-lead P&T Systems (Page 1 of 2)

Result of performance and effectiveness evaluation (item 29, Section 3.0)

+0.0%	default for blank value
+2.5%	performance & effectiveness not evaluated
+5.0%	performance & effectiveness evaluated and found not sufficient
-2.5%	performance & effectiveness evaluated and found sufficient

Number of pumping wells (item 18, Section 3.0)

+0.0%	default for blank value
+0.0%	no wells (e.g., drains, etc.)
-5.0%	1 to 2 wells
-2.5%	3 to 4 wells
+0.0%	5 to 9 wells
+2.5%	10 or more wells

Pumping rate (item 17, Section 3.0)

+0.0%	default for blank value
-5.0%	<10 gpm
-2.5%	10 to 99.99 gpm
+0.0%	100 to 500 gpm
+2.5%	>500 gpm

Down time per year (item 23, Section 3.0)

+0.0%	default for blank value
+0.0%	<2 wks
+2.5%	2.00 - 3.99 wks
+5.0%	4 wks or more

Number of above-ground treatment processes (item 24, Section 3.0)

+0.0%	default for blank value
-2.5%	0 or 1 processes
+0.0%	2 processes
+2.5%	3 processes
+5.0%	4 processes

Groundwater monitoring (number wells × events per year)
(items 25-26, Section 3.0)

+0.0%	default for blank value
-2.5%	<25
+0.0%	25 to 49
+2.5%	50 to 74
+5.0%	>75

Expected duration (item 22, Section 3.0)

+0.0%	default for blank value
-20.0%	<2 yrs
-15.0%	2.00 - 4.99yrs
-5.0%	5.00 - 9.99 yrs
-2.5%	10.00 - 19.99 yrs
+0.0%	20 yrs or more

Table 5-1: Site-Specific Criteria Used to Calculate the "Estimated Potential Life-cycle Savings (%)" from Optimization of each of the Identified Fund-lead P&T Systems (Page 1 of 2)

Difficulty in making minor changes to system due to political/social factors (item 30, Section 3.0)

-5.0%	default for blank value
-10.0%	severe difficulty expected
-5.0%	moderate difficulty expected
+0.0%	little difficulty expected

6.0 SYSTEM SELECTION

The intent of the project was to select two operational Fund-lead P&T systems in each Region to receive RSEs. However, the site-identification process demonstrated that Region 7 had only one operational Fund-lead P&T system and Region 8 had none. As a result, these extra three RSEs were allocated to other Regions.

The selection of systems was based on satisfying most of the following factors:

- system is operating (required)
- Region agreed system is suitable for optimization (required)
- system effectiveness is questioned or found not sufficient
- system has high potential for life-cycle cost-savings ($), based on the screening calculations, relative to other systems
- no major problems identified for potentially implementing RSE recommendations
- RPM request for involvement

For a variety of reasons, including recent optimization or litigation, some of the systems with the highest potential for life-cycle savings in a Region were not selected for RSEs. Narratives describing the system selection for each Region are included the Regional summary screening reports included in Appendix B. Table 6-1 lists for each Region the systems selected to receive RSEs and the "Estimated Potential Savings ($)" from system optimization.

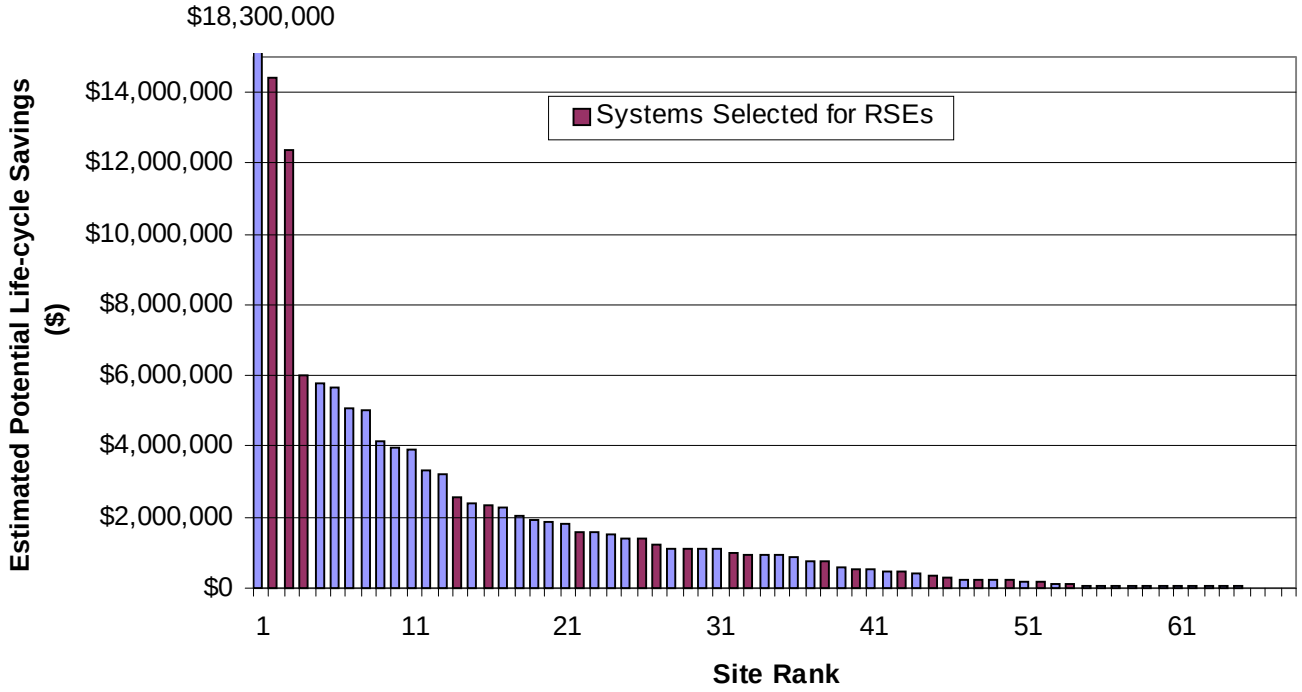
Table 6-2 ranks each Fund-lead P&T system according to "Estimated Potential Life-cycle Savings ($)" as calculated by the screening methodology. In addition, the systems that were selected for RSEs appear in **bold**. A graphical representation of this table is presented in Figure 6-1. Three of the top four ranked systems were selected for RSEs. Out of 20 total RSEs, 14 of them were allocated to a system that is ranked in the top 44 systems (top 50%). Summing the "Estimated Potential Life-cycle Savings ($)" of the systems selected for RSEs, the screening methodology suggests a total potential savings of approximately $48 million. The methodology also suggests approximately $134 million could be saved if RSEs are conducted at all 68 of the systems that indicate a positive "Estimated Potential Life-cycle Savings ($)".

Because the screening methodology is sensitive to the estimated duration of the P&T systems and this estimated duration could vary significantly from actuality, it is of significant interest to rank the systems according to estimated annual O&M costs. This ranking is provided in Table 6-3 and shown graphically in Figure 6-2. Figure 6-2 also shows the cumulative contribution of the systems to the total annual cost. It appears that 13 of the systems account for over 50% of the annual O&M costs of all systems combined. Regarding these thirteen systems, the following issues should be noted:

- three are selected to receive RSEs;
- one has previously received an RSE (by USACE);

- one has recently received an outside optimization evaluation;
- three are pre-operational and were therefore not selected to receive RSEs; and
- the remaining five were deemed inappropriate by the Regions for outside evaluations.

Figure 6-1: Fund-lead P&T Systems Ranked by "Estimated Potential Life-cycle Savings ($)"

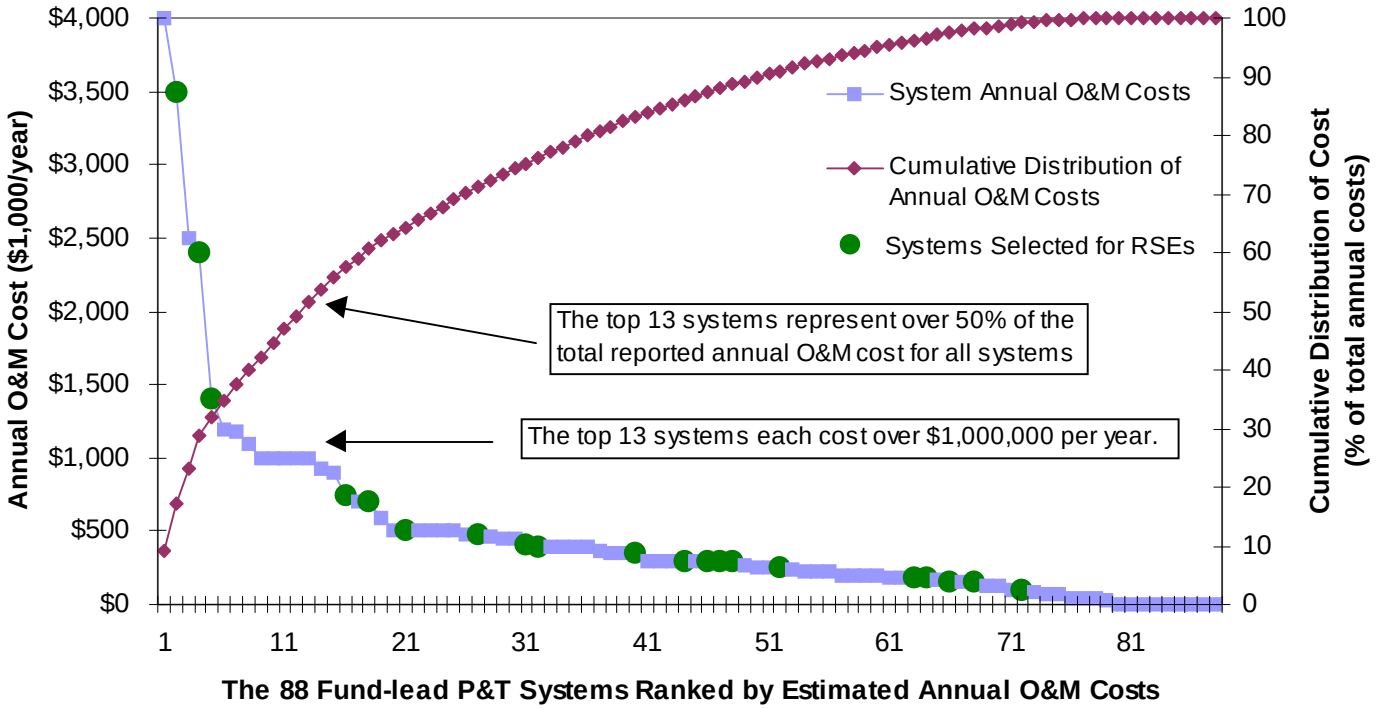


Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. "Estimated Potential Life-cycle Savings ($)" is calculated based on the screening methodology summarized in Section 5.0 and Table 5-1. The screening calculations for each system are presented in Appendix C and summarized in Appendix B.
3. Values are shown for the 68 systems with positive "Estimated Potential Life-cycle Savings ($)" . This parameter was less than zero for 12 systems and could not be calculated for 8 systems because of incomplete cost data.
4. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, life-cycle costs and life-cycle cost savings could be underestimated for some sites.
5. Cost information was reported for 79 of the 88 Fund-lead P&T systems. Costs for the remaining 9 systems are shown as $0 in this figure.

Figure 6-2: Fund-lead P&T Systems Ranked by Annual O&M Cost and the Cumulative Distribution of System Annual O&M Costs



Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Annual operation and maintenance (O&M) costs are estimates and include such items as labor, utilities, materials, analytical work, etc.
3. Cost information was reported for 79 of the 88 Fund-lead P&T systems. Costs for the remaining 9 systems are shown as $0 in this figure.

Table 6-1: For each Region Systems Selected for RSEs and the "Estimated Potential Life-cycle Savings ($)" Suggested by Screening Analysis

Region	Number of Systems Selected	Estimated Potential Life-cycle Savings ($)**
Region 1	Baird and McGuire	$12,402,549
	Savage Municipal Water Supply Well	$934,042
	Silresim Chemical Corp.	$6,025,600
Region 2	Claremont Polychemical	$2,578,700
	Mattiace Petrochemical	$2,357,411
	Brewster Well Field	$317,513
Region 3	Hellertown Manufacturing	$979,619
	Raymark	$216,640
Region 4	Elmore Waste Disposal (RSE demonstration project)	$375,872
	FCX Statesville (RSE demonstration project)	$134,513
Region 5	MacGillis and Gibbs (RSE demonstration project)	$1,399,624
	Oconomowoc Electroplating (RSE demonstration project)	$1,590,721
	Ott/Story	$14,418,502
Region 6	Bayou Bonfouca	$1,233,790
	Midland Products	$528,408
Region 7	Cleburn St. Well	$179,042
Region 8	—	—
Region 9	Modesto	$730,227
	Selma Pressure Treating	$261,332
Region 10	Commencement Bay/South Tacoma Channel, Well 12A	$465,677
	McCormick and Baxter	$1,127,934

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. "Estimated Potential Life-cycle Savings ($)" is calculated based on the screening methodology summarized in Section 5.0 and Table 5-1. The screening calculations for each system are presented in Appendix C and summarized in Appendix B.
3. Modesto is classified as a pre-operational system; however, it will have changed status and have operated for two months prior to the RSE visit.

Table 6-2: Fund-lead P&T Systems Ranked in Terms of "Estimated Potential Life-cycle Savings ($)" as Calculated by the Screening Methodology (Page 1 of 4)

Rank	Site name	Region	Estimated Potential Reduction in Life-cycle Costs	Estimated Potential Life-cycle Savings ($)
1	Vineland Chemical Co.	2	30.0%	$18,266,000
2	**Ott/Story/Cordova Chem Co.**	**5**	**40.0%**	**$14,419,000**
3	**Baird & McGuire Superfund Site**	**1**	**27.5%**	**$12,403,000**
4	**Silresim Chemical Corp.**	**1**	**40.0%**	**$6,026,000**
5	Higgins Farm	2	40.0%	$5,799,000
6	Sprague Road Ground Water Plume	6	32.5%	$5,653,000
7	Combe Fill South Landfill	2	38.0%	$5,065,000
8	American Thermostat	2	29.5%	$5,022,000
9	Boomsnub/Airco / Site-Wide Ground Water OU	10	27.5%	$4,124,000
10	Muscoy	9	27.0%	$3,959,000
11	Havertown PCP OU2	3	25.5%	$3,895,000
12	Newmark	9	25.5%	$3,322,000
13	North Penn Area 6	3	35.5%	$3,211,000
14	**Claremont Polychemical**	**2**	**30.0%**	**$2,579,000**
15	Garden State Cleaners/South Jersey Clothing Company	2	32.5%	$2,383,000
16	**Mattiace Petrochemical**	**2**	**23.0%**	**$2,357,000**
17	Cimarron Mining	6	15.0%	$2,281,000
18	Groveland Wells Superfund Site	1	27.5%	$2,066,000
19	Wyckoff/Eagle Harbor Superfund Site	10	25.5%	$1,935,000
20	Montgomery Township/Rocky Hill	2	30.5%	$1,850,000
21	Bog Creek Farm LTRA	2	30.0%	$1,833,000
22	**Oconomowoc Electroplating**	**5**	**24.5%**	**$1,591,000**
23	Ace Services	7	32.5%	$1,557,000

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. "Estimated Potential Life-cycle Savings ($)" is calculated based on the screening methodology summarized in Section 5.0 and Table 5-1. The screening calculations for each system are presented in Appendix C and summarized in Appendix B.
3. For a variety of reasons, including recent optimization or litigation, some of the systems with the highest potential for life-cycle savings in a Region were not selected for RSEs. Narratives describing the system selection for each Region are included the Regional summary screening reports included in Appendix B.
4. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, life-cycle costs and life-cycle cost savings could be underestimated for some sites.

Table 6-2: Fund-lead P&T Systems Ranked in Terms of "Estimated Potential Life-cycle Savings ($)" as Calculated by the Screening Methodology (Page 2 of 4)

Rank	Site name	Region	Estimated Potential Reduction in Life-cycle Costs	Estimated Potential Life-cycle Savings ($)
24	Greenwood Chemical Site	3	32.5%	$1,538,000
25	Syncon Resins	2	28.0%	$1,402,000
26	**MacGillis and Gibbs/Bell Lumber & Pole**	**5**	**32.0%**	**$1,400,000**
27	**Bayou Bonfouca**	**6**	**25.5%**	**$1,234,000**
28	Lipari Landfill site	2	17.5%	$1,136,000
29	**McCormick & Baxter Creosoting Co.**	**10**	**30.0%**	**$1,128,000**
30	Charles George Landfill Superfund Site	1	17.5%	$1,122,000
31	American Creosote Works	6	22.0%	$1,094,000
32	**Hellertown Manufacturing**	**3**	**20.5%**	**$980,000**
33	**Savage Well Municipal Water System**	**1**	**32.5%**	**$934,000**
34	Butz Landfill	3	25.0%	$925,000
35	Stanton Cleaners Area Groundwater Contamination Site	2	28.0%	$908,000
36	Verona Well Field	5	25.5%	$857,000
37	AIW Frank/Mid-County Mustang Site, OU#1	3	28.0%	$746,000
38	**Modesto Superfund Site**	**9**	**20.0%**	**$730,000**
39	Douglass Road	5	32.5%	$563,000
40	**Midland Products**	**6**	**20.0%**	**$528,000**
41	Croydon TCE	3	20.0%	$517,000
42	American Creosote Works (solute)	4	17.5%	$469,000
43	**Commencement Bay, South Tacoma Channel, Well**	**10**	**23.0%**	**$466,000**
44	Long Prairie	5	15.5%	$430,000
45	**Elmore Waste Disposal**	**4**	**20.0%**	**$376,000**
46	**Brewster Wellfield**	**2**	**17.5%**	**$318,000**

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. "Estimated Potential Life-cycle Savings ($)" is calculated based on the screening methodology summarized in Section 5.0 and Table 5-1. The screening calculations for each system are presented in Appendix C and summarized in Appendix B.
3. For a variety of reasons, including recent optimization or litigation, some of the systems with the highest potential for life-cycle savings in a Region were not selected for RSEs. Narratives describing the system selection for each Region are included the Regional summary screening reports included in Appendix B.
4. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, life-cycle costs and life-cycle cost savings could be underestimated for some sites.

Table 6-2: Fund-lead P&T Systems Ranked in Terms of "Estimated Potential Life-cycle Savings ($)" as Calculated by the Screening Methodology (Page 3 of 4)

Rank	Site name	Region	Estimated Potential Reduction in Life-cycle Costs	Estimated Potential Life-cycle Savings ($)
47	Palmetto Wood	4	18.0%	$262,000
48	**Selma Treating Co.**	**9**	**17.0%**	**$261,000**
49	Eastern Surplus Company Superfund Site	1	28.0%	$246,000
50	**Raymark**	**3**	**17.5%**	**$217,000**
51	Wash King Laundry	5	23.0%	$185,000
52	**Cleburn Street Well Site/OU2**	**7**	**17.5%**	**$179,000**
53	Vestal Water Supply Well 1-1	2	10.0%	$146,000
54	**FCX Statesville**	**4**	**20.0%**	**$135,000**
55	North Penn Area 1	3	10.0%	$86,000
56	Lang Property	2	5.0%	$63,000
57	City of Perryton Well #2	6	17.5%	$59,000
58	La Salle Electrical Utilities	5	12.5%	$57,000
59	Kearsarge Metallurgical Corp.	1	10.0%	$57,000
60	Saunders Supply Company	3	17.0%	$47,000
61	CryoChem	3	8.0%	$42,000
62	Better Brite Plating Co. Chrome and Zinc Shops	5	12.0%	$40,000
63	SMS Instruments	2	7.5%	$35,000
64	Cape Fear Wood Preserving	4	22.5%	$33,000
65	Benfield Industries	4	15.0%	$30,000
66	Circuitron	2	8.0%	$26,000
67	Geneva Industries	6	8.0%	$11,000
68	American Creosote Works (DNAPL)	4	7.5%	$3,000
69	Keefe Environmental Systems	1	7.5%	-$2,000

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. "Estimated Potential Life-cycle Savings ($)" is calculated based on the screening methodology summarized in Section 5.0 and Table 5-1. The screening calculations for each system are presented in Appendix C and summarized in Appendix B.
3. For a variety of reasons, including recent optimization or litigation, some of the systems with the highest potential for life-cycle savings in a Region were not selected for RSEs. Narratives describing the system selection for each Region are included the Regional summary screening reports included in Appendix B.
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Table 6-2: Fund-lead P&T Systems Ranked in Terms of "Estimated Potential Life-cycle Savings ($)" as Calculated by the Screening Methodology (Page 4 of 4)

Rank	Site name	Region	Estimated Potential Reduction in Life-cycle Costs	Estimated Potential Life-cycle Savings ($)
70	U.S. Aviex	5	5.0%	-$2,000
71	Islip Municipal Landfill	2	7.5%	-$9,000
72	Berks Sand Pit	3	5.0%	-$17,000
73	Arrowhead Refinery	5	5.0%	-$18,000
74	Onalaska Municipal Landfill	5	5.0%	-$20,000
75	Williams Property	2	5.0%	-$25,000
76	Odessa Chromium #1	6	5.0%	-$25,000
77	North Cavalcade Superfund Site	6	27.5%	-$25,000
78	Mohonk Road Industrial Plant Site	2	unknown	unknown
79	Dover Municipal Well 4	2	unknown	unknown
80	Metal TEC/Aerosystems	2	unknown	unknown
81	ABC Cleaners	4	unknown	unknown
82	Miami Drum	4	unknown	unknown
83	Coleman Evans Wood Preserving	4	unknown	unknown
84	Eau Claire Municipal Well Field	5	unknown	unknown
85	Duell and Gardner	5	unknown	unknown
86	Peerless Plating	5	unknown	unknown
87	Valley Park TCE Site - OU2	7	unknown	unknown
88	Bunker Hill Superfund Site	10	unknown	unknown

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. "Estimated Potential Life-cycle Savings ($)" is calculated based on the screening methodology summarized in Section 5.0 and Table 5-1. The screening calculations for each system are presented in Appendix C and summarized in Appendix B.
3. For a variety of reasons, including recent optimization or litigation, some of the systems with the highest potential for life-cycle savings in a Region were not selected for RSEs. Narratives describing the system selection for each Region are included the Regional summary screening reports included in Appendix B.
4. For some systems where the expected system duration is unknown, a value of 30 years may have been used as a default and may underestimate the expected duration of systems, especially those located at sites with continuing sources of groundwater contamination such as LNAPL and DNAPL. Therefore, life-cycle costs and life-cycle cost savings could be underestimated for some sites.

Table 6-3: Fund-lead P&T Systems Ranked According to Annual O&M Cost (Page 1 of 4)

Rank	Site name	Region	Annual O&M Cost
1	Vineland Chemical Co.	2	$4,000,000
2	**Baird & McGuire Superfund Site**	**1**	**$3,500,000**
3	Lipari Landfill site	2	$2,500,000
4	**Ott/Story/Cordova Chem Co.**	**5**	**$2,400,000**
5	**Silresim Chemical Corp.**	**1**	**$1,400,000**
6	Sprague Road Ground Water Plume	6	$1,200,000
7	American Thermostat	2	$1,175,000
8	Muscoy	9	$1,100,000
9	Higgins Farm	2	$1,000,000
10	Havertown PCP OU2	3	$1,000,000
11	Miami Drum	4	$1,000,000
12	Cimarron Mining	6	$1,000,000
13	Boomsnub/Airco	10	$1,000,000
14	Combe Fill South Landfill	2	$920,000
15	Newmark	9	$900,000
16	**Claremont Polychemical Corp.**	**2**	**$740,000**
17	Lang Property Superfund Site	2	$700,000
18	**Mattiace Petrochemical**	**2**	**$700,000**
19	North Penn Area 6	3	$592,900
20	Groveland Wells Superfund Site	1	$500,000
21	**Savage Well Municipal Water System**	**1**	**$500,000**
22	Garden State Cleaners/South Jersey Clothing Company	2	$500,000
23	Odessa Chromium #1	6	$500,000
24	Ace Services	7	$500,000
25	Wyckoff/Eagle Harbor Superfund Site	10	$500,000
26	Circuitron	2	$480,000
27	**Oconomowoc Electroplating**	**5**	**$471,000**

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Annual operation and maintenance (O&M) costs are estimates and include such items as labor, utilities, materials, analytical work, etc.
3. For a variety of reasons, including recent optimization or litigation, some of the systems with the highest annual O&M costs in a Region were not selected for RSEs. Narratives describing the system selection for each Region are included the Regional summary screening reports included in Appendix B.

Table 6-3: Fund-lead P&T Systems Ranked According to Annual O&M Cost (Page 2 of 4)

Rank	Site name	Region	Annual O&M Cost
28	Bog Creek Farm LTRA	2	$460,000
29	American Creosote Works (solute)	4	$452,000
30	Charles George Landfill Superfund Site	1	$450,000
31	**Bayou Bonfouca**	**6**	**$402,000**
32	**Brewster Wellfield**	**2**	**$400,000**
33	SMS Instruments	2	$400,000
34	Montgomery Township/Rocky Hill	2	$400,000
35	Greenwood Chemical Site	3	$400,000
36	Peerless Plating	5	$400,000
37	American Creosote Works	6	$360,000
38	Syncon Resins	2	$350,000
39	Williams Property	2	$350,000
40	**Hellertown Manufacturing**	**3**	**$350,000**
41	American Creosote Works (DNAPL)	4	$300,000
42	Palmetto Wood	4	$300,000
43	Long Prairie Groundwater Contamination	5	$300,000
44	**MacGillis and Gibbs/Bell Lumber & Pole**	**5**	**$300,000**
45	U.S. Aviex	5	$300,000
46	**Modesto Superfund Site**	**9**	**$300,000**
47	**Selma Treating Co.**	**9**	**$300,000**
48	**Commencement Bay, South Tacoma Channel, Well**	**10**	**$300,000**
49	Stanton Cleaners Area Groundwater Contamination Site	2	$270,000
50	Kearsarge Metallurgical Corp.	1	$250,000
51	Butz Landfill	3	$250,000
52	**McCormick & Baxter Creosoting Co.**	**10**	**$250,000**
53	Geneva Industries	6	$240,000
54	La Salle Electrical Utilities	5	$230,000

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Annual operation and maintenance (O&M) costs are estimates and include such items as labor, utilities, materials, analytical work, etc.
3. For a variety of reasons, including recent optimization or litigation, some of the systems with the highest O&M costs in a Region were not selected for RSEs. Narratives describing the system selection for each Region are included the Regional summary screening reports included in Appendix B.

Table 6-3: Fund-lead P&T Systems Ranked According to Annual O&M Cost (Page 3 of 4)

Rank	Site name	Region	Annual O&M Cost
55	Islip Municipal Landfill	2	$225,000
56	Verona Well Field	5	$225,000
57	Eastern Surplus Company Superfund Site	1	$200,000
58	Keefe Environmental Systems	1	$200,000
59	Croydon TCE	3	$200,000
60	Onalaska Municipal Landfill	5	$200,000
61	Vestal Water Supply Well 1-1	2	$180,000
62	AIW Frank/Mid-County Mustang Site, OU#1	3	$180,000
63	**Elmore Waste Disposal**	**4**	**$180,000**
64	**Midland Products**	**6**	**$180,000**
65	Eau Claire Municipal Wel Field	5	$175,000
66	**Raymark**	**3**	**$155,711**
67	Berks Sand Pit	3	$150,000
68	**FCX Statesville**	**4**	**$150,000**
69	CryoChem	3	$125,000
70	Douglass Road	5	$120,000
71	North Penn Area 1	3	$100,000
72	**Cleburn Street Well Site/OU2**	**7**	**$100,000**
73	Saunders Supply Company	3	$80,000
74	Wash King Laundry	5	$75,000
75	Arrowhead Refinery	5	$70,000
76	Cape Fear Wood Preserving	4	$40,000
77	City of Perryton Well #2	6	$37,000
78	Better Brite Plating Co. Chrome and Zinc Shops	5	$36,000
79	Benfield Industries	4	$30,000
80	Mohonk Road Industrial Plant Site	2	unknown
81	Dover Municipal Well 4	2	unknown

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Annual operation and maintenance (O&M) costs are estimates and include such items as labor, utilities, materials, analytical work, etc.
3. For a variety of reasons, including recent optimization or litigation, some of the systems with the highest O&M costs in a Region were not selected for RSEs. Narratives describing the system selection for each Region are included the Regional summary screening reports included in Appendix B.

Table 6-3: Fund-lead P&T Systems Ranked According to Annual O&M Cost (Page 4 of 4)

Rank	Site name	Region	Annual O&M Cost
82	Metal TEC	2	unknown
83	ABC Cleaners	4	unknown
84	Coleman Evans Wood Preserving	4	unknown
85	Duell and Gardner	5	unknown
86	North Cavalcade Superfund Site	6	unknown
87	Valley Park TCE Site - OU2	7	unknown
88	Bunker Hill Superfund Site	10	unknown

Data reflect estimates provided by site Remedial Project Managers between February and May 2001. These estimates may vary from actual values. Data, including the number and status of systems, may change over time.

Notes:

1. Fund-lead P&T systems refers to systems where groundwater extraction and treatment is specified in the Record of Decision and oversight is provided by the EPA or by a State with financial support from Superfund.
2. Annual operation and maintenance (O&M) costs are estimates and include such items as labor, utilities, materials, analytical work, etc.
3. For a variety of reasons, including recent optimization or litigation, some of the systems with the highest O&M costs in a Region were not selected for RSEs. Narratives describing the system selection for each Region are included the Regional summary screening reports included in Appendix B.

7.0 CONCLUSIONS AND LESSONS LEARNED

This nationwide effort to identify and gather information on Fund-lead P&T systems resulted in an improved understanding of the number of Fund-lead P&T systems, the specifications and performance of these systems, and the estimated costs required to operate and maintain these systems. In total, 88 operational and pre-operational Fund-lead P&T systems were identified, with pre-operational referring to systems that are identified in a ROD and are in a stage of pre-design, design, or installed but not yet operating. Of these 88 systems, 67 are operational and 21 are pre-operational. Annual costs for each system ranged from less than $100,000 per year to approximately $4,000,000 per year. The following findings result from the cost information for Fund-lead P&T systems:

- The estimated average annual operation and maintenance (O&M) cost for a Fund-lead P&T system (based on those 79 systems providing cost data) is approximately $570,000 and the median cost is $350,000. The discrepancy between these two statistics is due to a small number of systems with relatively high O&M costs.

- Based on the 79 systems that provided cost information, the estimated total annual O&M cost for operating the Fund-lead P&T systems in 2002 is approximately $38 million, with EPA incurring approximately $32.5 million of the total annual cost and the associated States incurring the remaining $5.5 million.

- Based on the 79 systems that provided cost information, the estimated future cost for Long-term Remedial Action (LTRA) O&M for all of these systems exceeds $210 million with discounting (i.e., net present value) and exceeds $270 million without discounting. LTRA refers to the first 10 years of operation of a groundwater or surface water restoration action. During this period, EPA typically funds 90% of the cost and the associated State funds 10% of the costs. These percentages translate directly to the presented costs; therefore, the Superfund is expected to pay approximately $189 million ($243 million without discounting) and the States are expected to pay approximately $21 million ($27 million without discounting).

- Based on the 79 systems that provided cost information, the estimated future cost for O&M of Fund-lead P&T systems until remediation completion is achieved is approximately $470 million with discounting (net-present value) and $790 million without discounting. (These estimates of future O&M costs are based on the annual costs of systems and expected durations of systems as specified by the site managers. For some systems where expected system duration is unknown, a value of 30 years may have been used as a default value for this parameter. While the practice of using 30 years as a default was prevalent in the past, more recent EPA guidance on feasibility study preparation recommends that 30 years not be used as a default.)

- 13 of the 79 systems that provided costs account for approximately 50% of the total reported annual O&M costs.

A total of 26 States reportedly have Fund-lead P&T systems. Upon completion of the 10-year LTRA period each system will be transferred to its associated State and that State will assume 100% of the remaining O&M costs. For systems where restoration is not a goal (i.e., containment and water supply

systems) the systems are typically transferred to the States after one year. The collected data suggest that the States will incur between approximately $250 million with discounting or $520 million without discounting in post-LTRA O&M costs for Fund-lead P&T systems that reported annual O&M costs. Furthermore, the data suggest that the following five States will likely incur 78% of these post-LTRA O&M costs:

- New Jersey (27.6%)
- Massachusetts (22.6%)
- New York (9.7%)
- Pennsylvania (9.6%)
- Michigan (8.4%)

In addition to cost information, the following statistics about the Fund-lead P&T systems were also gleaned from the information reported by the system RPMs:

- 40 of 67 operating systems are reported to be controlling plume migration.
- 60 of the 67 operating systems have groundwater restoration as a goal but 21 of that 60 do not have estimates of the progress toward that restoration. Of the 39 systems that have both groundwater restoration as a goal and an estimate of progress toward restoration, 7 are estimated to have made more than 80% progress toward restoration.
- 52 of the 88 systems have three or more primary contaminants of concern, and chlorinated solvents are the most prevalent contaminants as they are addressed by 56 of the 88 systems.
- 35 of the 88 Fund-lead P&T systems are associated with sites where non-aqueous phase liquid (NAPL) has either been observed or suspected.
- Carbon adsorption and air stripping are the most prevalent treatment processes (carbon adsorption is used at 50 of the 88 systems and air stripping is used at 41).
- Based on 64 of 88 systems where RPMs were able to determine costs specifically used for groundwater monitoring, Fund-lead P&T systems have, on average, 23 monitoring wells for groundwater sampling that are sampled three to four times per year for an average cost of $112,000 per year.
- 36 of the 67 operating systems have previously had performance and effectiveness evaluated and found “sufficient” while 7 had performance and effectiveness found “not sufficient” (the remaining systems are either being evaluated, have not been evaluated, or have not provided information regarding previous effectiveness evaluations).

The following items detail lessons learned from this data-collection phase of the Nationwide Remediation System Evaluation (RSE) Optimization Project.

Additional RSEs should be commissioned

Although the screening methodology targeted systems in each Region that had effectiveness problems or relatively high operating costs, a number of systems with similar issues were not selected for RSEs. Some of these unselected systems are receiving third-party optimization evaluations not associated with this project. Many of the other unselected systems, however, would benefit from third-party optimizaton evaluations such as an RSE. Therefore, additional RSEs should be commissioned to optimize some of the remaining Fund-lead systems.

A central database or other information system for Fund-lead systems (not limited to P&T) should be developed and maintained through annual or semi-annual updates by Remedial Project Managers. Consideration should also be given to extend such a database to include non-Fund-lead systems as well.

- Identifying all of the Fund-lead P&T systems in each Region was greatly facilitated by the project liaisons in each Region. However, to identify these systems, liaisons were required to interview branch chiefs and individual Remedial Project Managers. A central, up-to-date database would eliminate the need for repeating this interview process in the future. Managers for each site, including sites new to Superfund, should be required to update site information in a central information system (e.g., a database). The database created for this project offers a solid beginning. The data in the current database could be made available to site managers so that they may update it when required rather than reentering all of the information.

- Questions as to the definition of "pump-and-treat" arose repeatedly. In Region 9 well-head treatment systems were not included, and in Region 8, a NAPL-recovery system was not included. Furthermore, soil-vapor-extraction (SVE) systems were also not included. By not including these systems in the study, the total amount of Fund-lead expenditures could not be estimated and these systems were not considered for optimization.

- Within each Region, "fact sheets" are prepared for each system by the system's Remedial Project Manager (RPMs). As these "fact sheets" are already updated on a regular basis, broadening the required information on each "fact sheet" would make them the primary information source on each system. Because they are written documents, these "fact sheets" are more flexible than databases. First, they are not constrained to single preformatted answers (e.g., a selection from a list or single number) as is typically required for database questionnaires. Second, they can be used for any type of system or site whereas database questionnaires are typically tailored for a specific type of system or site. Future databases for specific projects could be easily generated from these "fact sheets".

- The CERCLIS database and many resources or databases within each Region are available. Consideration should be given to linking the proposed central database to CERCLIS and these Regional resources.

- Some of the data collected as part of this project may also be relevant for tracking the progress of non-Fund-lead systems. Consideration should be given to collecting information on these systems as well.

Future web-based questionnaires may need to be more lenient in accepting data.

A number of RPMs did not complete questionnaires because information required by the web-based survey (i.e., "required fields") was not available for the specific system. This repeatedly occurred for planned P&T systems for which RPMs did not yet have cost estimates or system specifications. Because these fields were required in order to save the input, information on many systems had to be gathered through phone interviews.

APPENDICES

Appendix A: Information Sheets for each Fund-lead P&T System
Appendix B: Summary Phase 1 Reports of each Region
Appendix C: Screening Calculations for each Fund-lead P&T System

These appendices are not included in this document. This document, with its appendices (EPA 542-01-021b) or without its appendices (EPA 542-01-021a), may be downloaded from EPA's Clean Up Information (CLUIN) System at http://www.clu-in.org. A limited number of hard copies of each version are also available free of charge from the National Service Center for Environmental Publications (NSCEP) at the following address:

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