Operation and Maintenance in Superfund Part 2 Internet Course

Participant Manual

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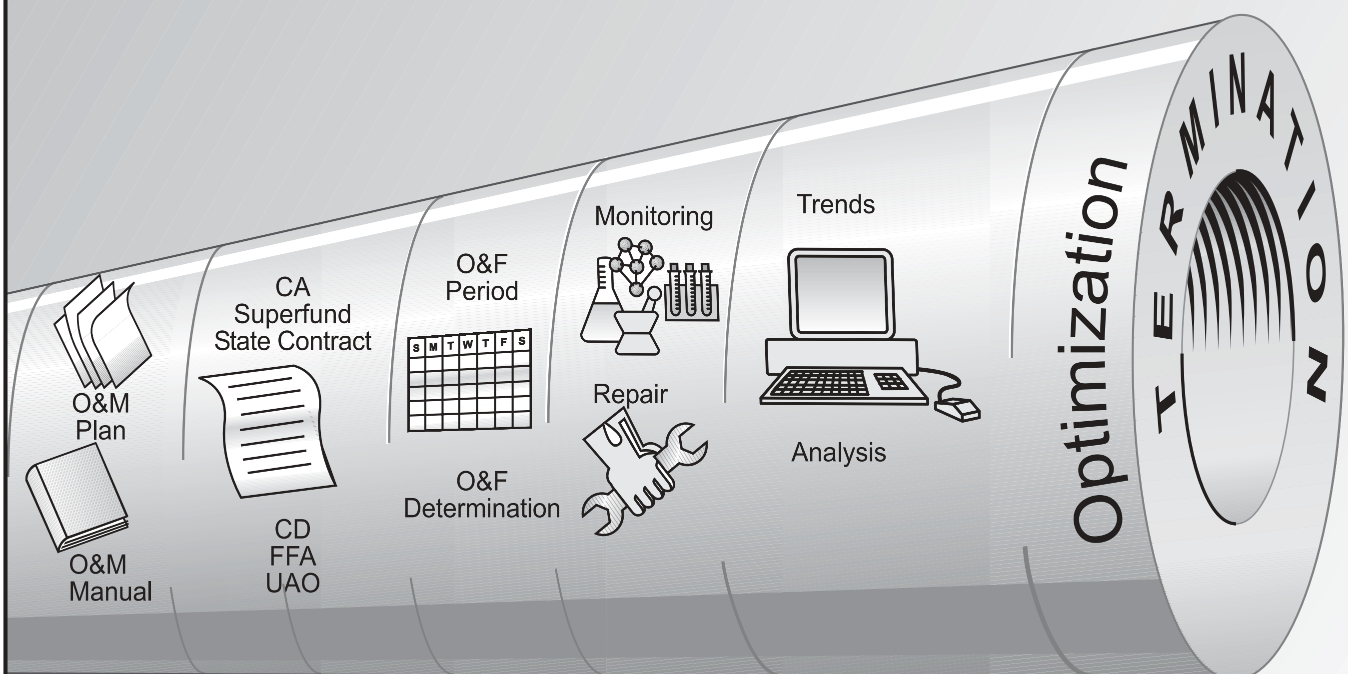


Summer 2004

Abbreviations and Acronym List

AFCEE	Air Force Center for Environmental Excellence
ALR	Action leakage rate
ARAR	Applicable or relevant and appropriate requirements
ATV	All terrain vehicle
ASTSWMO	Association of State and Territorial Solid Waste Management Officials
BTU	British thermal unit
BUREC	U.S. Bureau of Reclamation
CA	Cooperative agreement
CCL	Construction completion list
CD	Consent decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COPC	Chemical of potential concern
DCE	Dichloroethene
DNAPL	Dense non-aqueous phase liquid
ECOS	Environmental Council of States
EPA	U.S. Environmental Protection Agency
ESD	Explanation of significant differences
FCOR	Final close-out report
FF	Federal facility
FFA	Federal facility agreement
FS	Feasibility study
GAC	Granular activated carbon
gpm	Gallons per minute
H_2S_2	Hydrogen disulfide
HPLC	High performance liquid chromatography
HQ	Headquarters
IAG	Interagency agreement
IC	Institutional control
INSS	Information Network for Superfund Settlements
LR	Long-term response
LTRA	Long-term response action
LTTD	Low temperature thermal desorption
MAROS	Air Force Software Program
MCB	Monochlorobenzene
MCL	Maximum contaminant level
MNA	Monitored natural attenuation

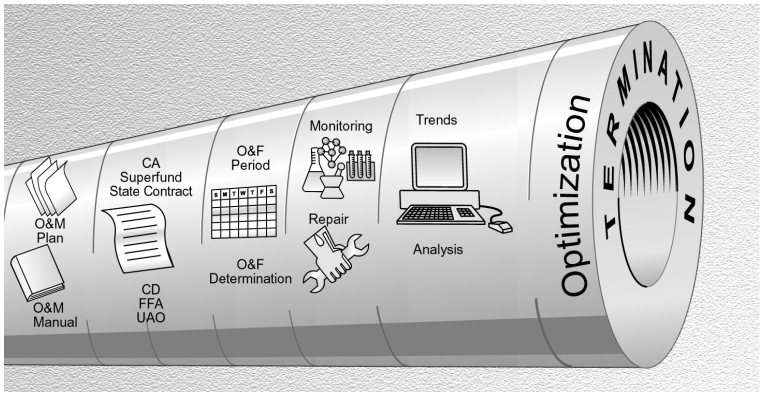
Abbreviations and Acronym List (continued)

NCP	National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan)
NOD	Notice of deletion
NOID	Notice of intent to delete
NOV	Notice of violation
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&F	Operational and functional
O&M	Operation and maintenance
ORC	Office of Regional Counsel
OSC	On-Scene Coordinator
OSRTI	Office of Superfund Remediation and Technology Innovation
OSWER	Office of Solid Waste and Emergency Response
OU	Operable unit
PCB	Polychlorinated biphenyls
PCC	Post-construction completion
PCE	Tetrachloroethene (also known as perchloroethene)
PCOR	Preliminary close-out report
POLREP	Pollution Report
POTW	Publicly-owned treatment works
ppb	Parts per billion
PRP	Potentially responsible party
P&T	Pump and treat
RA	Remedial action
RAO	Remedial action objectives
RCRA	Resource Conservation and Recovery Act
RD	Remedial design
RDX	Cyclotrimethylenetrinitramine
RI	Remedial investigation
ROD	Record of decision
RPM	Remedial project manager
RSE	Remediation system evaluation
RT3D	Groundwater model
SOW	Statement of work
SPIM	Superfund Program Implementation Manual
SSC	State Superfund contract
SVE	Soil vapor extraction
SVOC	Semivolatile organic compound

Abbreviations and Acronym List (continued)

TCE	Trichloroethene (or trichloroethylene)
TCLP	Toxicity characteristic leaching procedure
TI	Technical impracticability
TNT	2,4,6-Trinitrotoluene
TRT	Technical review team
UAO	Unilateral administrative order
USACE	U.S. Army Corps of Engineers
µg/L	Micrograms per liter
VC	Vinyl chloride
VE	Value engineering
VOC	Volatile organic compound

Welcome to EPA's Internet-Based Training
Operation and Maintenance in Superfund – Part 2



This training is sponsored by EPA's Office of Superfund Remediation and Technology Innovation.

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I-1

Notes:

General Logistical Reminders

- Phone Audience
  - Keep phone on mute
  - * 6 to mute your phone and again to un-mute
  - Do NOT put call on hold
- Simulcast Audience
  - Use ? at top of each slide to submit questions
- Links to Additional Resources
- Your Feedback

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I-2

Notes:

Specific Course Logistics

- *Operation and Maintenance in Superfund* contains two parts
  - » Part 1 presented on September 20, 2004
  - » Part 2 presented on September 21, 2004
- Slide and page numbering
  - » Slides and pages are numbered sequentially for each module beginning with a letter that identifies the module
  - » Slide and page numbers may not match because some notes are longer than one page
  - » Instructors will refer to the slide number
- Acronyms
  - » A list of acronyms used in the course is located at the beginning of the course materials

EPA I-3

Notes:

Specific Course Logistics (continued)

- Questions and Answers (Q&A)
  - » 2 Q&A sessions, at the end of most modules
  - » Instructors will do their best to address all questions
  - » Telephone audience must wait until the Q&A session to ask questions
  - » Simulcast audience may submit questions at any time
- Moderator - Therese Gioia, Tetra Tech EM Inc.
  - » 20 years of experience in all phases of the Superfund program
  - » U.S. EPA Remedial Project Manager from 1984 until 1992
  - » Broad-based experience in training development for EPA Superfund courses

EPA

I-4

Notes:

Meet Instructor Tracy Hopkins

- Biography
  - » 15 years of Superfund experience (EPA Headquarters
  - » Works on policy and implementation issues for remedial design, remedial action, and post-construction
  - » Leads an effort to develop a Superfund Post Construction Completion Strategy
  - » Involved in the development and presentation of this O&M course since 1999
  - » 8 years of Navy facilities engineering experience (NAVFAC)
  - » B.E., chemical engineering, Vanderbilt University; M.S., environmental engineering, Stanford University
  - » Professional Engineer, Virginia

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EPA I-5

Notes:

Meet Instructor Fran Costanzi

- Biography
  - » Senior EPA Remedial Project Manager
  - » Manages many different types of Superfund sites during all phases of the process
  - » Develops and reviews EPA guidance and policy regarding many different Superfund activities, including RD/RA and post-construction activities
  - » Involved in the development and presentation of this O&M course since 1999

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EPA I-6

Notes:

Course Background

- 1998 RPM survey identified O&M as an area where additional training was needed
- As a result of the RPM survey, the O&M training was first developed for and presented at EPA's National Association of Remedial Project Managers (NARPM) conference in 1999
- Developed by a team of EPA technical and program experts and Tetra Tech EM Inc. staff
- Revised and updated each year for presentation at the NARPM conference
- Simulcast on the web during the 2002 NARPM conference presentation

EPA I-7

Notes:

Review of Part 1

- Described the key definitions and concepts related to O&M at Superfund sites
  - » When O&M begins
  - » Who conducts O&M
  - » What is "operational and functional" (O&F)
  - » What is long-term response action (LTRA)
- Described planning activities for O&M during RI/FS, RD, and RA
- Described O&M considerations for specific types of remedies
- Described the activities that must occur to ensure a smooth transition to O&M

EPA I-8

Notes:

- The Part 1 Internet Seminar consisted of four modules (1) Introduction, (2) Overview of O&M, (3) Planning O&M, and (4) Transitioning to O&M. Part 2 takes up where Part 1 left off.

Preview of Part 2

- Overseeing O&M
- Optimizing remedies

EPA I-9

Notes:

- The Overseeing O&M module discusses activities conducted during O&M and examines typical problems that occur during O&M. This module describes a systematic process for collecting, analyzing, presenting, and responding to O&M data.

- The Optimizing Remedies module describes various components of remedial actions that should be evaluated to determine if optimization is possible. This module also describes EPA's optimization initiative for groundwater pump-and-treat remedies.

Objectives of Part 2: Participants Will Be Able to

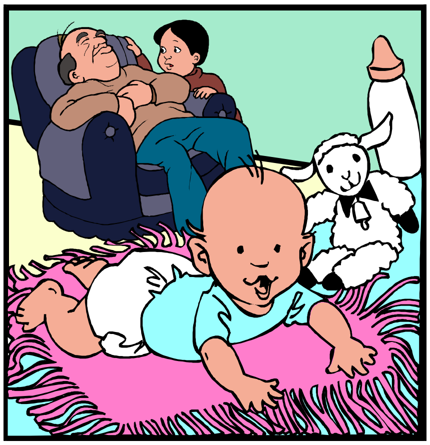
- ◆ Define major O&M oversight activities
- ◆ Describe the process for identifying, evaluating, and addressing typical problems with common types of remedial actions
- ◆ Evaluate issues related to remedy optimization

EPA I-10

Notes:

- After attending this course, participants will be better able to oversee O&M at Superfund sites and to optimize Superfund remedial actions.

Overseeing O&M



- More information on overseeing O&M can be found in Appendix A

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Os-1

Notes:

Preview of Overseeing O&M Module

- Review activities conducted when overseeing O&M
- Review O&M issues and discuss examples
- Review process for collecting, analyzing, presenting, and responding to data
- Review typical problems for different types of remedies and describe how to identify and resolve some of these problems

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Os-2

Notes:

What is meant by "O&M oversight"

- O&M activities are usually conducted by a contractor
- Oversight of O&M occurs at two levels
  - » First level
    - – State
    - – PRP
    - – Federal Facility
  - » Second Level
    - – EPA
- The entity conducting first or second level oversight will be referred to as the "reviewer"

EPA Os-3

Notes:

- O&M oversight refers to the review of the O&M activities conducted by the O&M contractor. O&M oversight occurs at two levels. The first level oversight is conducted by the entity that has the contractual relationship with the O&M contractor. Depending on the lead for the site, first level oversight will be conducted by the state, PRP, or Federal facility. EPA conducts second level oversight of O&M.

Importance of O&M Oversight

- Ensures that remedy remains effective
- Ensures that commitments are kept
- Aids with five-year review

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Os-4

Notes:

- The reviewer's responsibilities do not end when O&M begins. The reviewer must oversee O&M to ensure that the remedy remains effective in protecting human health and the environment. O&M oversight is more than just "babysitting." It requires continual review of data to ensure effectiveness of the remedy and to optimize components of the remedy. Reviewers must pay constant attention to O&M, not merely gear up to conduct the five-year reviews.

- Oversight is also necessary to ensure that written commitments for conducting O&M are kept. These commitments are contained in the SSC or CA for a fund-lead project, the CD or UAO for a PRP-lead project, and the FFA for a Federal facility-lead project. Each of these agreements has enforcement provisions in the event that commitments are not kept.

- The EPA RPM is statutorily obligated to conduct and report on the five-year review. The RPM will be able to conduct the five-year review more efficiently if he or she has been overseeing O&M.

O&M Reports and Inspections

- Ensuring that reports are submitted
- Types of reports
  - » Routine reports
  - » Annual reports
  - » Special reports
  - » Five-year review data reports
- O&M report template is available
- Inspection checklist/tickler list
  - » See checklist in the materials

EPA Os-5

Notes:

- The reviewer should ensure that the required O&M reports are submitted in accordance with the schedule and format established in the O&M manual and the controlling enforcement document. The reviewer should be involved in determining the content and format of the O&M reports and the schedule for their submittal. These details are finalized in the O&M plan and O&M manual and may be specified in an SSC, CA, UAO, CD, or FFA.

- Several types of O&M reports are usually required. The following O&M reports may be required for a given site:

  Routine reports. Routine O&M reports summarizing O&M activities performed are to be prepared for the State, PRP, or Federal facility on a regular basis (such as monthly, every 2 months, or annually) and submitted to the RPM. Routine reports include the following sections: data collection, sampling results, discharge and emission calculations, routine inspections, repairs, equipment change-outs, updates of the O&M manual and as-built drawings, community complaints and responses, and verification of the integrity of institutional controls.

  Special reports. O&M safety, emergency, and contingency plans include provisions for responding to and reporting on safety concerns; emergencies; and other unusual events such as fires, floods, or weather damage. The controlling enforcement document for the site should require that these reports be submitted to the reviewer in a timely manner.

Annual reports. The reviewer may require comprehensive annual O&M reports that summarize the O&M budget to assist in analyzing O&M activities and costs. For example, the magnitude of O&M activities performed may increase unexpectedly over time or may be significantly lower than had been estimated at the time of remedy selection. The reviewer can perform an analysis to determine (1) whether increased cost and effort were necessary simply to ensure that the remedy was functioning properly or were needed to respond to deteriorating facilities and (2) whether a pattern of decreased cost and effort is an early indicator of deteriorating care of the site. Based on such an analysis, the reviewers would consider what actions, if any, should be taken. As appropriate, a PRP may use the annual report to propose additional response actions in order to reduce O&M activities or contain costs.

Five-year review data reports. The State, PRP, or Federal facility must provide data to document O&M activities and the effectiveness of the remedy at the site. The type of data required depends on the type of remedy and may include records of equipment repairs, system modifications, sampling results, discharge and emission compliance, routine inspections, safety and emergency incidents, and verification of the integrity of institutional controls. The data reports assist the RPM in assessing the adequacy of O&M, the frequency of repairs, changes in monitoring indicators, O&M costs at the site, and how these factors relate to maintaining the remedy's protectiveness.

- EPA has developed an O&M Report Template for groundwater pump and treat remedies. The template is available online at www.clu-in.org/optimization.

- On-site inspection is a necessary part of the reviewer's oversight responsibilities. Inspections may be routine and scheduled or unannounced. The inspection checklist/tickler list is a tool to remind reviewers of the type of things they should be looking for during an O&M inspection. It is not meant to be an exhaustive list of items that must be evaluated. During a site inspection, the reviewer should observe the general condition of the site and the remedy and should look for any signs of improper maintenance. Basic site conditions, such as functioning lights and doors and well-tended grounds, may reflect a well-maintained and effective remedy. The reviewer should review on-site records and reports to assess compliance with requirements. For example, the reviewer should ensure that daily and monthly logs, discharge (air and water) reports, and sampling reports are being maintained on site and are up to date. The reviewer should also review the site's permit list to check the status of permits and whether there are any notices of violations (NOV). The reviewer should also review the O&M manual and the health and safety plan to ensure that both are up to date.

O&M Inspection Checklist

O&M Inspection Checklist

- Review O&M reports
  - Five-year review reports
  - Routine reports
  - Emergency and special activity reports
- Conduct a general physical inspection of the site, ascertaining the general condition of the remedy
  - Observe slope maintenance and any seeps
  - Check for erosion, the presence of deep-rooted plants or brush, and rodent burrows
  - Observe fence's condition
  - Observe the condition of warning/informational signs
- Review on-site records and reports to assess compliance with requirements and maintenance of the remedy
  - Operational records (daily logs, monthly reports, and so on)
  - Discharge (air and water) reports
  - Sampling (influent and effluent) reports
  - Maintenance reports
  - Permits
  - Inspection reports (such as local government or emergency safety inspection reports)
- Examine on-site documents to confirm that they are complete and up to date
  - O&M manual including as-built drawings
  - Site-specific health and safety plan
  - O&M plan at a fund-lead site
- For a groundwater remedy conduct a walk-through of the treatment plant and verify that wells are intact

EPA

Os-6

Notes:

O&M Inspection Checklist

- Review O&M reports
  - Five-year review reports
  - Routine reports
  - Emergency and special activity reports

- Conduct a general physical inspection of the site, ascertaining the general condition of the remedy
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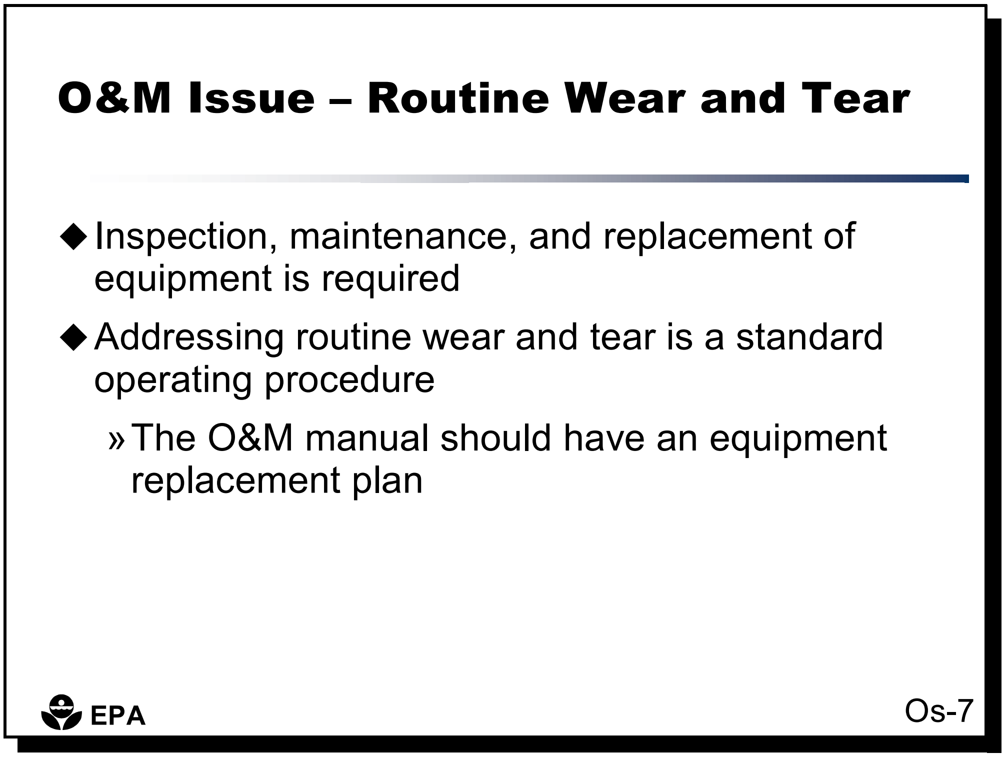

Notes:

- Components of any remedial system will be subject to routine wear and tear. The O&M manual should contain schedules for inspection, maintenance, and replacement of remedial equipment. The reviewer should ensure that scheduled equipment inspection, maintenance, and replacement activities are conducted to address routine wear and tear.

Routine Wear and Tear Example

At the New Lyme site, wells and piping had to be replaced with new materials due to iron scaling and plugging (more than expected) before transition to O&M was made.

EPA Os-8

Notes:

O&M Issue – Design Defects

- It is rare but not unheard of to discover design defects during O&M
- The designer is responsible for design defects

EPA Os-9

Notes:

- Design defects can cause a remedy to fail to protect human health and the environment. It is rare to discover design defects as late as during O&M. The designer is responsible for any design defects. The designer may argue that any system in the ground is unpredictable or that the construction rather than the design is defective. EPA's RPM, attorney, and contracting officer (for a Fund-lead site) need to work together to resolve issues associated with design defects.

Design Defects Example – Sand, Gravel, and Stone Site

- Groundwater removed via trenches and treated by air stripping
- During design phase, EPA suggested PRP consider pretreatment for high iron levels
- PRP declined but agreed to design system so pretreatment could be added later
- System was clogged with iron bacteria 3 weeks after start up
- Treatment system for iron was added

EPA Os-10

Notes:

Site Name: Sand, Gravel, and Stone Site

Site Location: Elkton, Maryland

Background: The site is a former sand and gravel quarry that was used for disposal of solvent recycling waste. The selected remedy includes pumping and treatment of highly contaminated groundwater that also has high iron levels. Several trenches have been placed at key locations on the 40-acre site, and water is pumped from the trenches to a central treatment system consisting of an air stripper.

During the design phase, both EPA and the State of Maryland recognized that iron levels in groundwater could cause problems in the treatment system, and thus they notified the PRPs of their concerns in writing. The PRPs were not planning to pretreat the groundwater in order to remove metals and steadfastly refused to include pretreatment in the design, citing cost and O&M concerns. One of the PRPs' major O&M concerns involved disposal of filter cake on a regular basis. EPA and the State ultimately decided that the PRPs could proceed with the design as planned but that if any problems arose related to the iron levels, the PRPs would have to deal with them. The PRPs agreed to this provision and built the housing unit for the air stripper with sufficient space to house a pretreatment unit.

O&M Issue: The treatment system was installed as designed. Within 3 weeks of start up, the system was shut down because of clogging attributable to iron bacteria. The PRPs also had problems with the piping system — something EPA, the State, and the PRPs did not foresee. Both iron and manganese bacteria formed in the pipes leading from the trenches to the treatment system, narrowing the openings in the pipes and greatly limiting the flow of water to the system.

How the Issue Was Resolved: The PRPs continue to struggle with the iron bacteria issue. They have installed a unit that injects a proprietary agent (FeRemede) into the treatment system to keep the iron in suspension as it goes through the system. H_2S_2 is also added at the trench wells on a regular basis. Discharge limitations for the treatment system effluent are difficult to meet because of the FeRemede and H_2S_2 (hydrogen disulfide) treatments. The PRPs continue to work on this problem.

Also, the PRPs have used a specialist to clear the pipes from the trenches to the treatment system.

Lessons Learned: During design meetings, EPA representatives should "stick to their guns," but later they should be prepared to be flexible. It is important to make sure that PRPs have (1) a comprehensive understanding of site soil and groundwater characteristics and (2) contingency plans in case things go wrong.

O&M Issue – Performance Failures

- Although the remedy operates as designed, it fails to meet remedial action objectives
- Performance failures include inability to
  - » Fully contain plume
  - » Achieve groundwater cleanup levels
  - » Meet discharge limitations
  - » Reduce infiltration

EPA Os-11

Notes:

- Remedies may operate as designed but still fail to perform as required to achieve cleanup levels or other performance standards. Performance failures include the inability to (1) fully contain the groundwater plume, (2) achieve groundwater cleanup levels, (3) meet discharge limitations, and (4) reduce infiltrations to a level that protects groundwater.

Performance Failure Example: Groundwater Containment Remedy for Reilly Tar Site

- RA: contained contaminant plume at the site boundary
- Data review: note that plume was migrating several hundred feet off site before capture
- Containment evaluation: modeled additional well influence and conducted pump tests
- Results of evaluation: installed two new extraction wells along the site boundary

EPA Os-12

Notes:

- The RA at the Reilly Tar site in Indiana involves containment of a groundwater contaminant plume. The contaminated groundwater must be contained at the site boundary. The remedy involved continuous extraction from two wells at the site boundary and discharge of the untreated water to the publicly owned treatment works (POTW).

- Groundwater levels and contaminant levels were measured monthly, and the results were plotted on contour maps. Monitoring wells were located both on and off site. The data showed that the plume was migrating several hundred feet off site before being captured by the containment system. The objective of the RA was not being met because contaminants were migrating beyond the site boundary.

- The containment system was evaluated by modeling the containment objectives of the remedy with additional extraction wells and by conducting several pump tests.

- Based on the results of the evaluation, two additional extraction wells were installed at the site boundary. Monitoring data show that the contaminated groundwater is no longer migrating beyond the site boundary. The RA is now achieving its containment objective.

What's Next?

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Notes:

Data Collection

- Types of data
  - » Operational data
  - » Monitoring data
  - » Observational data

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Os-14

Notes:

- The types of data included in O&M reports depend on the type of remedy involved. For a remedy with treatment systems, the following types of data should be included:
  - – Operational data. Operational data include all data pertaining to the treatment systems at the site, including influent concentrations, effluent concentrations, treatment efficiencies, treatment parameters and flow rates, and air and water discharge levels. The reviewer should evaluate these data to ensure that the treatment systems are operating within specified design parameters and are meeting contaminant limitations established for air and water discharges.
  - – Monitoring data. Monitoring data are provided for remedies with and without treatment systems. These data include contaminant concentrations in groundwater, surface water, and air and reflect the progress made toward achieving the performance standards in the ROD. The reviewer should evaluate these data to determine whether performance standards are being achieved as projected and to ensure that contaminants are not increasing unexpectedly. The reviewer should also conduct statistical analyses to ensure that performance and cleanup standards are being met.

– <u>Observational data</u>. Observational data are provided based on inspections. These data show the condition of the containment system and treatment systems, surface water runoff and runon control systems, and monitoring wells. The reviewer should evaluate these data to ensure that the containment system is being maintained and is functioning properly and that monitoring systems are in place.

O&M Data Analysis

- Regular analysis of O&M data is necessary
- Contaminant trends and modeling
- Operational inefficiencies
- Compliance with ARARs and performance standards

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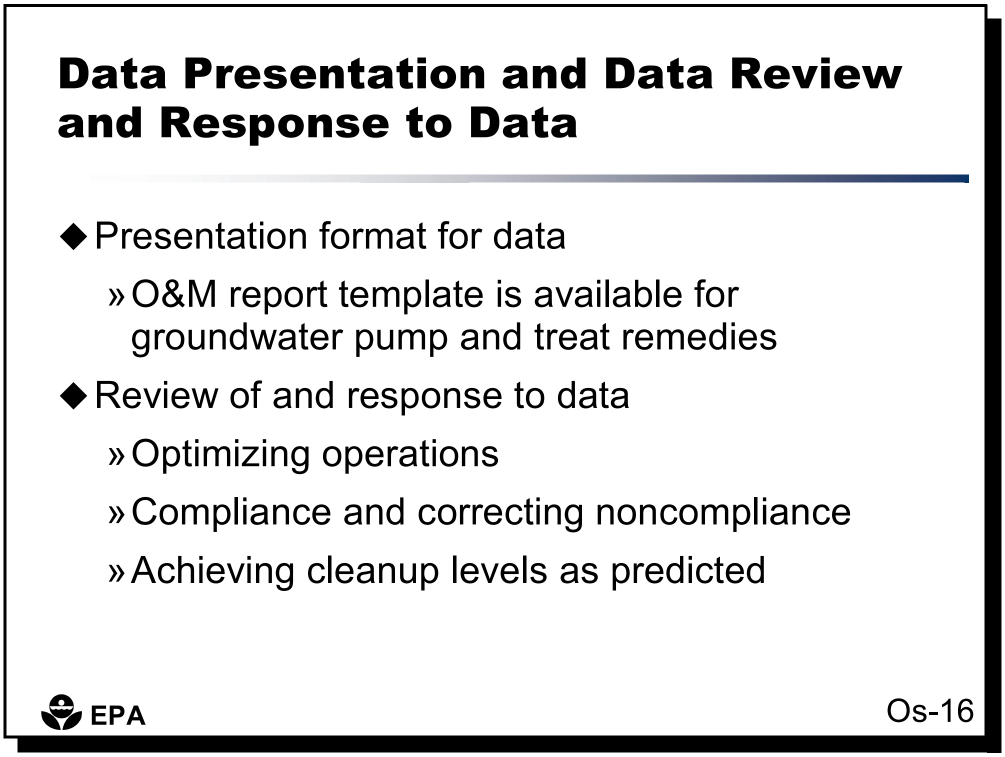
Notes:

- O&M data should be analyzed and evaluated regularly throughout the O&M period. Reviewers should strongly consider requiring routine analysis of O&M data in the O&M documents, such as the O&M plan, O&M manual, SSC, CA, UAO, CD, or FFA. If these documents have already been developed and finalized, the reviewer should request that the entity responsible for O&M analyze the O&M data. The O&M reports should not be mere data dumps. O&M data should be analyzed to determine if (1) operations can be optimized, (2) discharge limitations are achieved, and (3) cleanup standards are being achieved. The analysis should be objective and based on accepted engineering and scientific practices. For example, modeling should not be conducted using proprietary programs that are difficult to validate. Publicly available programs should be used whenever possible.

- Contaminant trend analysis is necessary to determine if (1) contaminant levels are being reduced as projected, (2) contaminant plumes are being contained, (3) contaminant plumes are expanding, (4) contaminant plumes are being fully treated, and (5) additional reductions in contaminant levels can be achieved. Contaminant trend analysis and associated modeling will assist reviewers in determining the efficacy of the remedial system, whether it is active extraction and treatment or natural attenuation. A contaminant trend analysis for groundwater should be a statistically based analysis of contaminant levels over time.

- Analysis of O&M data should identify operational inefficiencies and recommend options for improving operational efficiency. Operational inefficiencies can affect the protectiveness of the remedy (such as when problems with a treatment system cause frequent shutdowns) and costs (such as when problems with the remedy increase labor costs).

- O&M data should be analyzed to ensure that the remedy is complying with Applicable Relevant and Appropriate Regulations (ARAR) and performance standards. The analysis should include a periodic review of newly promulgated ARARs (such as Maximum Containment Level [MCL]) to ensure the remedy is still protective.



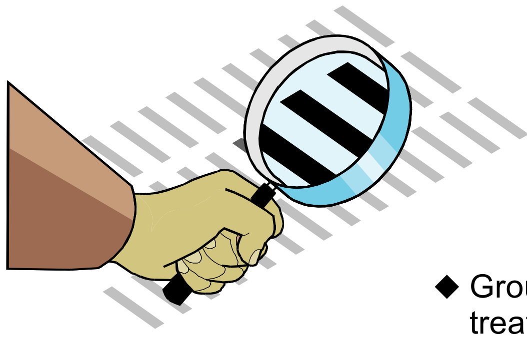
Notes:

- Data should be presented in O&M reports in such a way as to facilitate evaluation. Software improvements now allow 3-dimensional rendering of data collected over time. The reviewer should consider how data can be most effectively presented and should request a format (such as ASCII) that can be provided electronically and used easily in several different software programs. Some EPA Regions now have specified data formats.

- The reviewer must evaluate the data and the analysis and determine what types of actions, if any, should be taken. The reviewer should obtain the appropriate expertise to assist in reviewing and commenting on O&M reports, especially for complex systems or for systems experiencing problems. The reviewer can obtain assistance from in-house experts, U.S. Army Corps of Engineers (USACE), Bureau of Reclamation (BUREC), or an EPA contractor. The USACE has developed remedial site evaluation checklists that can be used by the RPM and that are part of EPA's optimization initiative. USACE assistance can be obtained through the normal IAG process.

  Every effort should be made to optimize operations of any treatment and monitoring systems. Incidents of noncompliance with discharge limitations or other standards must be corrected. The reviewer must require that the systems come into compliance and must follow up to ensure correction of every incident of noncompliance. The reviewer should also determine if the remedy is achieving cleanup levels or contaminant reductions in the time frame or at the rate predicted in the FS or design. Failure to achieve cleanup levels or reduce contaminants as predicted may indicate a problem with the remedial action.

Identifying Problems – Finding Solutions



- Groundwater restoration treatment
- Landfills
- Groundwater containment

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Os-17

Notes:

Typical Problems with Groundwater Restoration Systems

- ◆ MCLs still exceeded
- ◆ Contaminant levels not decreasing in groundwater
- ◆ Monitoring and extraction system problems
- ◆ Ineffective or inefficient monitoring system
- ◆ Treatment component redundancy
- ◆ Treatment for contaminants that are not above cleanup levels
- ◆ Vandalism and accidents

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Os-18

Notes:

- Most groundwater remediation projects have difficulty achieving MCLs. In many cases, asymptotic levels are reached and maintained for long periods. The asymptotic levels are usually above the MCLs. A statistical analysis of contaminant trends over time should be conducted to determine whether the asymptotes have been reached. If so, aggressive measures (such as using different extraction rates or system configurations) may be needed to reduce contaminant levels further.

- In some cases, contaminant levels do not decrease as expected. Sometimes this is due to undiscovered contaminant sources or the presence of a DNAPL that continue to contribute to groundwater contamination. Monitoring wells may be in the wrong locations and therefore not detecting decreases in contaminants due to differences in hydrogeologic properties.

__Example__: At the Hanscom Air Force Base, residual soil contamination was a continuing source of groundwater contamination. The soil contamination was better defined in a accelerated investigation that used a dynamic work plan and field analytical and sampling techniques. The groundwater extraction configuration was adjusted to better account for the contaminated soil.

VOCs in soil served as a continuing source of groundwater contamination at the Verona Well Field site in Region 5. Loss of VOCs from soil samples during the RI sampling resulted in underestimation of the level of VOCs in soil by at least 50 percent. The sampling technique popular at the time, split-spoon sampling and transferring soil to sample jars, caused significant VOC losses. This was demonstrated when brass sleeves were used inside the split spoon and 50 percent more VOCs were detected.

- Extraction system problems occur because of biofouling with iron bacteria, pump failure, piping failure, and insufficient design. Naturally occurring compounds in groundwater, such as iron, calcium carbonate, and others will increase O&M costs associated with extraction and treatment systems.

- Operational and compliance monitoring problems can lead to ineffective remedial operations and failure to detect problems with the effectiveness of remedial systems.

__Example__: At one site, monitoring data from permanent wells indicated that a groundwater contaminant plume was not migrating, and the Federal facility proposed to use monitored natural attenuation. To strengthen its proposal and to establish locations for additional monitoring wells, the Federal facility used a direct-push technology to sample groundwater in the "clean" area. The groundwater in this area was unexpectedly found to be contaminated. The monitoring data from the permanent wells were not reliable indicators that the plume was not migrating.

- The P&T Optimization Study noted that several systems have unnecessary redundancy of treatment components. This redundancy of components does not increase the effectiveness of the treatment system and can increase costs significantly. Both inorganic and organic treatment components of the treatment train should be reviewed to determine if the same treatment levels can be achieved by eliminating redundant components.

- The P&T Optimization Study also showed that in some cases treatment is occurring for contaminants that are not present above required cleanup levels. This may occur because RI data indicated the presence of contaminants at concentrations above acceptable risk levels but at the time the remedy is implemented, the levels of the contaminants are no longer above cleanup levels. This discrepancy may be due to sampling or analytical error or changes in groundwater chemistry since the time of the RI. Data for metals in groundwater from older RIs should be evaluated to determine if improvements in sampling techniques (low flow) affect the analytical results.

- Vandalism may be less of a problem at sites with a daily physical presence. However, many groundwater restoration remedies include remote operations. At these sites, vandalism and theft may be a problem.

***Examples**: Theft from Superfund sites is an ongoing problem. At one site, the fence was stolen for resale several times. This problem was overcome by painting the fence bright orange which gave it a low resale value. At another Superfund site, the newly installed sod was stolen. The sod had to be replaced. Orange sod was not acceptable to the property owner or neighbors.*

At one Superfund site, sand was poured into the gas tanks of heavy equipment on the site. This caused delays and additional expense for the site work.

The site trailer was severely vandalized at one Superfund site. It was blown up. No one was in the trailer at the time.

Typical Problems with Landfill Remedies

- Slope failure
- Illegal dumping
- Leakage
- Vandalism and accidents
- Settlement and ponding
- Landfill gas migration
- Leachate migration
- Surface water run-on/run-off control

EPA Os-19

Notes:

- Slope failure may occur at landfill sites with steep side slopes. At sites in the western states, slope failure may also be attributed to seismic activity. Geotechnical analyses should be performed during the design to assess the potential for slope failure and the ability of remedial systems to withstand earthquakes.

Example: *At the Operating Industries Inc. site in California, a toe buttress was installed at the bottom of a steep slope located adjacent to homes.*

- Superfund sites are prime targets for illegal dumping and illegal storage of hazardous wastes and materials. Site security can and will be breached if someone can save money by illegally dumping wastes rather than disposing of them properly.

Example: *At one landfill site, construction contractor laborers dumped their household trash at the landfill. Tracing the garbage was relatively easy because junk mail with the persons' names and addresses was found in the garbage. The contractor then had the laborers remove the material.*

- For those remedies that involve the construction of a RCRA-compliant top and bottom lined landfill with a primary leachate collection system and a leachate detection system, the action leakage rate (ALR) should be evaluated. Leakage through the cover is expected, even in well designed and operated landfills. EPA's ALR is 100 gallons per acre per day for landfills. The ALR is evaluated by measuring the leachate volumes in the leakage detection system. The RCRA regulations are written to ensure that no more than 1 foot of head develops on the bottom liner of the landfill. Leakage through double-lined systems should be evaluated and addressed as part of O&M.

Example*: At one Superfund fund site, transition to O&M was delayed because leachate was collecting in the secondary leachate collection system. The State was concerned that the amount of leachate in the secondary leachate collection system indicated that there was a problem with the bottom liner or the final cover. However, the volume of leachate in the secondary system was actually less than 100 gallons per acre per day.*

- Vandalism and trespassing are frequent problems at closed landfills, especially those that are in more remote areas. Vandalism and trespass lead to inappropriate uses of the landfills. These uses endanger the trespasser and compromise the protectiveness of the remedy.

Example*: Vagrants took up residence after the remedy was completed a Superfund site. O&M activities included preventing vagrants from gaining access to the site as well as periodic inspections to remove vagrants that circumvented access controls. Local authorities can be used to conduct frequent inspections of such sites.*

At one Superfund site, the fence is periodically knocked down or cut open by all terrain vehicles (ATV) drivers. The ATV drivers then use the site as an ATV track. This presents two problems. First, the overall security of the site is compromised when the fence is knocked down. Second, the ATVs erode the capped surface of the site. O&M activities include repair of the fence and the cap. Local police can be used to prevent ATVs from using Superfund site.

The cap of a Superfund landfill was used as an air strip. The pilot found the cap to be very suitable for landing the airplane. The pilot was informed that such a use was unacceptable and could damage the remedy.

- Many landfills exhibit settlement and ponding as a result of decomposition of landfilled wastes. Settlement should be evaluated during the design of the RA, and ponding caused by settlement should be routinely addressed as part of O&M activities.

- Landfill gas migration can be a serious ambient or in-home air problem, depending on the amount of gas generated by the landfill and the proximity of homes. Landfill gas migration to homes presents an explosion hazard because of methane and may present a inhalation risk because of volatile organic compounds, such as vinyl chloride. Landfill gas can be a nuisance problem in the ambient air and can become a health concern during temperature inversions when emission are trapped. Landfill gas management systems usually include passive venting or active extraction.

Example*: In-home air sampling conducted near the Operating Industries Inc. Landfill indicated unacceptable levels of vinyl chloride in nearby residences. The landfill gas was migrating below ground surface despite an active gas extraction and air curtain (injection) system at the landfill. The in-home sampling results caused EPA to accelerate planned upgrades to the landfill gas management system.*

- Leachate generation is not easy to predict or control at many landfill sites. Over time, leachate may migrate around a collection system and into groundwater or overland to surface water. At very large landfills, leachate may unpredictably emerge at the toe of slopes. O&M activities should include routine inspections for leachate seeps and collection and treatment of any new seeps discovered.

Example: *At the Reilly Tar site, coal tar was solidified with fly ash and disposed of on site. Periodically, seeps of coal tar were discovered in the on site disposal area. These areas were excavated and resolidified. Seepage solidification is an ongoing concern.*

- Insufficient surface water run-on controls can lead to erosion of the cap. Cap erosion can lead to the exposure of waste material and subsequent contamination of surface run-off. Both surface water run-on and run-off controls are necessary to ensure the effectiveness of a landfill capping remedy.

Typical Problems with Groundwater Containment Remedies

- Ineffective or inefficient plume capture
- Monitoring and extraction well problems
- Ineffective or inefficient monitoring system
- Vandalism and accidents

EPA Os-20

Notes:

- Plume capture problems have arisen for many groundwater remedial systems. Failure to capture a contaminant plume is usually attributable to insufficient understanding of the site hydrogeological model. New measurement tools, such as surface geophysics, borehole geophysics, and direct-push technologies, can now be used to gain a better understanding of a site's hydrogeology.

- Monitoring wells are subject to many problems, including destruction by heavy equipment or vandalism and clogging with solids or bacteria. Iron and manganese fouling of monitoring and extraction wells is common. These problems increase the cost of O&M.

Example: *At one Superfund site, pumps in the extraction wells were burning out every week because the well screens were clogged. The wells were being clogged by hard blue pellets which were the result of an unexplained biochemical reaction. Acid was added to the wells to clean them out and solved the problem.*

- Operational and compliance monitoring problems can lead to ineffective remedial operations and failure to detect problems with the effectiveness of remedial systems.

- Vandalism includes destroying and damaging of property. Accidents can also destroy and damage property or endanger on-site workers. O&M activities include repairing damaged property and implementing ideas for preventing vandalism and accidents.

Example: *Accidental damage of monitoring wells by tractors and other vehicles is common. Preventative measures to protect monitoring wells from being damaged, such as bumper posts and flagging and including the extra expense of below ground access, should be considered.*

Groundwater Containment (Hydraulic) – Ineffective or Inefficient Monitoring System – Data Collection

- Water level and water quality data from monitoring wells
- Pumping rates and drawdown levels for extraction wells
- Hydrogeological parameters of the aquifer of concern
- Confirm data quality

EPA Os-21

Notes:

- Water level data from monitoring wells is necessary to understand the directional flow of the groundwater being contained. Water quality data from monitoring wells is necessary to understand the movement of the contaminated plume. A sufficient number of wells must be installed at appropriate locations, to evaluate the effectiveness of the containment.

- The pumping rates and the drawdown levels for the extraction wells is required to determine the effectiveness of the hydraulic containment system. This data is used in conjunction with the data from monitoring wells.

- The hydrogeological parameters should already be well known based on the RI/FS and RD/RA data collection efforts. These parameters are necessary to predict contaminant transport and flow.

- The reviewer should evaluate and approve all data collection plans (QAPP) and quality assurance/quality control documentation to ensure the data collected is of sufficient quantity and quality for its intended purpose.

Groundwater Containment (Hydraulic) – Ineffective or Inefficient Monitoring System – Data Analysis

- ◆ Determine groundwater containment boundaries
- ◆ Evaluate sufficiency of monitoring wells, including number, placement, and depth
- ◆ Temporal trend evaluation of water levels and contaminant concentrations

EPA Os-22

Notes:

- The data should be analyzed to determine the boundaries of the groundwater containment system. The groundwater containment zone should be in compliance with the requirements of the ROD and RD/RA.

- The data should also be analyzed to evaluate the ability of the current monitoring well network to detect changes in the containment boundaries and the performance of the remedy. The number, placement, and depth of the monitoring wells should be examined.

- The data should be analyzed to determine how water levels and contaminant concentrations change over time. This analysis may include geostatistical modeling to determine the significance of any changes that are observed.

Groundwater Containment (Hydraulic) – Ineffective or Inefficient Monitoring System – Data Presentation and Review

- Data presentation
  - » Contaminant contour maps
  - » Groundwater elevation contour maps
  - » Report of data analysis with conclusions
  - » Raw data in useable electronic format
- Data review
  - » Obtain appropriate expertise
  - » Determine if containment boundaries comply with ROD and RD/RA
  - » Evaluate potential for optimizing pumping and monitoring
  - » As appropriate, use electronic data to conduct independent analysis

EPA

Os-23

Notes:

- The data analysis should be presented in a report. The report should include contour maps of the contaminant concentrations and groundwater elevations. The report should include conclusions about the effectiveness of the containment and monitoring systems. All deficiencies should be clearly identified. The reviewer should request that the raw data used to write the report be provided in a useable electronic format.

- The reviewer should obtain the appropriate expertise to assist in reviewing the report, if necessary. All conclusions and supporting data should be evaluated to determine if the reviewer concurs. In cases where inconsistencies exist or conclusions are not supported, the reviewer can use the electronic data to conduct an independent analysis.

Groundwater Containment (Hydraulic) – Ineffective or Inefficient Monitoring System – Response to Data

- ◆ Containment unknown or not demonstrated
  - » install additional monitoring wells to fill data gaps
- ◆ Containment not achieved
  - » change rates of pumping wells
  - » install additional pumping wells
- ◆ Containment achieved
  - » optimize monitoring system
  - » optimize pumping system

EPA Os-24

Notes:

- It is not uncommon for the data analysis to conclude that the effectiveness of the containment system is unknown or not demonstrated. Ineffective monitoring systems cannot determine if containment is achieved. This situation is not acceptable when a primary goal of the ROD is containment of contaminated groundwater within a specified area. The reviewer should respond by requiring additional monitoring wells in areas where the data gaps exist. The reviewer will then repeat the process of collecting, analyzing, presenting and reviewing the data from the new monitoring system in order to formulate an appropriate response.

- If the data shows that containment is not achieved then the reviewer should respond by requiring appropriate changes in pumping rates of existing wells or installation of additional pumping wells. Additional monitoring would then need to be conducted to ensure the changes result in containment being achieved.

- If the data shows that containment is achieved then the reviewer should evaluate opportunities for optimizing the monitoring system and the pumping system. This could include changes in monitoring frequency, monitoring parameters, or pumping rates.

Overview of O&M Termination Requirements

- Termination of O&M is most likely at groundwater restoration sites
- Performance standards must be met
- Risks must be reduced to acceptable levels
- EPA must agree to terminate O&M

EPA

Os-25

Notes:

- Termination of O&M is most likely to occur at groundwater restoration sites where no sources are left on site.

- Performance standards must be met before O&M can be terminated unless an ARAR waiver, such as the TI waiver, is issued for a particular performance standard.

- Site risks identified in the RI/FS and ROD must be reduced to acceptable levels based on the most reasonable future land use of the site before O&M can be terminated. Another risk assessment may be required to demonstrate that risks are acceptable. If institutional controls are necessary to achieve acceptable risk levels, O&M termination would not be appropriate.

- O&M cannot be terminated unless EPA agrees with doing so. States, PRPs, and Federal facilities are bound by signed agreements to conduct O&M. These parties cannot unilaterally determine that O&M should be terminated. Such a determination would violate the agreements and would be subject to enforcement actions.

Issues Associated with Indefinite O&M

- Ensuring that long-term O&M continues
- Ensuring that O&M oversight continues
- Optimizing O&M
- O&M can continue after a site is deleted from the NPL

EPA

Os-26

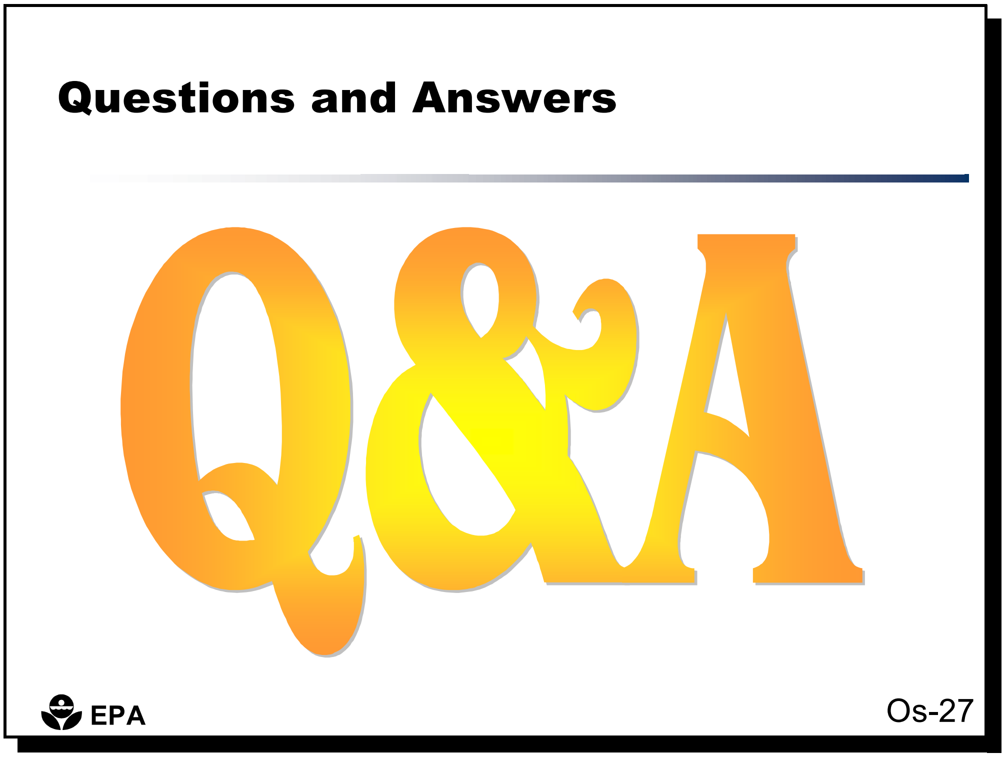
Notes:

- The RPM must ensure that arrangements are made for long-term performance of O&M activities. Many sites, such as landfill sites with large containment remedies, require O&M for indefinite periods. The continued ability of the State, Federal facility, or PRP to conduct O&M at a site for an extended period should be evaluated at least annually by the RPM.

- The RPM must ensure that O&M oversight continues at a site until O&M can be terminated. The RPM should evaluate resources available for overseeing O&M. Local officials may provide the RPM with support for conducting inspections and reviewing reports. The RPM also may use EPA contractor support, especially if optimization studies are involved, or may simply conduct the O&M oversight himself or herself. O&M agreements should be updated as necessary.

- Optimizing O&M leads to more effective and efficient O&M activities and easier oversight. Reductions in monitoring once a remedial system has operated for several years can provide great savings in both O&M costs and in the time necessary to oversee O&M.

- A site can be deleted from the NPL while O&M activities are being conducted.



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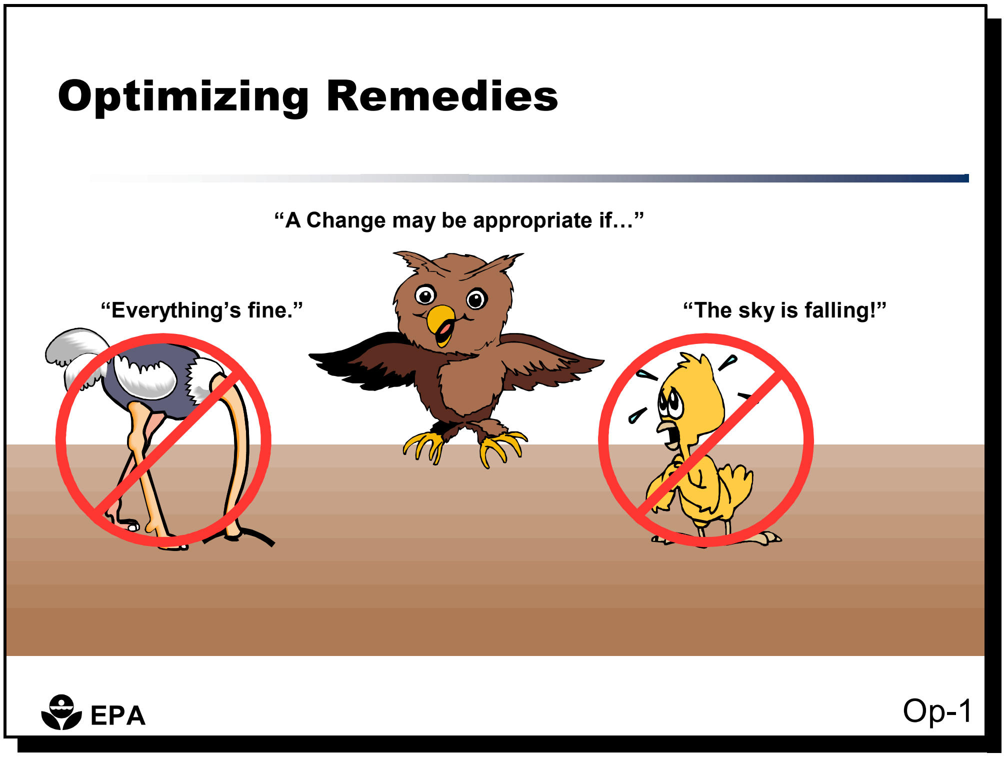

Optimizing Remedies
"A Change may be appropriate if…"
"Everything's fine."
"The sky is falling!"
EPA
Op-1

Notes:

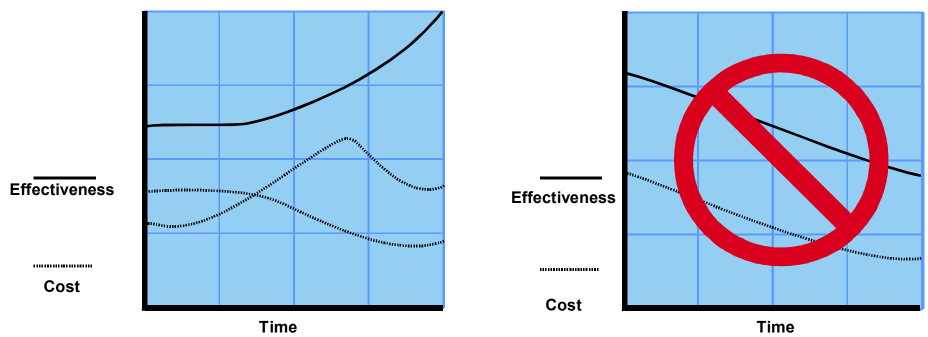
Preview of Optimizing Remedies Module

- Review goal of optimizing and potential areas for optimization
- Review results of recent optimization initiatives
- Review recent proposals for changing remedies
- Review O&M termination requirements and issues

EPA Op-2

Notes:

Goal of Optimizing



EPA Op-3

Notes:

- The goal of O&M optimization is to minimize costs while maintaining and improving the effectiveness of the remedy. Optimization does not involve sacrificing quality to achieve cost savings. Equivalent or greater operational quality and remedy effectiveness should result from optimization efforts.

Optimizing O&M Involves Evaluating Changes Over Time

- ◆ Changing site characteristics
- ◆ Available technologies
- ◆ Regulatory environment

EPA

Op-4

Notes:

- O&M may continue for many years; therefore, it is necessary to adapt to various changes that may occur over time. Optimization involves assessing (1) changing site characteristics; (2) available remediation, sampling, and analytical technologies; and (3) regulatory requirements for opportunities to realize cost savings without loss of quality. If changes are made to the O&M requirements for a site, changes may also need to be made to (1) amend the ROD or issue an ESD, (2) amend the enforcement document or agreement with the State covering O&M for the site, and (3) change the O&M plan and O&M manual. Changes in cleanup levels may require a technical impracticability ARAR waiver, which is documented in a ROD amendment or ESD.

Potential Areas for O&M Optimization Sampling and Monitoring Techniques

- Real-time monitoring
- Remote monitoring
- Field-based analytical methods as substitutes for off-site laboratory analyses
- Reduce labor costs
- Faster response

EPA

Op-5

Notes:

- Emerging sampling and monitoring techniques include taking of real-time field measurements using fiber-optic instruments and sensors with on-line analyzers. Also, the hardware and software exist for remote monitoring of system operations and on-line troubleshooting. Use of these technologies can reduce labor and sampling costs. Field-based analytical technologies can now achieve low detection limits and can generate data that are reliable for many O&M purposes. Substituting field-based analytical technologies for off-site laboratory analytical methods can save money and can allow quicker adjustments to remedial operations. There is an increased usage of screening tools, like XRFs, as quality data used for decision-making.

Example of Optimizing Sampling and Monitoring Techniques:
Umatilla Chemical Depot Groundwater Treatment Plant

- Groundwater contaminants: RDX and TNT
- Treatment method: Extraction and treatment by GAC
- Original GAC monitoring scheme: colorimetric and HPLC
- Revised GAC monitoring scheme: colorimetric
  - » Faster response to operational problems
- Cost savings: $40,000 per year for GAC; $50,000 per year for analytical procedures
  - » Real-time results
  - » Similar data quality
  - » More efficient carbon usage

EPA Op-6

Notes:

- Field-based colorimetric analyses for RDX and TNT were used as a substitute for high-pressure liquid chromatography (HPLC) analyses in an off-site laboratory to identify breakthrough in the granular activated carbon (GAC) units. The immediate results obtained from the colorimetric analyses also were used to detect and respond to operational problems. Use of the colorimetric analyses allowed more effective and efficient use of the GAC units, and a $40,000 per year cost savings attributable to more efficient carbon use was realized. Also, use of colorimetric rather than HPLC analyses resulted in a $50,000 per year savings in analytical costs according to USACE.

Potential Areas for O&M Optimization Monitoring Requirements

- Locations
- Analytes – COC's instead of TCL/TAL
- Frequency
- Compliance and cleanup levels

EPA

Op-7

Notes:

- Based on data obtained from operational and compliance monitoring, adjustments should be made to monitoring requirements. Trend analyses will be necessary to make appropriate judgments about such adjustments. These adjustments may be related to monitoring locations, analytes, or frequency. Also, such adjustments may be required to address changes in compliance and cleanup levels.

  – Locations. Site O&M and compliance monitoring requirements should be reviewed to determine whether monitoring locations should be adjusted. The locations of monitoring wells for the purpose of characterization may not be appropriate locations for monitoring the RA. For example, the points of compliance should be adjusted if the leading edge of a groundwater contaminant plume changes as a result of migration or because of the remedial system. RPMs should be aware that obtaining access for installing monitoring wells may be difficult, especially in urban areas and from property owners that are not PRPs.

  – Analytes. Adjustments to the site analyte list may be necessary because of changes in regulatory requirements (such as changes in discharge limitations) or as contaminant characteristics change. Based on operational experience, the analyte list for operational monitoring may be adjusted to include only indicator chemicals while all contaminants of concern remain on the analyte list for compliance monitoring.

– Frequency. The frequency of monitoring will be driven by (1) the need to comply with limitations established for discharges to air, surface water, and groundwater (for a system involving reinjection of treated groundwater), (2) the need to make operational decisions about the effectiveness of treatment system components (such as the need for carbon change-out, adjustments to the vacuum of a soil vapor extraction system, and adjustments to a landfill gas extraction system), and (3) the effectiveness of the remedy in cleaning contaminants. The frequency of compliance monitoring will be driven by regulatory requirements and should be adjusted to reflect any changes to the regulations. The frequency of operational monitoring should be adjusted to meet the operational needs of a particular remedial system as those needs change over time.

– Compliance and cleanup levels. Changes in compliance or cleanup levels may be necessary because of changes in regulations or based on long-term operational and monitoring data. Changes in groundwater cleanup levels will likely require a technical impracticability ARAR waiver documented in a ROD amendment or ESD. Before a technical impracticability waiver is issued, data should be reviewed to determine whether cleanup levels in the ROD can be achieved. However, under some site-specific circumstances a technical impracticability waiver may be granted in a ROD. Changes in regulations that affect cleanup levels should be reviewed to determine whether they require a change in the ARARs for a site.

Example of Optimizing Monitoring Requirements:
Reduction in Monitoring at Waste Inc. Landfill Site

- Requirement: perform quarterly monitoring of groundwater and surface water
- Data assessment: reviewed four quarters of data and included older RI data
- Proposal: reduce sampling frequency, locations, and parameters – from quarterly to semi-annual
- Changes are easier to make if a good database exists

EPA

Op-8

Notes:

- The Waste Inc. site contains a landfill. The RA requires quarterly monitoring of groundwater and surface water and analyses for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), polychlorinated biphenyls (PCB), and inorganic compounds. The UAO allows the PRPs to request reductions in monitoring frequency, analytical parameters, and sampling locations based on at least two quarters of data.

- Data from RA monitoring in 1998 (four quarters) were collected and reviewed before the PRPs requested changes in the monitoring requirements. The PRPs also evaluated monitoring data from 1996 and 1997 to provide a more complete data set and to better demonstrate any trends.

- Based on the data assessment and temporal trend analysis, the PRPs proposed to modify the monitoring requirements for the RA. Contaminant trends included decreasing concentrations at wells that were monitored; also, several sampling parameters were consistently undetected at the site. Therefore, the PRPs proposed reducing the sampling frequency, locations, and parameters. EPA responded to this proposal by incorporating many of the PRPs' requests into a revised monitoring program.

Potential Areas for O&M Optimization Extraction and Treatment System Configurations

- ◆ Placement of extraction system
- ◆ Extraction rates

EPA Op-9

Notes:

- As extraction and treatment systems operate, operational and monitoring data should be analyzed to determine system effectiveness over time. Data analyses include (1) contaminant trend analyses for points at strategic locations around and in the area of attainment and (2) hydrogeological data analyses to determine groundwater flow directions and rates in the remediation area. Direct-push techniques may be used to collect groundwater data inside or outside the contaminated zone if questions remain after review of permanent monitoring well data. The results of the contaminant trend and hydrogeological data analyses should be used to determine whether the placement of extraction trenches or wells should be adjusted or whether the extraction rates of pumping wells should be adjusted. In addition, pulse pumping or intermittent pumping may be used to change the equilibrium within an aquifer so that contaminants desorb from the aquifer solids.

Example of Optimizing Extraction and Treatment System Configuration: Remedy Enhancements at LaSalle Electric Utilities Site

- RA: groundwater extraction and treatment
- Data review: contaminant levels in groundwater not decreasing
- Problem: residual VOC contamination in vadose zone acting as continuing source
- Proposal: use of SVE with hydraulic soil fracturing
- Result: pilot test very successful, full-scale application proceeding – contaminant levels starting to decrease

EPA

Op-10

Notes:

- The LaSalle Electric Utilities site RA involves extraction and treatment of groundwater contaminated with VOCs.

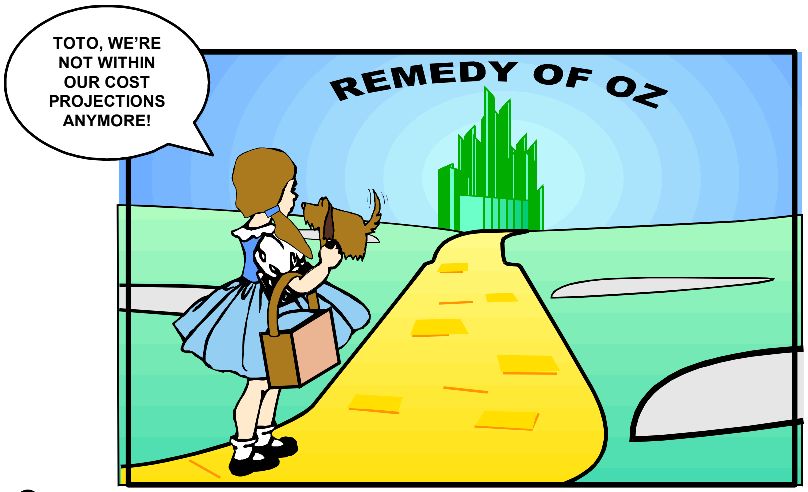
- Review of groundwater monitoring data indicates that groundwater contaminant levels were not decreasing. VOC levels remained above maximum contaminant levels (MCL) in specific portions of the groundwater contaminant plume.

- VOCs in the vadose zone served as a continuing source of groundwater contamination. The remedial system relied on natural flushing of VOCs from the vadose zone to groundwater and eventual collection and treatment of the VOCs by the extraction and treatment system.

- The PRPs conducted a focused FS to evaluate alternatives for reducing VOC levels in the vadose zone. Several technologies were evaluated, and soil vapor extraction (SVE) with hydraulic soil fracturing was determined to be the most viable alternative. SVE with hydraulic soil fracturing was pilot-tested to determine its effectiveness.

- The pilot test was very successful and the PRPs and EPA agreed that full-scale application of SVE with hydraulic soil fracturing should proceed. The design is complete and the system is operational. Contaminant levels are starting to decrease.

One Way to Begin: Follow the Yellow Brick Road



EPA Op-11

Notes:

One Way to Start: Using Detailed Cost Breakdowns to Identify Optimization Options

- Detailed cost breakdowns categorize O&M items
- Optimization options should focus on high cost O&M items

EPA

Op-12

Notes:

- The spreadsheet at the end of this module is an example of a detailed O&M cost breakdown. This type of breakdown is necessary in order to identify the high cost items that are amenable to optimization efforts. Optimization also may be conducted to enhance remedy performance, but for remedies that are performing as expected, optimization usually focuses on cost savings.

- The primary goal is to ensure the RA is achieving cleanup levels. Cost saving measures should never compromise the protectiveness of the remedy. Optimization should be conducted to enhance remedy performance. However, for remedies that are performing as expected, optimization usually focuses on cost savings. Therefore, options for optimizing the remedy should focus on the highest cost items.

Example O&M Cost Breakdown

Screening Analysis

Site: WannaBeClean Site
Scenario: 1) Current System

Discount Rate: 0.05

	Up-Front Costs	Annual Costs	# Years	Total of Annual Costs	Total Costs
O&M Costs					
-Electric	$0	$13,000	20	$170,109	$170,109
-Gas	$0	$5,000	20	$65,427	$65,427
-Materials (pH adjustment)	$0	$67,000	20	$876,716	$876,716
-Maintenance	$0	$50,000	20	$654,266	$654,266
-Discharge Fees	$0	$0	20	$0	$0
-Annual O&M	$0	$250,000	20	$3,271,330	$3,271,330
-Analytical: Treament Plant	$0	$50,000	20	$654,266	$654,266
-Analytical: GW	$0	$50,000	20	$654,266	$654,266
-Steam	$0	$80,000	20	$1,046,826	$1,046,826
-Carbon (air stripper)	$0	$5,600	20	$73,278	$73,278
-Metals Precip	$0	$45,000	20	$588,839	$588,839
-Sludge Disposal	$0	$20,000	20	$261,706	$261,706
-Chemicals	$0	$40,000	20	$523,413	$523,413
-Labor	$0	$100,000	20	$1,308,532	$1,308,532
-Spare Parts	$0	$20,000	20	$261,706	$261,706
-Other	$0	$20,000	20	$261,706	$261,706
Costs of Analysis					
-Flow Modeling	$25,000	$0	20	$0	$25,000
-Transport Modeling	$0	$0	20	$0	$0
-Optimization	$15,000	$0	20	$0	$15,000
-Other 1	$0	$0	20	$0	$0
System Modification Costs					
-Engineering Design	$40,000	$0	20	$0	$40,000
-Regulatory Process	$25,000	$0	20	$0	$25,000
-New wells/pipes/equipment	$0	$0	20	$0	$0
-Increased Monitoring	$0	$0	20	$0	$0
-Other 1	$0	$0	20	$0	$0
-Other 2	$0	$0	20	$0	$0
-Other 3	$0	$0	20	$0	$0
Total Costs	$105,000	$815,600		$10,672,388	$10,777,388

Note: All costs are in present-day dollars. The discount rate is applied to annual costs to calculate the Net Present Value (NPV).
The@PVAL function in Lotus 123 was utilized to calculate NPV, with payments applied at the beginning of each year.

Assumptions
Assume pumping rate cut by approximately 33%
Assume steam cut 33%, materials cut by 33%
Assume electric cut 20%
Assume no new wells

Optimization Initiatives

- Groundwater pump-and-treat optimization
- Long-term monitoring optimization

EPA Op-13

Notes:

- Optimization of fund-lead pump-and-treat systems began as part of the Superfund Reform Initiative. A total of 30 systems have now been reviewed, using the RSE tool. Sites are generally selected based on a review of O&M activities, cost, and schedule for transfer to the State. OSRTI has also conducted RSEs at one PRP-lead Superfund site and several sites regulated under RCRA and UST programs. The USACE has developed remediation system evaluation (RSE) checklists for various types of remedies. The USACE has conducted several remediation system evaluations with encouraging results. Sites are selected based on a review of O&M activities and costs. The RSE checklists are available at *http://www.environmental.usace.army.mil/library/guide/rsechk/rsechk.html*. USACE is also available to provide technical expertise to RPMs for evaluating remedial systems.

- OSRTI and Region 5 also are studying several long-term monitoring systems at Region 5 sites to determine ways to optimize these systems. The results will be useful in planning future monitoring systems and in optimizing existing systems.

Overview of Optimization of Fund-Lead P&T Systems Initiative

- Pilot phase included optimization reviews at 20 Fund-lead P&T systems in FY00 – 01
  - » 10 additional Fund-lead sites reviewed since pilot
- Current efforts include tracking implementation for RSE recommendations and conducting additional RSEs
- In FY04, OSRTI will launch an effort to fully integrate optimization into the overall cleanup process
- Further information about the initiative is available at *http://www.epa.gov/superfund/action/postconstruction/optimize.htm*

EPA Op-14

Notes:

- The optimization approach involves conducting a RSE, a process developed by the USACE for evaluating the cost and effectiveness of a P&T system. A team of senior engineers and hydrogeologists perform each RSE and write a report detailing the site and system characteristics, closure criteria, operational performance, and recommended modifications for improving system effectiveness, reducing costs, and gaining site closure.

- The pilot phase is now complete. OSRTI has tracked progress with the implementation of recommendations, which demonstrated that this effort offers measurable benefits in the form of cost savings and improved remediation systems.

- OSRTI will now focus resources and attention on the application of lessons learned during the pilot in order to promote remedy optimization as standard practice.

Trends from Optimization of Fund-Lead P&T Systems

- Outside expert review very beneficial
- Inadequate evaluation of plume delineation and capture zone
- Systems over-designed or treatment processes no longer required
- Excessive monitoring of treatment processes
- Inefficiencies in contracting and excessive oversight costs
- Lack of exit strategy

EPA Op-15

Notes:

- Overall, the RSEs were beneficial because they were performed by outside senior-level individuals with specific expertise in P&T systems.
- In general, the RSEs found that plumes were not adequately delineated and capture zones were not defined. Therefore, full containment and collection of the contaminant plume could not be verified.
- Systems are over-designed and components continue to be operated even after contaminants have been remediated.
- The RSEs noted excessive monitoring of treatment processes. The monitoring was not necessary to determine the effectiveness of the treatment system.
- The RSEs noted incidents of inefficiencies in contracting and excessive oversight costs.
- In general, the RSEs noted the lack of an exit strategy for the remediation systems; it had not been determined when, if ever, the remediation systems could be considered complete.

Common Obstacles to Implementation of Recommendations

- Reductions in project management and oversight costs are difficult to achieve
  - » Labor reduction is particularly sensitive
  - » Rigid contracts inhibit reductions in scope
- Project managers may be heavily dependent on contractors for technical decisions
  - » Contractors not likely to support changes that reduce costs
  - » Contractors may expend more effort/resources than required for system changes
- System changes may be incorrectly approved as value engineering

EPA Op-16

Notes:

- Reductions in operator labor account for a significant portion of the total potential cost savings from optimization. However, project managers are sensitive about laying off contractor staff, which has created a significant obstacle to implementation.

- Many contracts are structured in such a way that reductions in scope or other revisions are very difficult, which causes recommendations to be postponed until the existing contract expires.

- Project managers are heavily dependent on site contractors for technical decisions, however these contractors are not motivated to make any system changes that will result in lower operating costs (and lower profit for them). Rather, it seems many contractors are "over-implementing" recommendations by expending greater effort than is required.

- Some recommendations have been approved as value engineering (VE), which results in an award for the contractor and reduced savings to EPA. Situations where VE may not be appropriate include reductions in monitoring due to established trends, discontinued use of one portion of the treatment train once influent levels meet effluent criteria, or reductions in operator labor once the remedy operates smoothly and effectively.

Integrating Optimization into the Superfund Process

- ◆ Prioritize P&T sites to be optimized
- ◆ Provide funds for recommended system changes
- ◆ Monitor progress with implementation and provide technical assistance
- ◆ Continue to develop new tools and guidance
- ◆ Communicate openly with States and PRPs

EPA Op-17

Notes:

- The pilot optimization initiative demonstrated both environmental and fiscal benefits. As a result, optimization efforts will be fully integrated into the Superfund cleanup process. In FY04, OSRTI will release an Action Plan which will apply lessons learned and describe the key aspects of optimization as everyday business. Including optimization in routine site management efforts will ensure that the most efficient P&T systems are being turned over to the States for O&M.

- The highest priority sites for optimization will be those with the highest annual operating costs, as they likely offer the greatest opportunities for cost savings to both EPA and the States. OSRTI will also closely consider the LTRA transfer time line to ensure that recommendations can be addressed before States become responsible for O&M. Sites with protectiveness concerns will be addressed regardless of operating costs or LTRA schedule.

- OSRTI is committed to funding a number of optimization reviews each year (current estimate is 5-8 sites) and funding the implementation of recommendations.

- Current efforts to monitor implementation progress involve annual follow-up calls with project managers to discuss site-specific recommendations. This is an effective way to document cost savings and expenditures, as well as benefits and obstacles to implementation. Technical assistance is also available to project managers to aid in the implementation of system changes.

- Various technical tools are under development to apply lessons learned and help overcome obstacles to implementation, including fact sheets and training courses. Fact sheets will be described later in this course.

- It is essential that optimization efforts are closely coordinated with State counterparts because the States will be responsible for O&M at these sites. Project managers should be aware that PRPs have also begun to pursue their own optimization efforts.

Implementation Observations/ Lessons Learned

- Request funding for optimization from EPA HQ
- Involve State throughout process
  - » Revisions to SSC scope or funding may be necessary
  - » Renegotiation of discharge limitations/permits may be necessary
- Minimize delays due to contract revisions
- Avoid duplication of effort
  - » Capture zone analyses and other evaluations may complement 5-year reviews, don't wait if you don't have to
- Carefully consider on-site contractor's resistance to system changes
- Consider need for updated site decision documents

EPA Op-18

Notes:

- The implementation of optimization recommendations will receive priority funding from HQ, typically from the ongoing RA advice of allowance (AOA). The Region's should request ongoing RA funds as part of the current budget process. The Regions may need to perform additional characterization or design work in some situations. These funds would come from the Regional pipeline AOA and do not typically require coordination with HQ.

- Some recommendations may trigger revisions to either the scope or funding associated with existing SSCs. For example, if a P&T is shut down in favor of MNA, the States O&M obligation and the operating costs will be affected. Optimization efforts may also require that discharge limitations/permits be renegotiated.

- When planning system changes, site managers should minimize any delays associated with contract revisions. Of course, a more flexible contract structure will minimize these delays. Detailed guidance on this issue will be available in the fact sheet "Effective Contracting Approaches for Operating P&T systems (EPA 542-R-04-005, in review)."

- Optimization often identifies opportunities for new studies or evaluations, such as capture zone analyses or updates to the conceptual site model.

- Site managers should carefully consider the fact that their on-site contractors may stand to benefit from the implementation of recommendations that increase operating costs, and there may be cases where contractors advise site managers against changes that will reduce operating costs. Site managers should be sure to carefully review value engineering proposals with site optimization as the primary goal.

- Site managers should continuously evaluate whether optimization analyses or implementation will require changes in site remedy decision documents. Minor changes (i.e., changes in pumping rates) will not require a remedy update. Be sure to document any actions taken in the AR for the site.

Guidance – Elements for Effective Management of Operating Pump and Treat Systems

- Guidance based on lessons learned from optimization reviews of 20 P&T systems
- Primary activities of P&T management
  - Setting system goals and exit strategy
  - Evaluating performance/effectiveness
  - Evaluating cost-effectiveness

EPA

Op-19

Notes:

- The fact sheet, "Elements for Effective Management of Operating Pump and Treat Systems," December 2002, OSWER Directive No. 9355.4-27FS-A, summarizes the key aspects of effective management of operating P&T systems based on lessons learned from conducting optimization evaluations at 20 Superfund-financed P&T systems as part of the Superfund Reform Initiative. The guidance is considered relevant to any P&T system.

- The guidance describes three primary activities conducted to effectively manage a P&T system:

  – Setting system goals and exit strategy - System goals should be clearly stated with estimated time frames for achievement. The goals and time frames should be appropriate for the particular project. Measurable performance standards (metrics) should be available for evaluating the system. It should also be clear what is required in order for some or all of the P&T system to be discontinued.

  – Evaluating performance/effectiveness - Data should be evaluated to determine if the P&T system is achieving the stated short-term goals (such as preventing plume migration). Data should also be evaluated to determine if the system will likely achieve the stated long-term goals (such as cleanup to specified levels or continued containment of the plume).

– Evaluating cost-effectiveness - The P&T system should be evaluated to determine if the life-cycle cost of the system can be reduced (while maintaining effectiveness) by lowering the annual costs of O&M and/or shortening the system duration.

Continuous improvement can occur if these primary activities are routinely addressed and if modifications to improve the system are subsequently implemented.

Additional Guidance Under Development

- ◆ Cost Effective Design of Pump and Treat Systems
- ◆ Effective Contracting Approaches for Operating Pump and Treat Systems
- ◆ O&M Report Template for Ground Water Remedies (With Emphasis on Pump and Treat Systems)
- ◆ A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Sites

EPA

Op-20

Notes:

What Remedy Change Proposals Can You Expect?

- Technical impracticability waivers
- Reduced monitoring
- Amend remedies to monitored natural attenuation
- Treatment train changes

EPA

Op-21

Notes:

- Now that many groundwater restoration remedies have been operating for several years, EPA can expect to receive requests for technical impracticability waivers. So far, EPA has only granted several technical impracticability (TI) waivers. Those proposing or considering proposals for a TI waiver RPMs should be very familiar with the TI waiver guidance and with TI waiver decisions at other sites across the nation. Knowledge of the guidance and how it has been applied will assist in determining whether TI waivers are appropriate at their sites.

- Remedies that have been operating for several years and have stabilized may be candidates for reduced monitoring. Reduced monitoring can include (1) reductions in the location and number of monitoring points, (2) reduction in the number of analytes for which monitoring is conducted, (3) reductions to the frequency of monitoring, and (4) changes in the analytical methods used for monitoring.

- Groundwater restoration remedies that involve active remediation and that are experiencing reduced contaminant levels (but still above cleanup standards) are likely candidates for monitored natural attenuation (MNA) requests. However, the MNA guidance provides good suggestions about the types of determinations that should be made before MNA is selected as a remedial action. Those proposing MNA or those considering MNA proposals should be familiar with the MNA guidance and other sites where MNA has been selected.

- Proposals to change the treatment train are not uncommon such proposals may include eliminating a component of the treatment train or replacing one component with another component.

TI ARAR Waiver for Conrail Railyard Site in Elkhart, Indiana Example

- TI waiver sought for groundwater in source area
- Remedy change from groundwater restoration in source area to groundwater containment in source area
- Groundwater restoration required outside source area
- Presence of DNAPL primary reason for TI waiver request
- EPA approves request – with comments

EPA

Op-22

Notes:

- The PRPs requested a TI waiver for groundwater in the source area at the Conrail site. MCLs were the ARARs for the groundwater in the 1994 ROD. The PRPs demonstrated that sufficient institutional controls were in place and previously provided alternative water to an area around the site.

- The TI waiver is necessary in order to change the remedy from groundwater restoration to groundwater containment in the area of the source. The PRPs argue that restoration in the area of the source is not practicable and therefore propose a containment remedy that also reduces concentrations of contaminants in groundwater.

- Restoration of groundwater outside the source area to MCLs is still proposed by the PRPs. This area is downgradient of the source area and outside the Conrail property boundaries.

- The TI waiver request is supported by the presence of dense nonaqueous phase liquid (DNAPL) deep below ground surface. The PRPs argue that the DNAPL, which cannot be pinpointed for remediation, will continue to be a source for dissolved concentrations of contaminants in the groundwater at levels above MCLs.

- EPA approves the PRPs request with several technical modifications that require additional extraction and monitoring wells. EPA issues a proposed plan to change the 1994 remedy based on the PRPs request document and the technical modification to the proposal.

Questions and Answers

Q&A

EPA

Op-23

Notes:

Wrap Up for Part 2

- Your oversight of O&M is an important responsibility
- As a reviewer, you are responsible for ensuring O&M activities are conducted properly
- You can resolve problems with remedies by employing a systematic process using O&M data
- You should determine if your remedial actions have components that can be optimized

EPA W-1

Notes:

Appendix A

Overseeing O&M
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Appendix A

Overseeing O&M
Contents

1.0 Types of Operational Data to Collect for Landfill Sites

Landfills often have leachate and landfill gas management systems that must be operated, maintained, and monitored. Leachate may be collected and treated on site or off site. Landfill gas may be passively vented or actively collected and treated. Effluent and influent quality and rates should be monitored. In addition, treatment rates and efficiencies should also be monitored. Operational data should also include leachate and landfill gas generation rates under variable conditions.

2.0 Types of Monitoring Data to Collect for Landfill Sites

Monitoring data should include groundwater levels and quality and effluent/influent quality. Data regarding ambient air quality should also be collected if landfill gas generation could create an ambient air quality problem. Many states have enacted regulations regarding the allowable concentration of landfill gas over the surface of the landfill and at the boundaries of the landfill. Landfill gas monitoring should be conducted to determine compliance with such regulations.

3.0 Types of Observational Data to Collect for Landfill Sites

Observational data from periodic inspections should be collected and reported. The integrity of surface water run on and runoff controls should be evaluated and reported. The integrity of the cap and measures to maintain its integrity should also be reported, including any signs of subsidence or erosion. Periodically, the integrity of the institutional controls should be evaluated and reported. Site security measures, such as fencing and signs, should be observed and reported on periodically. Compliance with onsite safety measures, including compliance with the health and safety plan should also be observed and reported.

4.0 Analysis of Data for Landfill Sites

The O&M reports should analyze the data and determine if the various management and monitoring systems are operating at an optimum level and if not, what steps should be taken to improve these systems.

The remedy must comply with all discharge limitations and performance standards listed in the ROD. Instances of noncompliance, such as failure to meet effluent discharge limitations or ambient air concentrations, must be reported and corrected.

Site security and safety issues include institutional controls. The reviewer should require reporting on the viability of institutional controls as part of O&M. Reviewers should refer to EPA's draft fact sheet, "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls," March 28, 2000, for more information on institutional controls.

5.0 Review of and Response to Data for Landfill Sites

The reviewer should require thorough reporting of operational problems and actions taken to resolve the problems. The reviewer should also look for opportunities to optimize operations and monitoring requirements.

The reviewer must follow up to ensure instances of noncompliance are corrected. The actions taken by the reviewer to correct all instances of noncompliance should be well documented in case noncompliance becomes a continuing problem.

Failure of institutional controls can seriously jeopardize the long-term protectiveness of landfill remedies. Problems with other site security issues, such as fencing and adherence to the health and safety plan, should be evaluated and addressed by the reviewer.

6.0 Operational Data Collection for Groundwater Containment Sites

For hydraulic containment systems, operational data would include pumping rates and drawdown levels for the pumping wells. Poor pump operation may indicate a problem with biofouling or clogging of the well screen. For physical containment systems, such as a slurry wall, data would include pumping rates for the well or wells inside the wall and the groundwater level inside the wall. Other operational data would relate to the groundwater extracted under either a hydraulic or physical containment system. If the water is treated on site then the operational components of the treatment system are monitored, including influent and effluent volumes and quality and treatment rates and efficiencies. If the water is discharged without treatment, discharge rates and volumes are monitored.

7.0 Monitoring and Observational Data Collection for Groundwater Containment Sites

Monitoring of groundwater within and outside the area of containment indicate the level of containment achieved. Both groundwater quality and groundwater levels are checked to determine if the contaminated groundwater is being contained. Groundwater modeling may be conducted to assess the degree of containment achieved by the remedy.

Observational data includes inspecting wells and pumps to ensure they have not been unintentionally damaged or intentionally vandalized. In addition, site security measures, including institutional controls need to be evaluated.

8.0 Analysis of Data for Groundwater Containment Sites

The data presentation should include contaminant contour maps and groundwater elevation contour maps. Data should be analyzed to determine if the groundwater is contained in accordance with performance requirements. Changes in the rate or placement of pumping wells should be recommended if data show containment is not achieved or that optimization of the pumping rate is appropriate. Interpolation of groundwater levels should include an evaluation of the sufficiency of the monitoring points. The analysis of the data should include a temporal trend evaluation of water levels and contaminant concentrations, including geostatistical modeling to determine the significance of changes in the groundwater.

The data should indicate compliance or noncompliance with discharge limitations. Migration of groundwater contaminants beyond the containment system would also be a noncompliance issue as well as an operational issue.

The integrity of pumping and monitoring wells is important to a hydraulic containment system. Data should be used to assure the integrity of all wells in the containment system. Data on institutional controls, such as groundwater use restrictions, should also be reported. This is especially important if contaminated groundwater is beyond the site boundaries.

9.0 Review of and Response to Data for Groundwater Containment Sites

Lack of containment is the most urgent type of operational problem that may be encountered. Groundwater contaminants should not be detected beyond the containment system. The reviewer may need to require increased pumping rates or additional pumping wells for hydraulic systems. Breaches in physical containment systems, such as a slurry wall, can be repaired using techniques such as deep soil mixing or by supplementation with hydraulic containment.

For groundwater containment remedies, compliance monitoring and operational monitoring are closely linked. Compliance with the containment performance standard is paramount. Compliance with discharge limitations for treated groundwater should also be determined. CDS, UAOs, and FFAs may also contain specific requirements that must be complied with. The reviewer must ensure instances of noncompliance are quickly corrected. Monitoring can be costly. The reviewer should consider decreasing monitoring requirements (number of wells or number of analytes) if the data indicate it is appropriate. As a general rule of thumb, 8 quarters of data are usually necessary before considering changes to a monitoring system.

The reviewer must (1) determine if institutional controls are in place and effective and (2) require reporting of information necessary to make this determination. This is essential when groundwater use restrictions are relied on to ensure the protectiveness of the remedy.

10.0 Types of Operational Data to Collect for Groundwater Treatment Systems

For pump and treat systems, groundwater extraction rates are monitored. For in-situ treatment systems, chemical injection and groundwater quality data are relied on to evaluate operations. Ex-situ treatment systems are monitored by collecting data on the influent volume and quality and the effluent volume and quality. These data are then used to calculate treatment rates and efficiencies. For systems using GAC units, the carbon regeneration or change-out rates should be monitored.

11.0 Types of Monitoring and Observational Data to Collect for Groundwater Treatment Systems

Data is collected to evaluate contaminant reductions, groundwater levels, contaminant migration control, and effluent discharge concentrations. This data is used to determine progress toward meeting groundwater cleanup levels and the treatment system's ability to achieve discharge limitations. Both are compliance issues.

Observations are made of pumping and monitoring well integrity and of site security and adherence to the health and safety plan. The integrity and effectiveness of institutional controls must also be evaluated through observation.

12.0 Analysis of Data for Groundwater Treatment Systems

The data should be analyzed to determine if the treatment system is operating as predicted. Predicted contaminant trends should be evident from actual data. Additional modeling may be conducted using operational data to calibrate the model and reassess contaminant reduction predictions. The data should also be analyzed to determine if the monitoring points and analytes are appropriate and recommend increases or decreased. Data from the treatment system components should be analyzed to determine if they are operating efficiently. The results of the analysis should be recommendations for maintaining the status quo or for optimizing operations. Depending on the contaminants of concern, operational monitoring data may be collected more cost effectively using field analytical methods instead of methods which must be conducted in a fixed laboratory.

The data should be analyzed to determine if standards are being complied with. This includes groundwater cleanup standards as well as discharge limitations for treated groundwater. Instances of noncompliance should be highlighted.

Data should be presented that indicates the level of adherence to the health and safety plan and the integrity of site security. Institutional controls should be analyzed to determine if they are effective.

13.0 Review of and Response to Data from Groundwater Treatment Systems

The reviewer should respond to recommendations made in the analysis of O&M data. Operational problems should be corrected because they may affect the quality of effluent (compliance issue) or may cause a complete shutdown of the system. The reviewer may also need to make recommendations for changes to the remedy if operational problems affect the protectiveness of the remedy. The reviewer should also look for opportunities to lessen requirements (such as monitoring) if the protectiveness of the remedy will not be affected.

Failure to meet discharge limitations is serious and should be addressed immediately. Achievement of groundwater cleanup standards is evaluated over time and therefore requires a more considered approach. Contaminant trend analysis should be statistically based so that uncertainty in decision making can be reduced to an acceptable and known level. The reviewer must be able to verify all modeling conducted to predict contaminant migration and reductions. Other requirements, such as reporting, also impact compliance. The reviewer must ensure that all instances of noncompliance are corrected. The reviewer is responsible for documenting each instance of noncompliance and the actions taken in response to the noncompliance.

The reviewer should evaluate all data regarding site security and respond to any recommendations made in the O&M reports. The reviewer should ensure data is collected and analyzed regarding the effectiveness of institutional controls.

14.0 Five-year Review Requirements

A statutory 5-year review is conducted within 5 years after initiation of the first RA at a site. The date of RA initiation is the date that the PRP or RA contractor mobilizes to start construction. This date is a Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) subevent, "RA On-Site Construction." A policy 5-year review should be initiated within 5 years of completion of physical construction at a site. For the purpose of triggering a policy 5-year review for a site, "completion of physical construction" refers to the date that the site qualifies for listing on the construction completion list (CCL). A site qualifies for listing on the CCL at the time of signing of the PCOR or FCOR. Completion of physical construction is documented as a CERCLIS event.

The following activities are conducted during 5-year reviews:

- Document review
  - ROD
  - ROD summary
  - Settlement agreement
  - O&M information
  - Monitoring information

- Standards (ARAR) review
  - Changing standards
  - Risk evaluation
- Site visit
  - Visual inspection
    - Site
    - Institutional controls
  - Interviews
    - Neighbors
    - Contractors
    - Local governments

- Report - contents
  - Introduction
  - Remedial objectives
  - ARARs review
  - Summary of site visit
  - Areas of noncompliance
  - Recommendations
  - Statement of protectiveness
  - Next review

The level of effort for 5-year reviews for completed and active sites is different.

Institutional controls specified in the ROD must be in place for a completed remedy to be considered protective of human health and the environment. The 5-year review must confirm that institutional controls are not only in place but are effective in limiting uses of the site to those deemed appropriate for the level of cleanup attained. Institutional controls should be checked by ensuring any required proprietary controls have been recorded in the deed. Deeds are available for review in the county recorder's office. Inspection of the site should be conducted to observe current uses.

The RPM should involve the community in the 5-year review process. The community should be notified of impending 5-year reviews, and the results of the reviews should be made available to the community in the information repository for the site. Availability sessions or informational meetings may also be held, depending on the interest of the community.

A copy of the Comprehensive Five-Year Review Guidance, dated June 2001, can be obtained at *www.epa.gov/superfund/resources*.

15.0 EPA Recordkeeping Requirements

All planning and reporting documentation for O&M should be maintained in the remedial file for the site. The location of this file will usually be in the Regional Records Center. The file should be well organized so that information can be easily found.

The RPM should keep several O&M documents at his or her desk if retrieving documents from the Regional Records Center is not convenient. Both the O&M plan and O&M manual should be kept on hand. In addition, the most recent O&M reports should be kept on hand for reference in case community members or local officials have questions and for comparison to the next O&M report submitted.

16.0 Resources for O&M Oversight by EPA

The RPM may use others to assist in overseeing O&M activities at a site. Technical assistance can be obtained from USACE (via an interagency agreement), an EPA contractor, and community members with appropriate technical expertise. In-house expertise may also be available within the regional office or through the Engineering Forum, Groundwater Forum, Federal Facility Forum, or the Environmental Response Team.

In some cases, the RPM may need assistance with legal issues. The Office of Regional Counsel (ORC) should be consulted regarding (1) issues associated with establishment and enforcement of institutional controls and (2) violations of the terms of an SSC, CA, CD, UAO, or FFA.

Reference Section of Web Sites

Reference Documents and Web Sites for Downloading

1. U.S. Environmental Protection Agency (EPA), Close Out Procedures for National Priorities List Sites, January 2000, OSWER Directive 9320.2-09A-P, PB98-963223
http://www.epa.gov/superfund/resources/closeout/index.htm

2. EPA, Operation and Maintenance in the Superfund Program, Final Fact Sheet, May 2001, OSWER Directive No. 9200.1-37FS, EPA 540-F-01-004
http://www.epa.gov/superfund/resources/sheet.pdf

3. EPA, Remedial Design/Remedial Action Handbook, June 1995, OSWER Directive 9355.0-04B, PB95-963307
http://www.epa.gov/superfund/whatissf/sfproces/rdrabook.htm

4. EPA, Institutional Controls: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups, September 2000, OSWER Directive No. 9355.0-74FS-P, EPA 540-F-00-005
http://www.epa.gov/superfund/action/ic/guide/guide.pdf

5. EPA, Institutional Controls: A Guide to Implementing, Monitoring, and Enforcing Institutional Controls at Superfund, Brownfields, Federal Facility, UST and RCRA Corrective Action Cleanups, February 2003, DRAFT
http://www.epa.gov/superfund/action/ic/guide/icgdraft.pdf

6. EPA, Comprehensive Five-Year Review Guidance, OSWER Directive No. 9355.7-03B-P, June 2001
http://www.epa.gov/superfund/resources/5year/index.htm

7. EPA, Superfund Post Construction Completion Activities, OSWER Directive No. 9355.0-80FS, June 2001
http://www.epa.gov/superfund/action/postconstruction/pcc_act.pdf

8. EPA, Superfund Post Construction Completion: An Overview, OSWER Directive No. 9355.0-79FS, June 2001
http://www.epa.gov/superfund/action/postconstruction/pcc_over.pdf

9. EPA, Elements for Effective Management of Operating Pump and Treat Systems, OSWER Directive No. 9355.4-27FS-A, December 2002
http://www.epa.gov/superfund/resources/gwdocs/ptfactsheet.pdf

10. EPA, Transfer of Long-Term Response Action (LTRA) Projects to States: Fact Sheet, OSWER Directive No. 9355.7-08FS, April 2003
http://www.epa.gov/superfund/action/postconstruction/operate.htm