



# Effective Contracting Approaches for Operating Pump and Treat Systems



*One of a Series on Optimization*

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## DISCLAIMER

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This document provides references to models and processes in use by outside parties and other Federal Agencies. Mention of these models and processes does not imply endorsement for specific purposes.

This fact sheet is not intended to be a detailed instruction manual. In addition, this fact sheet is not a regulation; therefore, it does not impose legally binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances. The document offers technical recommendations to EPA, States and others who manage or regulate ground water pump and treat systems as part of the Superfund program or other cleanup programs. EPA and State personnel may use other approaches, activities and considerations, either on their own or at the suggestion of interested parties. Interested parties are free to raise questions and objections regarding this document and the appropriateness of using these recommendations in a particular situation, and EPA will consider whether or not the recommendations are appropriate in that situation. This fact sheet may be revised periodically without public notice. EPA welcomes public comments on this document at any time and will consider those comments in any future revision of this document.

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## PREFACE

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This fact sheet summarizes key aspects to consider for contracting to operate pump and treat (P&T) systems. It is part of a series of fact sheets that the EPA Office of Superfund Remediation and Technology Innovation (OSRTI) is preparing as guidance to the ground water remediation community on effectively and efficiently designing and operating long-term ground water remedies. This series is available at [www.cluin.org/optimization](http://www.cluin.org/optimization) and consists of the following fact sheets plus others that will be available in the future.

- *Elements for Effective Management of Operating Pump and Treat Systems*  
OSWER 9355.4-27FS-A, EPA 542-R-02-009, December 2002
- *Cost-Effective Design of Pump and Treat Systems*  
OSWER 9283.1-20FS, EPA 542-R-05-008, April 2005
- *Effective Contracting Approaches for Operating Pump and Treat Systems*  
OSWER 9283.1-21FS, EPA 542-R-05-009, April 2005
- *O&M Report Template for Ground Water Remedies (with Emphasis on Pump and Treat Systems)*  
OSWER 9283.1-22FS, EPA 542-R-05-010, April 2005

In addition, access to a wider range of EPA documents is available at [www.cluin.org](http://www.cluin.org).

The recommendations contained in this series of fact sheets are based on professional experience in designing and operating long-term ground water remedies and on lessons learned from conducting Remediation System Evaluations (RSEs) at Superfund-financed P&T systems. The results of the first 20 RSEs conducted at Superfund-financed P&T systems are summarized in *Pilot Project to Optimize Superfund-Financed Pump and Treat Systems: Summary Report and Lessons Learned* (EPA 542-R-02-008a), and the site-specific recommendations from the evaluations are available in the individual RSE reports (EPA 542-R-02-008b through 542-R-02-008u). The content of these fact sheets is relevant to almost any P&T system. Therefore, these documents may serve as resources for managers, contractors, or regulators of any P&T system, regardless of the regulatory program. In some organizations, contracting options may be limited. In such cases, some of the information in this document may not be applicable. In addition, environmental professionals in some organizations may have specific contracting personnel that should be contacted to follow appropriate contracting procedures. For example, government contracting includes specific roles for designated contracting officers.

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## A. INTRODUCTION

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Remediation System Evaluations (RSEs) conducted at 20 Superfund-financed pump and treat (P&T) systems identified contracting issues at some sites that potentially affected the effectiveness and/or cost of the remedy. The lessons learned from these RSEs pertain to P&T systems in any regulatory program. Therefore, this document provides an overview of effective contracting approaches for any operating P&T system. An example is provided in Appendix A to highlight items that are presented in the document.

A contract to operate a P&T remedy governs the relationship between the customer, who is responsible for the remediation, and a contractor performing remediation services. A good contract is beneficial to both parties, and promotes cost-effective services that enable the P&T system to achieve its remedial goals. A good contract fosters a customer/contractor relationship that emphasizes clear expectations and roles and responsibilities, which, in turn, enhances performance and timely problem resolution.

The customer generally prefers the following:

- performance that follows the specifications and schedule, with all work performed in accordance with applicable laws, regulations, and accepted industry practices
- contract terms that define and limit costs, and reduce exposure to cost overruns
- flexibility to allow for optimization to improve remedy effectiveness and/or reduce costs, based on changing site conditions, newly available technologies, or other developments

The contractor generally prefers the following:

- a clear scope of work that accurately defines the services associated with the cost proposal
- a project schedule that reflects the scope of work and is flexible to accommodate unforeseen items
- contract terms that fairly address financial risk associated with the given scope of work
- fair and timely payment for services rendered

In this document, the term “O&M” refers to activities associated with operation and maintenance of a P&T

system, and does not refer to any specific period of time or regulatory status associated with the remedy. For example, Superfund refers to the first 10 years of a Fund-lead P&T system as Long-Term Response Action (LTRA), and the subsequent period as “O&M”. However, in this document both of those time periods are considered to be types of O&M.

## B. ESSENTIAL CONTRACT COMPONENTS

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In general, a contract is likely to include the components listed below.

Scope of Work. Specifies the technical work product and/or services expected from the contractor.

Schedule and Deliverables. Defines the timing, nature, and quantity of work products (e.g., O&M reports) associated with the scope of work.

Level of Effort and/or Pricing. Provides the estimated cost and, in some cases, the number of labor hours, to complete the scope of work. The amount of detail depends on the contract type.

Period of Performance. Defines the contract duration.

Terms and Conditions. Includes clauses that accomplish the following:

- bind the contractor work quality to acceptable standards (warranty, indemnification, etc.)
- establish bonding and insurance requirements

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- define payment terms and invoicing requirements
- specify inspection and acceptance clauses, and allow the customer and contractor reasonable rights to terminate the agreement

Points of Contact. Establishes points of contact between the contractor and the customer.

Procedures for Contract Changes. Defines the manner in which changes to the contract are to be made.

Special Clauses. Any other clauses that may be required by either party. Examples include clauses related to conflict of interest, use of subcontractors, or ownership of property associated with the remedy.

### C. OPTIONS FOR CONTRACT TYPE

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Contracts for O&M are generally grouped into one of three broad categories, as follows:

- fixed-price
- cost-reimbursement
- time-and-materials (T&M)

Each of these broad categories is discussed below. Variations of fixed-price contracting and cost-reimbursement contracting are also briefly described.

Exhibit 1 compares and contrasts, in general terms, fixed-price contracting versus cost-reimbursement or T&M contracting.

#### ***Fixed-Price***

Fixed-price contracts provide the customer with a defined cap on the expenditure. An advantage for the customer is that detailed review of invoices and related backup material is generally not required. The customer can still divide the work into some discrete tasks (with associated fixed-prices per task) for tracking purposes and/or to simplify potential scope reductions during the contract performance period.

A fixed-price contract requires the contractor to assume additional risk relative to cost-reimbursement contracts because the contractor has to complete the scope regardless of the costs incurred. However, the contractor also has a chance for greater reward if the work is completed more efficiently than expected. To reduce the risks of fixed-price contracting, the contractor generally insists on a very clearly defined scope so that any cost increases due to unknown or poorly defined circumstances do not become their responsibility. If, during the performance of the contract, work is required that falls outside of the scope, the contractor can then request a change order (which could ultimately result in increased costs to the customer). Fixed-price contracts typically provide the contractor with timely payments based on pre-established terms and/or milestones.

### Exhibit 1

#### Fixed-Price Contracts versus Cost-Reimbursement or T&M\* Contracts

Consideration	Fixed-Price	Cost-Reimbursement or T&M*
risk to contractor	higher risk – contractor is required to finish scope regardless of actual cost	lower risk – work is only performed until estimated cost is incurred
definition of tasks	more appropriate for tasks with predictable components	more appropriate for tasks with unpredictable components
contractor incentive	encourages contractor to work efficiently to avoid overruns and earn a higher profit	no incentive within contract for contractor to work efficiently
invoice information	customer only sees total cost on invoice – fewer details on invoices mean fewer accounting and invoicing procedures	customer sees component costs (hours, unit costs, etc.) and total costs on invoice – more details on invoices means more accounting and invoicing procedures
risk to customer	lower risk	higher risk

*\*T&M primarily differs from cost-reimbursement by using fixed billing rates for labor that incorporate profit*

Fixed-price contracts are preferable for work that is well defined, but are not well suited for items that are poorly defined because the contractor will either have to bear a greater risk of a cost overrun or make assumptions that increase cost to the customer.

Common fixed-price variations are as follows:

Firm-Fixed-Price. This generally refers to a specific scope of work for a specific price, without change. Options can be included for additional items on a unit-price basis.

Fixed-Price with Economic Price Adjustment. This provides for price adjustments based on an index (e.g., consumer price index) or some other contingency as defined in the contract. It is suitable for contracts of long duration. These adjustments limit risk to the contractor, and can reduce the overall cost to the customer because the contractor does not need to build as much contingency into the fixed-price bid.

Fixed-Price Incentive. This generally consists of a target cost, target profit, and price ceiling above the expected cost. It also includes a formula for establishing actual profit to be paid. If the work costs less than the target, the customer and contractor share the benefit based on contract terms. If the work exceeds the expected cost, the contractor generally becomes responsible for some of that additional expense based on contract terms, reducing the contractor's overall profit on the job.

### ***Cost-Reimbursement***

Cost-reimbursement contracts are used when uncertainties do not allow the effective use of fixed-price contracts. Cost-reimbursement contracts reduce the risk to the contractor, because work is only performed until the estimated cost is actually incurred, whether or not performance on the scope of work is completed. They also generally require much more detailed accounting and invoicing procedures on the part of the contractor, to serve as a basis for the incurred costs.

The risk to the customer is higher for cost-reimbursement contracts than for fixed-price contracts because of the potential for the contractor to work inefficiently or do more work than is actually required. This can be mitigated by adding incentives (discussed below). Greater administrative effort is also generally required by the customer to process and review invoices, compared to fixed-price contracts.

Common cost-reimbursement variations are as follows:

Cost-Plus-Fixed-Fee (CPFF). Allows the contractor to be paid for all allowable costs, plus a fee that is fixed regardless of actual costs incurred. The contractor assumes little risk, and is guaranteed a fee. However, there is little or no incentive within the contract for the contractor to perform efficiently. There are two basic types, completion form and term form. The completion form, which is generally preferred, is used when there is a clear goal with a defined end product, and delivering the specified end product is a condition for paying the entire fixed fee. The term form is used when a specified level of effort is required over a stated time period, and providing that level of effort over the specified period is a condition for paying the entire fixed fee.

Cost-Plus-Incentive-Fee (CPIF). Allows the contractor to be paid for all allowable costs, plus a fee that varies with the actual costs incurred. Generally a minimum and maximum fee are set, with a formula that determines the actual profit paid to the contractor based on costs actually incurred. This adds an incentive for efficient performance.

Cost-Plus-Award-Fee (CPAF). Allows the contractor to be paid for all allowable costs, plus a fixed fee, and a potential additional fee awarded for excellent performance in areas such as timeliness and quality of work. The additional fee is generally awarded based on a subjective evaluation, and again adds incentive for efficient performance.

### ***Time and Materials (T&M)***

In a T&M contract, labor is billed according to fixed billing rates that incorporate profit. Materials and other costs are reimbursed to the contractor (in the private sector, a fee may be added to these materials and other costs). T&M contracts typically include a "not-to-exceed" cost ceiling. Like cost-reimbursement contracts, the use of T&M contracts provide little incentive for the contractor to work efficiently.

## **D. CONSIDERATIONS SPECIFIC TO CONTRACTS FOR OPERATING P&T SYSTEMS**

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Operation of P&T systems has the following characteristics:

- It is a long-term activity (often measured in decades) that generally comprises the large majority of the remedy life-cycle costs.
- The conditions surrounding an operating P&T system may change. Changes may occur in the site conditions (e.g., decreasing concentrations), available technologies, regulatory climate, or social/political climate.
- Despite the changing conditions surrounding an operating P&T system, there are a number of routine O&M items. These routine items often include project management, monitoring, reporting, and operator labor.

Given these characteristics, a contract for operating a P&T system will ideally separate the routine, defined components from the non-routine components and allow for flexibility to address changing conditions. However, in some cases the contracting options may be limited by an existing “master contract”.

***Develop an Appropriate Scope of Work for Baseline O&M Activities***

Baseline or defined O&M includes project management, utilities, materials, labor, and analytical costs that are necessary to keep a system running effectively and efficiently. Baseline O&M does not include items such as additional investigations, piloting of innovative technologies, and new evaluations of nearby receptors, which can often match or exceed the cost of baseline O&M expenses.

Tracking Costs. By clearly distinguishing between baseline O&M costs and other costs, and having the contractor invoice according to cost categories, the customer can better compare the costs of the operating remedy against potential alternatives. It is important for the customer to review invoices and reports to determine if current costs are consistent with previous periods, and if not, to understand the reason for the change. Example 1 demonstrates how tracking baseline O&M costs obtained from contractor invoices

**Example 1**

**Advantages of Breaking Out Baseline O&M Costs from Other Costs of P&T System Operation**

The table below uses two approaches to tracking annual costs (from invoices) during four years of P&T operation:

- Approach 1 – with cost of baseline O&M and additional items separated (recommended)
- Approach 2 – with cost of baseline O&M and additional items combined

Year	General Tasks	Approach 1 (recommended)	Approach 2
1	<ul style="list-style-type: none"> <li>• Baseline O&amp;M</li> <li>• Non-routine maintenance</li> <li>• Community relations</li> <li>• Wetlands evaluation</li> </ul>	\$125,000 \$35,000 \$25,000 \$40,000	\$225,000
2	<ul style="list-style-type: none"> <li>• Baseline O&amp;M</li> <li>• Non-routine maintenance</li> <li>• Decommission specific wells</li> <li>• Indoor air evaluation</li> </ul>	\$150,000 \$10,000 \$30,000 \$30,000	\$220,000
3	<ul style="list-style-type: none"> <li>• Baseline O&amp;M</li> <li>• Non-routine maintenance</li> <li>• Community relations</li> <li>• Source area soil investigation</li> </ul>	\$175,000 \$0 \$5,000 \$45,000	\$225,000
4	<ul style="list-style-type: none"> <li>• Baseline O&amp;M</li> <li>• Non-routine maintenance</li> <li>• Community relations</li> <li>• New technology evaluation</li> </ul>	\$205,000 \$3,000 \$2,000 \$15,000	\$225,000

*Approach 2 suggests that total operating costs are relatively constant over time, at approximately \$225,000 per year. In reality baseline O&M costs are increasing at a rate higher than would be expected due to inflation, while non-baseline items are decreasing. Approach 1 would reveal the high rate of increase in baseline O&M costs per year, and lead the customer to ask questions about the contractor’s efficiency. Approach 2 would not allow the customer to distinguish the high rate of increase in baseline O&M costs per year.*

may help the customer determine if baseline O&M costs are increasing at a higher than expected rate. The costs for baseline O&M tend to remain relatively consistent from year to year, but the costs for some baseline O&M items are more predictable than others. For this reason, fixed-price contracting is more appropriate for some items and cost-reimbursement or T&M contracting is more appropriate for others. Typical items in a baseline O&M scope of work are described below, and Exhibit 2 summarizes what is generally considered the more appropriate contracting approach for each item. These items should be tracked as separate line-items by the contractor and customer so that costs can be easily and effectively evaluated.

**Project Management.** Project management should generally be limited to budget tracking, management of labor, invoicing, and routine correspondence. Because these items are routine and rather predictable, project management is often suitable for fixed-price contracting. For most systems, project management for P&T system operation can often be provided for \$2,000 to \$4,000 per month (2003 dollars). Other items beyond these routine services, such as community relations and meetings, should be separate line items.

**Reporting/Data Analysis.** The scope of work should clearly identify the reporting and data analysis requirements, and should also clearly establish which party is responsible for the interpretation of collected data. Some reports may be required for compliance and others for informing the customer of the remedy performance with respect to its goals. More frequent reporting (e.g., quarterly) may be appropriate during the first few years of system operation when changes in site conditions are greatest, and less frequent reporting (e.g., annually) may be more appropriate when changes in site conditions are more gradual. The costs for such reports depend on the complexity of the site, but for many sites will range from \$5,000 to \$25,000 per report (2003 dollars). Any requirements for providing data in electronic format should be established. Because the costs are predictable, data analysis and reporting are suitable for fixed-price contracting.

**Operating Labor/Routine Maintenance.** For simple systems, this may include weekly or biweekly site visits to check the status of the system and less frequent, but regular, visits to clean treatment components, clean wells that would foul without routine attention, or perform other routine maintenance. For complex systems, such as those with metals precipitation, labor may include one or two full-time employees to clean equipment, monitor the system, operate a filter press, and accept deliveries of materials. Ideally, a contract

## Exhibit 2

### Contracting Approaches for Typical Baseline O&M Items

#### *Fixed-Price (More Predictable Items)*

- project management
- reporting/data analysis
- operating labor and routine maintenance
- process monitoring/analysis (fixed-price by unit)
- ground water monitoring/analysis (fixed-price by unit)

#### *Cost-Reimbursement or T&M (Less Predictable Items)*

- utilities
- unpredictable non-utility consumables
- disposal

will allow the contractor the flexibility to quickly replace or repair minor system components such as valves, flow meters, pumps, switches and controls by having a set-aside sum (generally cost-reimbursement) that the contractor can access without delay. The contract need not specify the number of staff required but should specify performance requirements (e.g., allowable downtime, or volume of water to be treated per month).

Operating labor and routine maintenance costs are predictable and are often a large percentage of the overall operating costs, so consideration of fixed-price contracting for labor is appropriate. The costs for O&M labor depend heavily on the type of treatment components and rule-of-thumb estimates are not provided in this document. The reader is referred to *Elements for Effective Management of Operating Pump and Treat Systems* (EPA 542-R-02-009). The maintenance parts and materials can be included as cost-reimbursement with the maximum value of such items (per item and/or per year) established in the contract. Labor and materials in this category should not include more costly non-routine maintenance items.

**Process Monitoring/Analysis.** Process monitoring consists of measurements required by discharge permits and might also include monitoring of treatment plant process water that is necessary to operate the plant effectively and efficiently. Because

the process monitoring is routine and predictable, the cost can be included as a fixed-price per unit item that allows the number of samples to change. Contracting should not be an excuse for conducting too much or too little process monitoring. The contract may require modification if permit requirements change over time.

Ground Water Monitoring/Analysis. Ground water monitoring should provide the necessary data to evaluate the system performance. It is not simply a continuation of monitoring that was conducted during the remedial investigation or design. In the first few years of system operation, substantial changes in site monitoring may merit relatively frequent (i.e., quarterly) ground water monitoring. However, site conditions often stabilize within the first few years of operation, and less frequent sampling (e.g., annually) or sampling from fewer locations may be appropriate. As with process monitoring, the cost for ground water monitoring can be provided as unit price that allows the number of wells sampled and frequency of sampling to decrease or increase.

Utilities. Due to the potential for fluctuations in gas or electricity rates, utilities can be unpredictable over the long-term, especially with deregulation. Therefore, the customer may prefer to pay for the utilities directly or to have the contractor include them as a cost-reimbursement item, rather than including them in a firm-fixed price contract. Paying the utility bills directly also prevents the contractor from adding a fee to the actual cost. If energy usage is predictable and a long-term utility rate can be arranged, including it as a fixed-price item would be appropriate.

Non-Utility Consumables. These include materials and chemicals that are used as part of the routine O&M, such as granular activated carbon, chemicals for pH adjustment, and chemicals for well maintenance and equipment cleaning. The use and relative cost of non-utility consumables is site-specific. The customer should determine those items that are predictable and those that are unpredictable at their site, and then use the appropriate contracting approach. Fixed-prices or unit prices are best for predictable items and cost-reimbursement is best for unpredictable items.

Disposal. Disposal refers to discharging of water to a publicly-owned treatment works (POTW) as well as disposing of recovered product and treatment plant wastes such as sludge filter cake, spent filters, and used personal protective equipment. Disposal costs are rarely a large percentage of the total operating costs, but disposal of large volumes of waste can be costly, especially if classified as hazardous waste. Customer

involvement is appropriate for selection and negotiation with waste disposal facilities and/or the discharge location for treated water. It is often preferable for disposal to be a cost-reimbursement item, unless the disposal cost is relatively small (i.e., less than \$1,000 per month).

### *List Non-Routine O&M Items Separately*

Other items are often needed during system operation that are additional to the baseline O&M. These additional items might include non-routine maintenance, system optimization, additional investigations, piloting innovative technologies, and updating evaluations of nearby receptors. These items should be listed separately from those items that are part of baseline O&M, and in many cases, they are best accomplished under different contracts.

The following typical additional items might be included as separate line items in the same contract:

Non-Routine Maintenance. This item should either be funded as the need arises or with a defined set-aside sum to be used for items as they occur. Regardless, non-routine maintenance should be tracked separately from baseline O&M. Each significant task should be evaluated and paid on a cost-reimbursement or T&M basis. If additional maintenance items (e.g., extraction well rehabilitation) are needed on a regular basis, they should be added to the routine maintenance line item with a fixed-price.

Meetings. The contractor is often requested to attend meetings with the customer and/or regulators. Depending on the type of meeting, preparation may be required. For many meetings, the costs are predictable and meeting preparation and attendance can be costed together on a unit price per person per meeting. For example, \$2,000 per person per meeting may be appropriate at some sites (2003 dollars). This would translate to a total cost of \$4,000 for the meeting (including preparation) if two people attend and \$2,000 (including preparation) if one person attends.

Community Relations. The need for community relations is site-specific. Community involvement may be substantial at some sites and relatively limited or non-existent at others. At some sites, the customer may not want the contractor involved at all. These costs (generally cost-reimbursement) should be tracked separately from project management so that the customer can easily determine the costs of community involvement and distinguish them from the management costs required to run the system.

## Select an Appropriate Contract Duration

Contracting can be a lengthy and expensive process. Therefore, re-competing contracts for P&T operation more frequently than every three years should not be considered unless a contractor is incapable of performing to expectations. On the other hand, competition encourages quality and efficiency, and rebidding contracts for P&T operation allows for competition. Therefore, contracts often have a five-year maximum duration. Additional reasons to keep contracts for P&T operation no longer than five years are listed below.

- During the first few years of system operation, site conditions may change substantially due to the P&T remedy. As a result, the scope of work for system operation (or the actual components of the remedy) may be substantially different after several years of operation than in the first year of operation.
- Improvements in technology may allow substantial changes in the scope of work for P&T operation or the remedy.
- Optimization and/or a five-year review may result in recommended changes to the P&T system operation.

The use of option years is often appropriate, where the contract is awarded for two years, with three option years that can be exercised if performance meets expectations and the scope of work is still appropriate. Example 2 uses a hypothetical P&T system to illustrate the benefits of a short-term contract with option years.

### ***Consider the Remedy Goals When Including Performance-Based Awards or Incentives***

“Performance-based” or “incentive-based” contracts offer rewards for good performance and penalties for poor performance. The rewards for such contracts should consider the goals of the remedy.

In a remedy in which hydraulic containment is the primary goal, the key requirement is limiting system downtime and maintaining the design extraction rate (treatment of excess water will not improve the system performance in relation to the containment goal). Therefore, the contract performance incentives or penalties should focus on limiting downtime and decreases in extraction. In a remedy in which the treated water is used as an industrial or municipal water supply, the key requirement is typically meeting water

## Example 2

### **Using a Short-Term Contract with Option Years for the Early Years of P&T Operation**

#### ***Hypothetical P&T system at beginning of operation***

- system addresses VOCs from a former metal finishing facility and treatment is not required for hazardous metals
- current iron levels are sufficient to foul the air stripper
- design includes a temporary metals removal system to remove iron and allow the air stripper to function
- routine O&M is \$150,000 per year without metals removal and \$300,000 with metals removal
- metals removal would not be necessary if influent iron concentrations decrease sufficiently

***Contracting Approach 1:*** contract is for two years

***Contracting Approach 2:*** contract is for five years

***Contracting Approach 3:*** contract is for two years with up to three option years

If metals removal is required for the long-term, then the contract from Approach 1 needs to be rebid after two years, even though the scope of work and costs of the current contract are likely appropriate.

If metals removal is not required for the long-term, then the contract from Approach 2 is over-scoped and needs to be terminated or the scope needs to be substantially modified.

Approach 3 allows the current contract to continue after two years if metals removal is still needed, but provides an opportunity to rebid the contract if metals removal is no longer necessary.

quality limits. The contract incentives and penalties should focus on effluent quality.

In a remedy in which aquifer restoration is the primary goal, the key requirement is typically maximizing contaminant mass removal (although minimizing system downtime should also be a priority). It is difficult to focus a performance contract on mass removed because mass removal will often decrease over time. The contractor may have little control of the mass removed unless extraction points can be added or other remedial actions can be implemented, which may be costly compared to the incentive provided.

**Contract Additional Evaluations, Investigations, and Remedial Activities Separately**

Monitoring during P&T operation provides additional information that was not available at the time the remedy was designed. In addition, new or improved technologies are often developed. As a result, additional evaluations, investigations, or even remedial actions may be merited. These items should be contracted separately, and proposals for more costly items should likely be peer-reviewed before contracting.

**E. REMEDY OPTIMIZATION**

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Although a contractor may work to continually optimize a system, the customer should recognize that the contractor may not be motivated to make recommendations that decrease their level of effort, and such recommendations may be more likely from a third-party optimization evaluation. This section describes both internal and third-party optimization evaluations.

***Incentives and Internal Optimization***

It is often unnecessary to set aside a separate line item for optimization by the contractor operating the system. Rather, it is appropriate to use a contract award program for the contractor to share any cost savings from improvements they recommend, such as in “value engineering” approaches in Federal contracts as described in the Office of Management and Budget (OMB) Circular No. A-131, May 1993. When setting up such a program, procedures should be followed to ensure funds have been appropriated to cover the payments required by the contract.

This type of program should be carefully conceived. It requires thorough planning, management involvement, and clearly defined outcomes with agreed-on baselines from which to measure savings. Furthermore, elimination of unnecessary services (i.e., simple reductions in scope) should not result in an award. Rather, the contract should be flexible to allow such scope reductions (whether recommended by the contractor, customer, or a third party) to be implemented and for cost savings to be realized without disputes. Some items can be broken down into units (e.g., well sampling) without renegotiation. Reducing other items (e.g., project management, reporting, and operating labor) may require a new fixed-price contract. Exhibit 3 distinguishes between items that

**Exhibit 3**

**Distinguishing Between Scope Reduction and Contractor Recommendations that Merit Incentive Awards**

**Scope Reduction**

Over the course of P&T operation, some items are no longer needed or are not needed to the same degree. The scope of work can be reduced to eliminate or reduce these items without providing an award to the contractor (even if the contractor recommends the scope reduction). The following are examples:

- reducing ground water monitoring from quarterly to semi-annually due to established trends
- reducing process monitoring because the system efficiency has been established
- reducing operator labor because the remedy operates effectively and tasks are easily completed within a shorter amount of time
- discontinuing metals removal because the metals in the plant influent meet the effluent criteria and do not foul the other process equipment

**Technical Recommendations that Merit Awards**

Contractors may suggest a new technology or approach that simplifies the P&T system and reduces cost. By providing an award for such recommendations (e.g., a portion of the cost savings) contractors have added incentive to make such recommendations. The following are examples:

- using a new oxidant will increase the efficiency of the metals removal system and will reduce the cost of materials and the cost of sludge disposal
- including new equipment to further automate the system and reduce necessary operator labor

are scope reductions and items that are recommendations deserving of an award.

***Use Third-Party Evaluations for Comprehensive Optimization***

Periodic third-party (or independent) expert reviews of P&T operation and performance provide the following benefits:

- an unbiased, external review of system operation and costs
- expertise in hydrogeology and engineering



- specific knowledge and experience with new or alternative technologies
- experience gained from designing, operating, or reviewing other systems
- a fresh perspective on the problems at hand and the current remedy

As a result, these evaluations can be more effective at identifying improvements that increase protectiveness and reduce costs, and in general, should be used in place of internal optimization efforts. The results of 20 such reviews conducted at Superfund-financed P&T systems are summarized in *Pilot Project to Optimize Superfund-Financed Pump and Treat Systems: Summary Report and Lessons Learned* (EPA 542-R-02-008a).

The scope of the review should be commensurate with the complexity, sensitivity and cost of the system. The cost of the review is generally small relative to the annual cost to operate the system. Such reviews are beneficial every three to five years for most systems, and can be performed in conjunction with a five year review. These reviews are particularly useful prior to rebidding a contract for P&T operation.

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## APPENDIX A

### Example Contract Highlights for Operation of a Hypothetical P&T System

#### Description of Hypothetical Site

A P&T system has been designed and installed. The construction contractor has operated the system for six months demonstrating that the system performs to acceptable standards. The contaminants of concern are primarily VOCs but natural arsenic concentrations range from 9 ug/L to 15 ug/L, and the discharge criteria is 10 ug/L. The flow rate is approximately 25 gpm. VOCs are treated with an air stripper, and a temporary metals removal system is present to reduce arsenic concentrations below the discharge standard. Vapor phase GAC is used to treat the air stripper off-gas. Ground water monitoring and capture zone evaluations are conducted quarterly. Progress reports are prepared quarterly.

It is expected that the arsenic influent concentration will decrease as the remedy progresses due to the changing oxidative state of the aquifer that results from continuous pumping. It is expected that trends will be sufficiently established in two years and that the monitoring and reporting frequencies will decrease to either semi-annually or annually and that some sampling locations will be eliminated.

#### Contract Highlights:

Scope of Work. The contractor shall perform the services and provide the products described in the scope of work in Attachment A (not shown here because details are not pertinent to this example).

Schedule and Deliverables. A schedule is provided in Attachment A (not shown here because details are not pertinent to this example).

Level of Effort and/or Pricing. As presented in the cost schedule (see next page) some tasks are fixed-price while others shall be performed on a time-and-materials basis in accordance with the unit rates provided in Attachment B (not shown).

Period of Performance. The period of performance is October 1, 2003 through September 30, 2004. The period of performance can be extended on a yearly basis through September 30, 2008, upon mutual agreement between the customer and contractor. If the period of performance is extended, the unit rates on Attachment B will be increased by 2.5% per year to account for inflation.

Payment Terms. Invoices shall be no more frequent than once per month and will be payable within 30 days after receipt of a proper invoice. Invoices shall be prepared according to cost categories specified in the contract cost schedule (see next page).

Points of Contact. The points of contact and their contact information are provided in Attachment C (not shown).

Optimization. The contractor is encouraged to recommend technical improvements that result in lower operating costs or greater system effectiveness. Recommendations shall be provided in a proposal outlining the recommendation, a suggested approach to implementation, and a cost estimate for implementing the recommendation. For those technical improvements recommended by the contractor that result in cost savings, the contractor shall receive 50% of the cost savings incurred over two years after the cost of implementation has been considered. The shared savings are based on agreed-on baselines from which to measure savings, and the savings do not apply to recommendations provided by other parties or to recommendations by the contractor that result in eliminating items or costs that are simply no longer necessary. Funds have been set aside to ensure associated shared-in-savings payments can be made according to this contract.

*Note: Other contract items might include clauses that*

- bind the contractor to work quality to acceptable standards (warranty, indemnification, etc.)*
- establish bonding and insurance requirements*
- specify inspection and acceptance clauses*
- mandate disclosing conflicts of interest*
- establish procedures for contract changes*
- provide appropriate conditions for either the customer or contractor to terminate the contract*
- designate who provides and owns the property associated with the remedy*

## APPENDIX A (continued)

### Example Contract Highlights for Operation of a Hypothetical P&T System (continued)

Contract Cost Schedule (per year):

Item	Basis	Unit Rate	# of Units	Estimated Cost
<b>Baseline Items</b>				
Project Management	FP	\$24,000	1 job	\$24,000
O&M Labor	FP	\$125,000	1 job	\$125,000
O&M Parts and Materials	T&M	varies	varies	up to \$10,000
Vapor Phase GAC Replacement	T&M	\$2.50 per pound	up to 8,000 pounds	\$20,000
Waste Disposal (including transportation)	FPU	\$200 per drum	up to 10 drums	\$2,000
Ground Water Sampling (quarterly with the potential to reduce)	FPU	\$150 per well	up to 20 wells per event, up to 4 events	\$12,000
Ground Water Analysis 8260b (including QA/QC samples)	FPU	\$110 per sample	up to 25 samples per event, up to 4 events	\$11,000
Reports	FPU	\$8,000 per report	1 report per sampling event, up to 4 events	\$32,000
Process Sampling and Analysis 8260b and 6010 (including QA/QC samples)	FPU	\$160 per sample	up to 3 samples per month	\$5,760
Utilities (paid by customer)	N/A	N/A	N/A	N/A
<b>Total Estimated Baseline Cost (without utilities)</b>				<b>\$241,760</b>
<b>Additional Items</b>				
Non-Routine Maintenance	T&M	upon authorization		
Community Relations	T&M	upon request by customer		
Meetings (including preparation)	FPU	\$2,000 per meeting, per person	upon request by customer	

*T&M - time and materials*

*FP - fixed-price*

*FPU - fixed-price by unit*

#### Notes on Example:

- Because the system is new and metals removal may not be required after the first year, system operation is contracted for one year only with up to four option years. If metals removal is still required and contractor performance is acceptable, the option years can be exercised. If metals removal is not required, a third-party evaluation may be conducted to evaluate the best approach for the remedy, and a new contract can be entered into.
- The cost schedule includes both fixed-price and cost-reimbursement terms, depending on the item.
  - GAC is required for off-gas treatment and requires replacement when breakthrough occurs. The frequency of replacement is unpredictable, especially for the first year of system operation. GAC is, therefore, addressed on a cost-reimbursement basis, and an estimate is provided in the cost schedule.
  - Costs for sampling and analysis are fixed-price on a per unit basis so that reductions can be implemented.
  - Utilities are also variable and are paid directly by the customer.
- Baseline and additional items are provided separately.
- Internal optimization is encouraged through awards but is not funded.
- Separate investigations, evaluations, and actions are contracted separately (i.e., not included).
- Costs presented are the contracted costs, presumably based on a contractor proposal.

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