

Module 05
Achieving Success: Practical Solutions to
Corrective Action Challenges



**RCRA Corrective Action Training
Program: Getting to YES!**
Strategies for Meeting the 2020 Vision



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Notes:Purpose

- Holder slide for Module 5, Achieving Success: Practical Solutions to Corrective Action (CA) Challenges.

Key Points

- This is a holder slide. No specific key points.

References

- None.



Module 5

Achieving Success: Practical Solutions to Corrective Action Challenges

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Notes:Purpose of Slide

- Holder slide for Module 5, Achieving Success: Practical Solutions to CA Challenges.

Key Points

- No specific key points.

References

- None.



Module Overview

- ❖ Identify general principles for implementing practical solutions
- ❖ Review practical approaches to
 - Remedy selection and implementation
 - Field investigations and assessment

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Notes:

Purpose of Slide

- This module reviews how the Resource Conservation and Recovery Act (RCRA) CA program can be implemented using flexible, practical approaches to expedite cleanups.

Key Points

- In order to discuss implementing CA in the real world, we will discuss:
 - General considerations for implementing practical solutions; and
 - Use of results-based, practical approaches to remedy selection, remedy implementation, and field investigations.

References

- None.



General Principles for Implementing Practical Solutions

1. Science and engineering are the solutions; reports document them.
2. The process is not linear.
3. EPA encourages practical approaches.
4. Regulatory approval is not necessary for every decision.
5. The “traditional” process is a guide, not a list of requirements.

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Notes:

Purpose of Slide

- Summarize key principles for proactive CA processes. Each of the points on this slide will be elaborated further in subsequent slides.

Key Points

- Science and engineering are the solutions; reports document them. This theme was discussed previously in Module 2. *Think progress versus process* (Principle 7 of the 8 principles covered in Module 2).
- The process is iterative, not linear – a number of activities leading to site cleanup can be performed concurrently.
- EPA encourages practical approaches to selecting and implementing remedies.
- Regulatory approval is not necessary for every decision.
- The “traditional process” is a guide, not a list of requirements. After many years of experience in implementing the CA process, improvements in implementation that move beyond the traditional CA process can lead to significant time and cost savings without sacrificing environmental results.

References

- None.



1. Science and Engineering are Solutions

- ❖ Determine extent and risk, P.G.
 - Evaluate hydrogeology and chemistry
 - Predict migration, natural attenuation
- ❖ Design remedies and solutions, P.E.
 - Construct and operate
 - Evaluate effectiveness

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Notes:

Purpose of Slide

- Emphasize that the real goal of the CA Program is to get remedies in place, not to generate reports.

Key Points

- Remedial solutions will be selected, engineered, and constructed by professionals. Work plans, reports, and other documents support their efforts but they should not be more important than implementing a timely and effective cleanup. In addition to professional geologists (P.G.) and professional engineers (P.E.), some states have additional certifications such as Licensed Site Professionals (MA) and Licensed Environmental Professionals (CT).
- Real environmental progress is achieved when the remedy is constructed, not when a report is submitted.
- Major environmental reports require significant resources and can take months or years to finalize. If no remediation progress is made while work plans or reports work their way through the review and approval process, the process wins out over progress.
- The challenge for each Project Manager is to identify a streamlined reporting process that satisfies his or her needs for current and relevant information, but also maintains remediation progress at the site.
- At some points in the CA process, reports and associated reviews will be needed; these reports should be integrated into the CA timeline where they will be out of the project's critical path.

References

- None.



Effective Documentation/ Reporting

- ❖ **Purpose**
 - Establish and track schedule
 - Certify technical soundness, safety, QA/QC
 - Document decisions
- ❖ **Content and design**
 - Dynamic: for real-time decisions
 - Informal: e-mail or teleconference with minutes
 - Short: Tables and figures: minimal text
 - Clear: Decision matrices
 - Certified: Registered or licensed professional

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Notes:

Purpose of Slide

- Describe the appropriate role of documentation in the CA process.

Key Points

- If work plans are clear and succinct, they help to guide field and other activities (including the tracking of schedules) and help to streamline reporting on those activities. If the goals and protocols for a planned activity are well documented in the work plan, the resulting report can often refer back to the work plan, without additional discussions of procedures. Work plans and project documentation should be used strategically – to guide activities and document the rationale for important decisions.
- In most cases, the content and design of documents should be planned up front by the owner/operator (o/o) and agency. Goals for content and design can include documentation/reporting that is:
 - Dynamic – Documents should be dynamic, supporting real-time decisions.
 - Informal – Frequent, shorter communications can ensure all parties are on the same page. As much as is practicable, informal project updates and status reports (for example, e-mails and phone calls) can take the place of lengthy written status reports.
 - Short – Most seasoned report reviewers look first at conclusions, tables, and figures – the information-dense parts of a report. That is where most of the emphasis should also be placed in generating reports (not on lengthy discussions of site background and investigative procedures used [unless these are important to understanding the site]).
 - Clear – Decision rules should be incorporated, where feasible. Decision matrices and flow charts are one way to communicate decision points.
 - Documented – Professionals in their field (engineers, geologists, other state-licensed environmental professionals), generally should seal documents to certify their review and approval of the content. These certifications put a professional's reputation and registration behind the findings or approach.

References

- None.

Minimal, Dynamic Work Plan

PILOT TEST INSTALLATION

Bioremediation Work Plan

Approved in 48 Hours

EXAMPLE

Bioremediation Work Plan

OBJECTIVES:

- Reduce the effectiveness of bioremediation to reduce groundwater concentrations of 1,1-DCE and other VOCs to meet Groundwater Protection Standards (GPS) in the three monitoring wells (MW-1, MW-2, MW-3).
- Decrease the cost of bioremediation.
- Decrease the volume of subsurface injection of emulsified water (EW) and a bioremediation chemical (BIOREMEDIATION CHEMICAL).
- Develop design proposals for full-scale implementation.

PILOT TEST AREA

- Area of 4' x 4' x 4' (Figure 1) ranging to 1' x 1' around within the lower confined aquifer.
- Completion of monitoring of existing or existing well 11.6 located in the pilot test area for September 2004 and October 2004.
 - September 2004: 1,1-DCE = 1.1 µg/L, 1,1-DCA = 7.8 µg/L, Benzene = 1.4 µg/L, Toluene = 1.1 µg/L, Xylenes = 1.1 µg/L, and VOC = 1.1 µg/L.
 - October 2004: 1,1-DCE = 1.1 µg/L, 1,1-DCA = 7.8 µg/L, Benzene = 1.4 µg/L, Toluene = 1.1 µg/L, Xylenes = 1.1 µg/L, and VOC = 1.1 µg/L.
- Completion of 1,1-DCE up to 100 µg/L with new concentrations of 1,1-DCE, 1,1-DCA, Toluene, Xylenes, and VOC should be reported at their peak monitoring-related groundwater plume, located from the area shown in Figure 1.
- Full monitoring to be used for pilot test.
- Full monitoring to be used for pilot test.
- Groundwater monitoring to be used for pilot test.
- Groundwater monitoring to be used for pilot test.
- Groundwater monitoring to be used for pilot test.
- Groundwater monitoring to be used for pilot test.

Notes:

Purpose of Slide

- Provide an example of streamlined, but effective, documentation/reporting.

Key Points

- A bioremediation work plan was needed to implement bioremediation as an interim measure (IM) for volatile organic compounds (VOCs) in groundwater.
- E-mails and phone conversations (informal communications) were used to lay the initial groundwork for the work plan and to identify and address issues.
- Based on the initial communications, a concise work plan (6 pages) was submitted to the State, comprised mostly of tables, figures, and flow charts – text was minimal.
- The State reviewed and approved the work plan in 2 work days.
- This example points out the value of:
 - Effective, informal, communication and discussion of issues as an integral part of preparing formal documents; and
 - The value of short, information-dense documents.

References

- None.



2. Process Should Not be Linear

- ❖ Implement short-term stabilization before the assessment is complete
- ❖ Combine documents – such as Remedial Facility Investigation (RFI) and Corrective Measures Study (CMS)
- ❖ Evaluate risk first to identify exposure pathways

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Notes:

Purpose of Slide

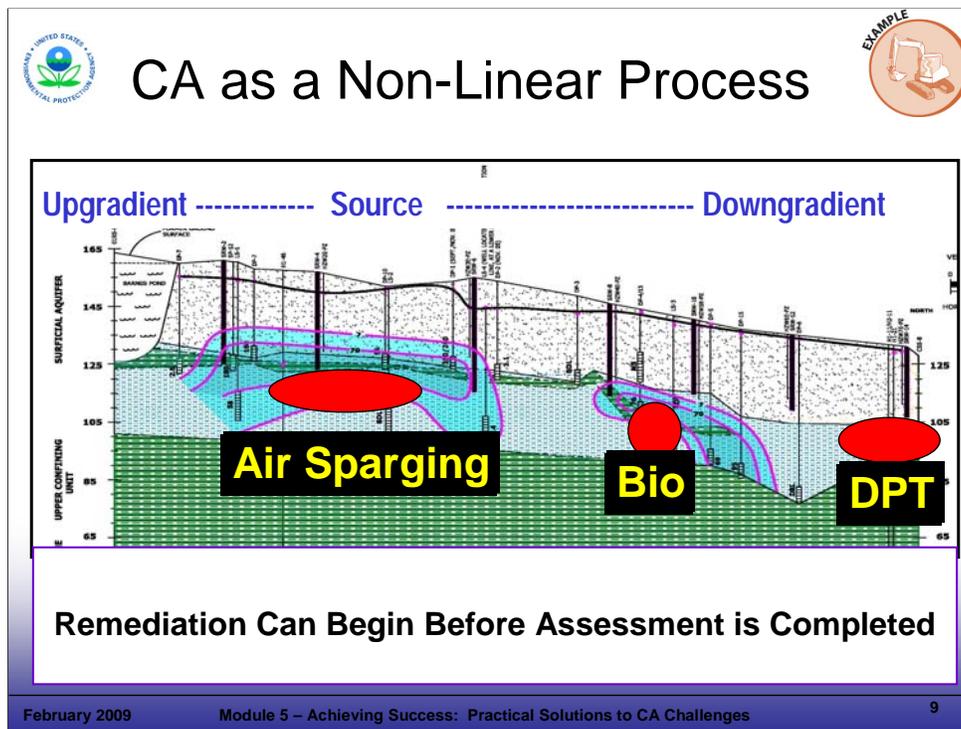
- Emphasize that CA is an iterative process.

Key Points

- In some cases, it makes sense to begin to implement remedial action before assessment of the site is completed. It can take years to characterize a complex site completely. During this time, IMs and other site stabilization activities can be implemented based on the information collected to date. For example, if a concentrated source area of groundwater contamination is identified during a site assessment (RCRA Facility Investigation [RFI]), implementing a source control action (for example., excavation, pump and treat, partial nonaqueous phase liquid [NAPL] removal or containment) may help to address the principal threat at the site and to reduce the overall timeframe and cost of site cleanup while the site investigations continue.
- Combining several traditionally separate documents (for example, RFI and Corrective Measures Study [CMS]) into one submittal can save substantial time in the overall project schedule, as well as saving on production costs and reducing agency review time.
- A timely evaluation of the potential exposure pathways and risks posed by a site can be used to focus site assessment activities and remedy considerations to those pathways and receptors that comprise the significant risks.

References

- Federal Register (FR). 1996. Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities, Advanced Noticed of Proposed Rulemaking (ANPR). 61 FR 19432. May 1.



Notes:

Purpose of Slide

- Present a case study of CA implementation through a non-linear CA process.

Key Points

- In the case of groundwater contamination with VOCs, two different remediation pilot studies (bioremediation and air sparging) were implemented during the ongoing site assessment (direct push technology [DPT] and well sampling) to address different source areas.
- Air sparging was implemented in an upgradient area of shallow groundwater contaminated with VOCs.
- Bioaugmentation was implemented in a downgradient area of deeper groundwater contaminated with VOCs, where air sparging was ineffective.
- By monitoring the effects of these pilot studies on contaminant levels and other site conditions over time, a good understanding of the remediation dynamics of the site was developed and these pilot systems were expanded and used as permanent remedies for the site.

References

- None.



3. EPA Encourages Practical Approaches

- ❖ Tailored oversight
- ❖ Facility-lead agreements
- ❖ Performance-based permits

Be creative

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Notes:

Purpose of Slide

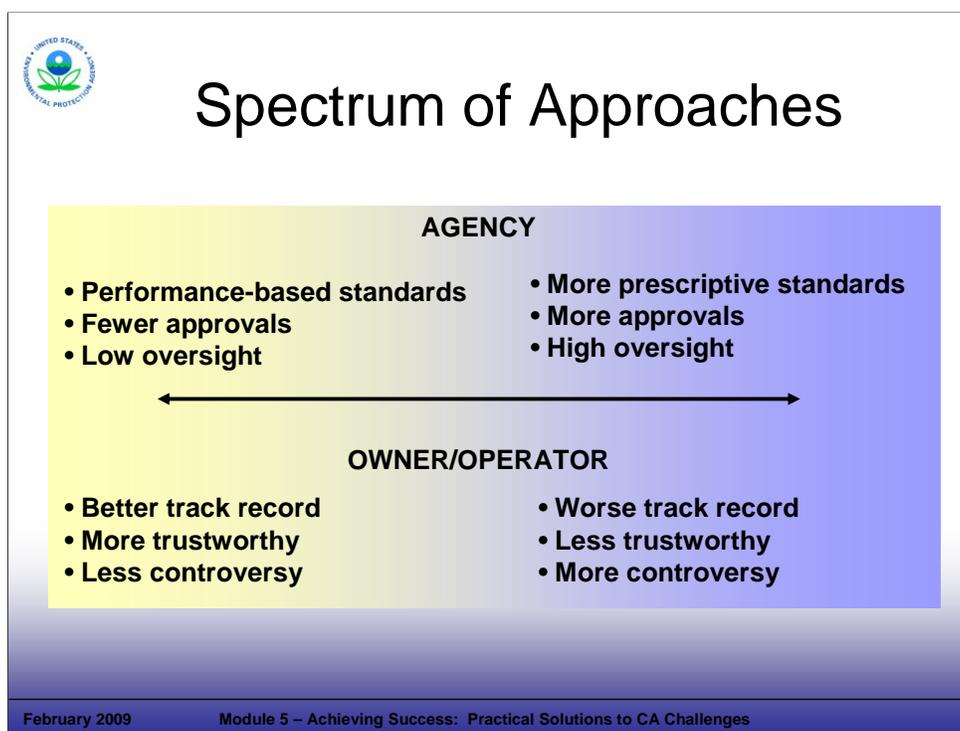
- Reiterate that EPA encourages practical considerations in the “process” because implementation challenges are rarely predictable. Emphasize CA program elements that support practical solutions.

Key Points

- Tailored oversight – The level of facility oversight should be based on facility-specific factors such as the facility’s past track record, capabilities, level of trust, and other factors.
- Facility-lead agreements, permits, orders, and other agreements such as voluntary agreements – Use creativity in applying these mechanisms.
- Performance-based permits – Set performance-based standards to allow the focus to be long-term and on results, rather than short-term and on process. Ideally, the regulator establishes clear and reasonable performance standards in the CA order or permit. The facility must meet these standards, but has flexibility in determining how the standards are met.

References

- EPA. 2003. Results-Based Approaches and Tailored Oversight Guidance for Facilities Subject to Corrective Action under Subtitle C of the Resource Conservation and Recovery Act. EPA 530-R-03-012. September.
- FR. 1996. ANPR. 61 FR 19432. May 1.

**Notes:**Purpose of Slide

- A range of approaches and mechanisms are available to achieve CA. The project manager must select the right approach on a facility-specific basis.

Key Points

- If an owner/operator (o/o) is more cooperative, the regulatory agency should be willing to provide greater flexibility.
- The o/o's track record (e.g., compliance history, technical capability) is one of the key factors that an overseeing agency should consider when deciding the appropriate level of flexibility.
- Generally, o/o's that demonstrate more cooperation and technical capability are better candidates for facility-lead or voluntary approaches. On the end of the spectrum are recalcitrant o/o's that are better candidates for enforcement approaches.

References

- None.

EXAMPLE

Tailored Oversight

DECLARATION OF RESTRICTIVE COVENANT
 THIS DECLARATION OF RESTRICTIVE COVENANT (hereinafter "Declaration") is made this ____ day of _____, 200 __, by {{property owner -}} {{a corporation authorized to conduct business in the State of Florida, -- if applicable (hereinafter GRANTOR) and the Florida Department of Environmental Protection (hereinafter "FDEP")

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Notes:

Purpose of the Slide

- Provide an example where the facility and regulators are working together to expedite cleanup activities to facilitate demolition of an existing manufacturing facility, and to allow redevelopment of the site for use as a large, high-end commercial development (upper right photograph on slide). The cleanup is under a state Voluntary Cleanup Program.

Key Points

- The previous owner, who is responsible for site cleanup, is working closely with the new owner and State agency to clean up the site as demolition occurs, and between demolition and new construction.
- The picture in the upper left shows interim groundwater recovery operations. Note the monitoring well in the lower left photograph – the demolition contractor must keep wells that were not abandoned intact so sampling can continue as long as possible. Similarly, a geologist is sampling where the building used to stand (photograph at the lower right).
- Expedited cleanup is essential to the previous owner, who hopes to remediate the property to no further action levels with ICs – hence, the draft Declaration of Restrictive Covenant for the property (as shown on the slide). Further cleanup during or following new construction would be far more complex and expensive than remedial operations before and immediately following demolition.
- The stakeholders - the previous owner, new owner, and State agency - are successfully working together on practical solutions, primarily through frequent meetings, calls, and emails. There is minimal process involved in this project – it's all progress!

References

- None.



Facility-Lead Agreement University of VA



- ❖ Agreement: 1999, after 2 months to develop
- ❖ RFI: 16 months after EPA's on-site evaluation
- ❖ Statement of Basis: 2003
- ❖ CA Complete without Controls: 2004



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Notes:

Purpose of Slide

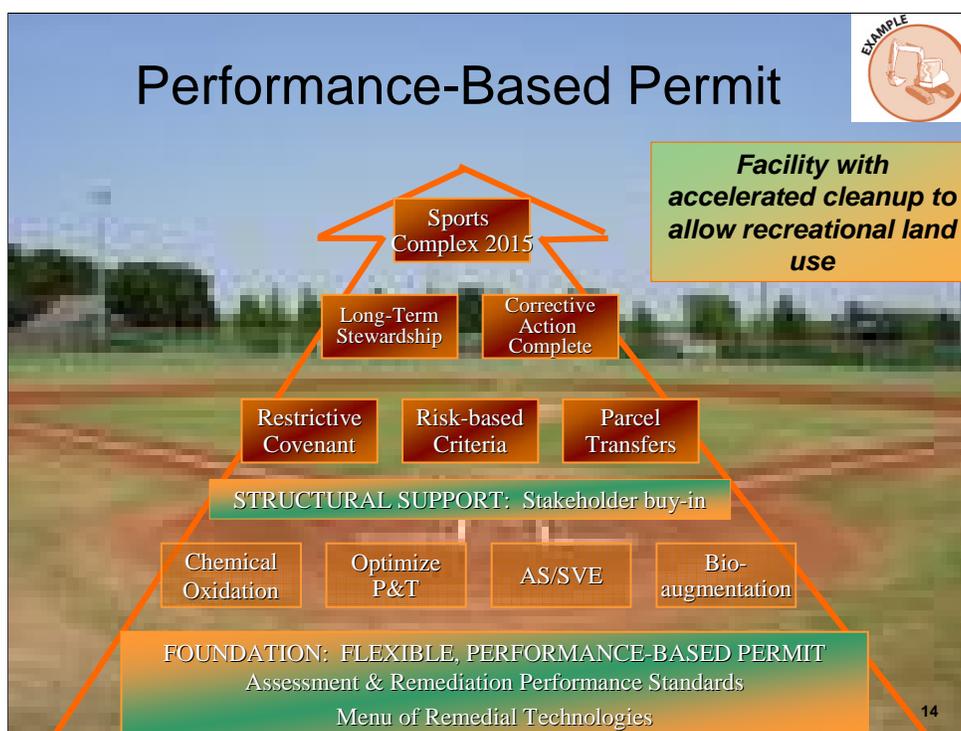
- Provide an example of a successful Facility-lead Agreement.

Key Points

- In 1999, EPA Region 3 identified the University of VA (UVA) as a high-priority facility on its RCRA Government Performance Results Act (GPRA) baseline, and there was no state or federal cleanup mechanism in place with the facility driving investigation and remediation of areas requiring cleanup (if any).
- After inspecting the facility in September 1999 and consulting with the VA Department of Environmental Quality (VDEQ), Region 3 determined that UVA was a good match for conducting CA investigations under the Region's new Facility Lead Program. This was the first such agreement put in place. The Facility-Lead Agreement required UVA to provide a site investigation schedule, a data quality assurance plan, time frames for achieving environmental indicators (EIs), and a plan for public participation. UVA was identified as a good candidate for the program as it had voluntarily begun to investigate its past waste disposal practices.
- As described in the EPA Region 3 Success Story documentation for this site, completion of the Facility-Lead Agreement took 2 months compared to an estimated 20 months to negotiate a 3008(h) consent order or to issue a Unilateral Administrative Order (UAO).
- UVA completed all field investigation activities, including three rounds of groundwater sampling and submitted a final report in October 2001. EPA conducted an additional round of sampling in May 2002 to verify UVA's results.
- In December 2003, EPA issued a Statement of Basis explaining the findings of the field investigation and EPA's conclusion that there are no unacceptable risks to human health or the environment associated with the facility (O-Hill area). EPA determined that no further CA is necessary and signed a Determination of CA Complete without Controls on March 1, 2004.

References

- EPA. Region 3 Success Story: Facility-Lead Agreement. Expediting RCRA CA at the University of VA. Accessed On-line at: http://www.epa.gov/reg3wcmd/ca/fl_success.htm.
- EPA. Region 3 Facility Lead Program Website. University of Virginia: Region 3 GPRA Baseline RCRA CA Facility Fact Sheet. Accessed On-line at: http://www.epa.gov/reg3wcmd/ca/fl_sites.htm.



Notes:

Purpose of Slide

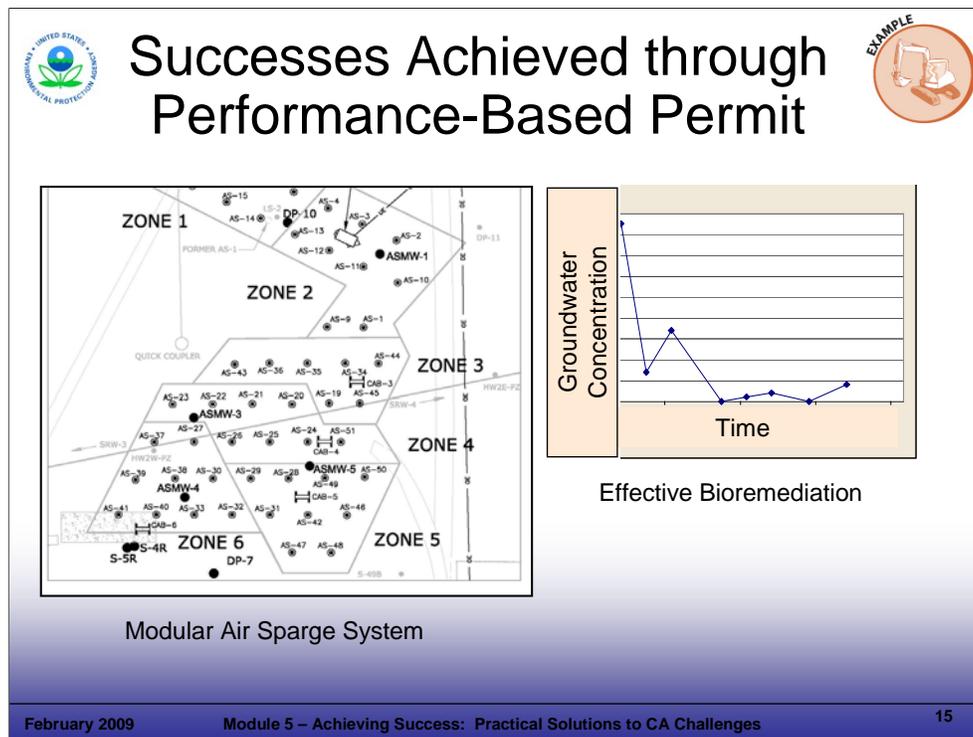
- Demonstrate how a performance-based permit can streamline the CA process. This example shows how a permit was used to support progress. While certain significant treatment system modifications may require permit modifications under 240 CFR 270.42, this course focuses on the flexibility that can be built into permits, through up-front planning. Examples are provided to illustrate how adjustments to field activities and treatment technologies can be planned for by including clear and appropriate performance standards in permits. The facility can then make changes within the specified parameters and report the changes to the agency, which provides review and oversight during the implementation process.

Key Points

- This slide was used earlier to introduce the concept of an Exit Strategy.
- The facility envisioned implementing one or more remediation technologies after the permit was issued, but it had not yet selected the technology. To eliminate the need for a future permit modification while meeting the need for public participation, several technologies were included in the permit application and CMS. No public comments were received and the permit was issued.
- The permit allows for any of the specified technologies to be implemented, as long as: (1) the technology meets performance standards established in the permit, (2) there is a 60-day notification to the State agency, and (3) the design is sealed by a professional engineer.

References

- None.



Notes:

Purpose of Slide

- Continue an example of how a performance-based permit proved effective. Establishing a performance-based permit is an example of tailored oversight. The facility makes and implements day-to-day decisions according to pre-established criteria in the permit.

Key Points

- By including multiple technologies in the permit, the following could be implemented without a permit modification and the associated time to process that modification:
 - Air sparge (implemented in a modular manner, as shown on the left, so portions could be turned off as the plume reduced in size); and
 - Bioremediation (graph shows order-of-magnitude drop in concentration levels).
- The performance standards in the permit allowed the following to be implemented without the need for permit modifications:
 - Modification of the existing pump and treat system (combined influent lines, turned off wells where cleanup complete, added recovery wells where necessary);
 - Effective implementation of pilot tests, full-scale implementation, and modifications/adjustments of new technologies; and
 - Adjustment of groundwater monitoring wells and sampling parameters over time.
- The successful transfer of a parcel of the facility in 2005 reduced maintenance costs. Soil and groundwater met residential criteria, and no institutional or engineering controls are associated with the parcel.
- Faster implementation of the remedy reduced the estimated time to achieve site cleanup by 15 years.
- Savings of an estimated \$3 million were achieved at this facility by implementing decisions efficiently and reducing the total time to achieve cleanup standards. Cost savings include sampling, operation (energy), and maintenance.

References

- None.



4. Regulatory Approval not Necessary for Every Decision

- ❖ Reserve regulatory approval for major milestones
- ❖ Make decisions regarding wells and system operations based on performance standards
- ❖ Licensed or registered professionals should document findings and decisions

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Notes:

Purpose of Slide

- Summarize a number of the previous concepts, indicating why approvals by regulatory agencies are not needed for all CA decisions.

Key Points

- Facilities can and should make routine decisions regarding sampling, well installation, and remedial operations – regulatory approvals should be reserved for major milestones in the process to evaluate the effectiveness of facility efforts (as long as they are in compliance with CA requirements included in permits or orders).
- Performance standards are important because they allow the facility to determine how best to achieve the cleanup criteria; performance standards keep regulators and the facility focused on outcomes. Establishing clear and specific performance standards is important to guide progress and also to support potential enforcement needs.
- Remember, the facility's documentation of critical determinations should be sealed by the appropriate professional (for example, P.E., P.G, or state-licensed professional), so allowing the facility to self-implement does not pose a large risk that activities will not be implemented appropriately.

References

- None.




Performance Standards Provide Flexibility

- ❖ Groundwater Monitoring Program:
 - Evaluate CA program effectiveness
 - Determine compliance with cleanup criteria
 - *Facility selects wells, parameters, frequency*
- ❖ Remediation Technologies:
 - Protect human health and the environment (HH&E)
 - Attain cleanup criteria
 - Achieve source control
 - *Facility selects technology and O&M data*

(continued)

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Notes:

Purpose of Slide

- Provide an example of how the threshold criteria were used as the underpinning for performance standards in one facility's permit that was structured to provide regulatory and technical flexibility. The slide lists the performance standards in the permit. The regulatory agency monitors implementation of the performance standards based on ongoing technical reporting by the facility.

Key Points

- The facility is responsible for maintaining a groundwater monitoring program that meets two performance standards: (1) collect appropriate data for evaluating the effectiveness of the CA program over time and (2) collect sufficient data to evaluate compliance with cleanup criteria.
- The permit allows the facility flexibility in demonstrating compliance with the performance standards by simply specifying that water levels and water quality samples are collected at sufficient well locations, for appropriate chemical and physical parameters, and at appropriate frequencies. The facility may modify wells, parameters, and frequency over time, as long as the performance standards continue to be met.
- The facility is responsible for maintaining a remediation system that meets three performance standards: (1) protect human health and the environment (HH&E), (2) attain media cleanup standards, and (3) control sources. (These standards are the EPA threshold criteria.)
- The facility incorporated alternative technologies in the permit (for example, air sparging, bioremediation, and excavation). As long as performance standards are met, one or more of these technologies can be implemented or the existing system can be modified, with 60 days notice to the State. No permit modification is needed for these changes; they are reported in the next routine monitoring report.
- The permit allows the facility flexibility in demonstrating compliance with the performance standards by simply specifying that the facility collect sufficient analytical, hydrologic, and O&M data, rather than specifying exactly what data should be collected.

References

- None.



Performance Standards Save Time and Reduce Costs

- ❖ Modified injection/recovery rates
- ❖ Adjusted sampling program
- ❖ Applied additional technologies






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Notes:

Purpose of Slide

- Continue example.

Key Points

- By employing a performance standards approach in the facility permit, substantial savings in time and dollars were realized by efficiently making monitoring system and remediation system adjustments, without the need for formal regulatory approvals or permit modification. The performance standards approach allowed:
 - Modification of the existing remediation system, including injection and recovery rates, as cleanup progressed. The photograph on the left shows rerouting of treatment lines to improve operational efficiency. With energy and other operational costs running over \$40,000 per month, combining influent from active groundwater recovery wells (many were shut down as the plume reduced in size) resulted in substantial savings.
 - Adjustment of groundwater monitoring wells and sampling parameters over time.
 - Application of additional remediation technologies, such as bioremediation (right photograph). Adding bioremediation reduced the total time to reach cleanup criteria by over 20 years, as predicted by fate and transport modeling.
- Remediation systems can cost hundreds of thousands of dollars annually to operate. Replacing comment/response/approval cycles with performance standards, allows facilities to make decisions and implement changes to the remedy efficiently (as specified by the performance standards). This approach can improve environmental conditions, while saving substantial costs and time.

References

- None.



5. Traditional CA Process is a Guide, not a List of Requirements

- ❖ Focus on the goal – protect HH&E
- ❖ Implement CA tasks
 - Risk management
 - Site characterization
 - Remedy design and implementation
- ❖ Document decisions

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Notes:

Purpose of Slide

- The “traditional” CA process is a series of reports. Today’s practical approaches to CA can involve multiple forms of communications, decisions, and results.

Key Points

- RCRA CA requires that CA obligations are met to protect HH&E. There is flexibility in how that end goal is achieved.
- Implement risk management, site characterization, and remedy design and implementation as you focus on the end goal.
- Document decisions properly but avoid generating documents without moving the process towards cleanup. Make sure each document supports decisions that will help drive cleanup, where necessary, or document when no further action is required.

References

- EPA. 1994. RCRA CA Plan. Final. OSWER Directive 9902.3-2A. May.



Practical Approaches to Remedy Selection and Implementation

- ❖ Risk management is essential
 - Eliminate unacceptable exposures
 - Ensure adequate monitoring and reliable controls to prevent exposure
- ❖ Cleanup timeframes can vary
 - Consider redevelopment and reuse
 - Accommodate facility operations

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Notes:

Purpose of Slide

- Discuss several concepts associated with remedy selection and appropriate timing in CA.

Key Points

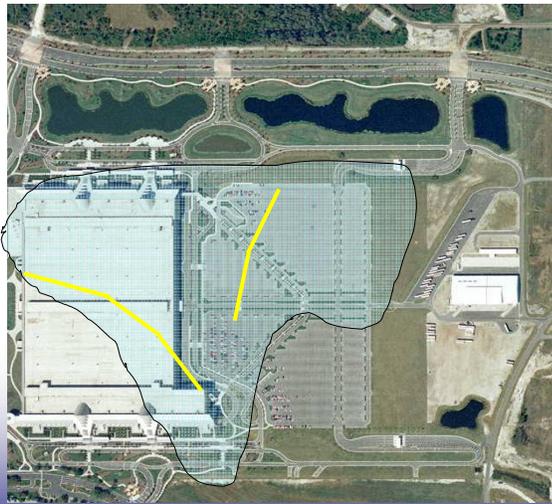
- Risk management – Immediate risks to human health and the environment (HH&E) presented by a site should be addressed in the short term (for example, remediating a source area near occupied buildings or intercepting a groundwater plume moving toward groundwater users). However, when the site has addressed short-term threats and is relatively stable (for example, Environmental Indicators (EIs) for controls on human exposure and groundwater have been achieved), a number of site-specific factors should be considered when evaluating an appropriate cleanup timeframe. Adequate monitoring and reliable controls must be implemented to prevent exposure, where longer-term cleanup approaches are implemented.
- Cleanup timeframe – The cleanup timeframe should be based on site-specific considerations of risk and other factors such as anticipated long-term site use and remediation costs. Examples of factors that can impact the timing of remedies include:
 - Redevelopment and reuse – A facility may want to expedite the schedule for cleanup of certain areas on a site in order to sell those parcels or change the land use (for example, from industrial to residential).
 - Operating facilities – Most of the RCRA facilities in the 2020 CA Universe will continue to be operating facilities, with little or no anticipated changes in use. For these facilities, where the current and anticipated use will continue to be industrial or commercial and the facility is adequately controlling contamination migration and exposure, a fair amount of flexibility should be used in deciding on the applicable cleanup schedules and timeframes. An operating facility's remedy should be designed based upon consideration of its ongoing industrial use.

References

- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action for Facilities Subject to Corrective Action Under Subtitle C of the Resource Conservation and Recovery Act. Update. EPA 530-R-04-030. April.
- EPA. 2003. Results-Based Approaches and Tailored Oversight Guidance for Facilities Subject to Corrective Action under Subtitle C of the Resource Conservation and Recovery Act. EPA 530-R-03-012. September.



Stabilization Approach to Remedy Implementation



- ❖ Operating facility
- ❖ Long-term cleanup

(continued)

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Notes:

Purpose of Slide

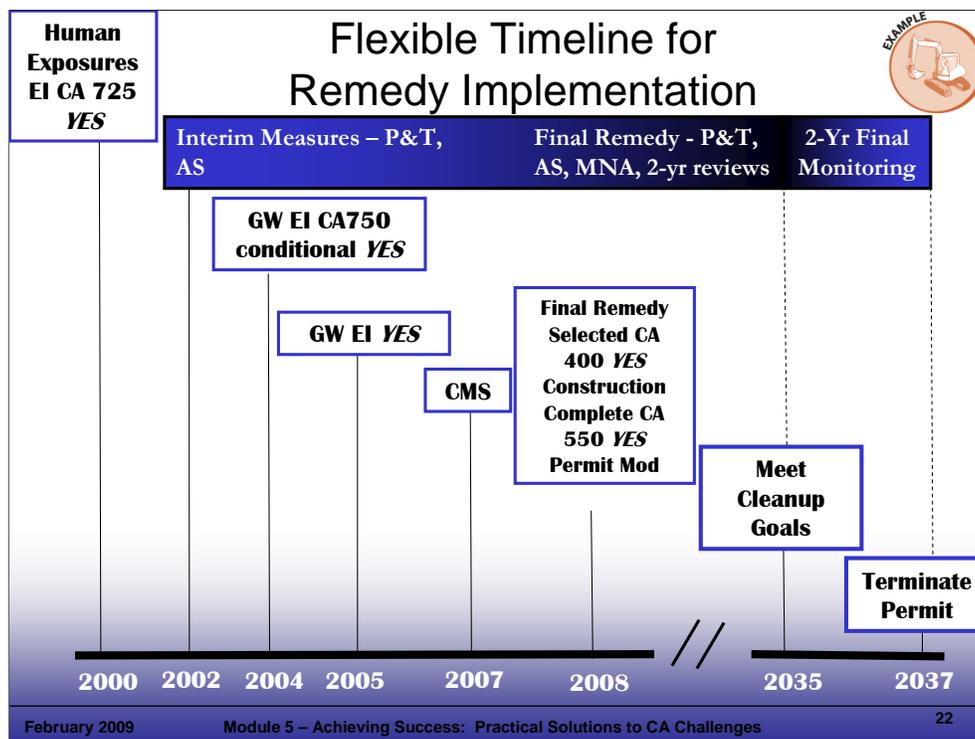
- Provide an example of a flexible, expedited implementation of a remedy - -combined with a long-term approach to completion.

Key Points

- In order to address a significant groundwater source area at the site, a stabilization approach (IM) was adopted.
- In this case, several horizontal recovery wells and an air sparge system were installed to attack the source area and stabilize the plume.
- The recovery wells are effectively controlling the “hottest” part of the plume under an existing building.
- Because the source area is being controlled, the less-concentrated, dissolved plume can be managed using a monitored natural attenuation (MNA) approach.
- The next slide shows how this site will move to completion over time.

References

- None.

**Notes:**Purpose of Slide

- Present a timeline example of implementation of a remedy (focusing on flexible timing).

Key Points

- As shown in the project schedule, the human exposure and groundwater controlled EIs have been met using an IM.
- The facility is on track to convert the IM plus MNA to a final remedy through a simple permit modification.
- Construction complete will be achieved by 2008, well in advance of 2020.
- Because the source area is being effectively controlled by pump and treat and air sparging and the surrounding plume is being effectively controlled by MNA, the facility has implemented a realistic schedule (with regulator approval) to meet final groundwater cleanup criteria; it estimated that cleanup criteria will be achieved in 2035.

References

- None.

 **Interim Measures (IM) Approach to Remedy Implementation** 



❖ Horizontal wells installed as IM

(continued)

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Notes:

Purpose of Slide

- Present a case study of how an IM was used at a major RCRA facility without requiring a CMS.

Key Points

- This CA facility had a high-concentration VOC plume in the central portion of the site.
- Based on experience at similar sites, the facility proposed the use of horizontal wells to capture source area groundwater as an IM.
- EPA and the State subsequently approved this IM.
- Through the use of IM, this facility saved 12 months and \$100,000 in implementing the remedy compared to what a traditional CMS would have required.

References

- None.



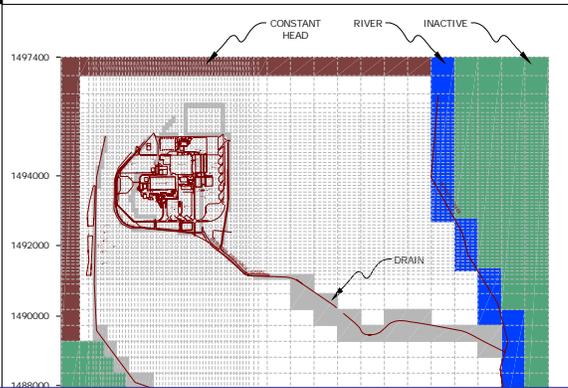
IM Approach to Remedy Implementation



IM



Final Remedy Verification



- ❖ **IM + MNA = CMS Not Necessary**
- ❖ **Permit modification required for IM to become final remedy**

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Notes:

Purpose of Slide

- Continue case study from previous slide.

Key Points

- Groundwater modeling was performed to verify that the planned IM would be an effective long-term remedy for the site.
- Horizontal wells were installed as an IM to address the source area plume. MNA was applied for dissolved contamination in groundwater; together, these actions met the performance criteria for a final remedy (that is, protection of HH&E, containment of the contamination, source area addressed, and achievement of media cleanup criteria over time).
- The facility was able to use the IM and MNA as a permanent remedy for groundwater at the site through a simple permit modification.
- No CMS was required. A simple verification report was submitted to the regulatory agencies to convert the IM to a final remedy based on system operating information. The same report justified MNA based on the groundwater modeling results for the site.

References

- None.



Practical Approaches to Field Investigations

- ❖ Triad approach to support field planning across technology types
- ❖ Field screening and real-time data acquisition can guide further sampling for laboratory analysis

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Notes:

Purpose of Slide

- Review some field considerations related to remedy selection and design.

Key Points

- Field strategies provide the data that will be used to select and design remedies and to monitor their effectiveness. Where presumptive remedies are planned or select technologies are being considered for a site, data collection should focus on those parameters that will support effective design.
- Triad is an EPA approach that can support planning for site data collection in a dynamic and cost effective manner.
- Evolving field sampling and field analysis techniques can supplement standard sample collection procedures and off site laboratory analysis.

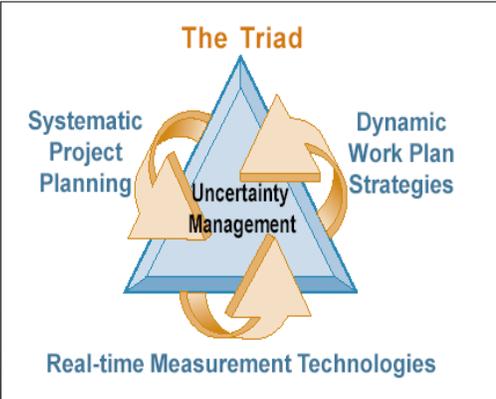
References

- None.



The Triad Approach

- ❖ Conceptual Site Model development
- ❖ Dynamic work strategies
- ❖ Real-time decisions



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Notes:

Purpose of Slide

- Describe Triad as an approach to support site investigations and decision-making.

Key Points

- The Triad approach to decision-making for hazardous waste sites offers a technically defensible methodology for managing decision uncertainty that leverages innovative characterization tools and strategies. Primary components are discussed below.
- Systematic Planning - is a planning process that lays a scientifically defensible foundation for proposed project activities. Systematic planning usually includes the identification of key decisions to be made, the development of a CSM to support decision-making, and an evaluation of decision uncertainty along with approaches for managing that uncertainty in the context of the CSM. Systematic planning is important to the success of all hazardous waste site projects whether Triad is applied or not, but it is particularly critical for the Triad approach where the use of real time measurement technologies allow the CSM to evolve and mature as field work is underway.
- Dynamic Work Strategies - are work strategies for contaminated site characterization, remediation, and monitoring that incorporate the flexibility to change or adapt to information generated by real-time measurement technologies. As information is gathered, it is used to make decisions about what subsequent activities will best resolve remaining data and decision uncertainties and/or meet cleanup goals. Dynamic work strategies are usually documented as a pre-approved decision logic flow within appropriate site planning documents.
- Real-Time Measurement Technologies - refer to any data generation mechanisms that support real-time decision-making (i.e., a dynamic work strategy) including rapid turn-around from a fixed laboratory (using either quantitative or screening analytical methods) or field-based measurement technologies. Real-time measurement technologies return results quickly enough to influence the progress of data collection and field activities.
- Uncertainty Management - The Triad approach recognizes that the contribution of sampling uncertainty to decision uncertainty often dwarfs the contribution of analytical uncertainty. Therefore, the Triad approach focuses on data collection methods that can increase spatial coverage for an area without sacrificing sample representativeness or increasing total sampling program costs. Triad uses a weight of evidence approach to decision-making, where appropriate, based on collaborative data sets. Collaborative data sets can contain data from a number of sources, including quantitative and screening analytical methods.
- A multi-agency partnership supports the Triad Central Website, which provides additional information.

References

- EPA. 2004. Summary of the Triad Approach. White Paper by Deana Crumbling of the Office of Superfund Remediation and Technology Innovation (OSRTI). March 25.
- ITRC. 2003. Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management. ITRC Sampling, Characterization and Monitoring Team. December.
- Multi-Agency Web Site. Triad Web Site. Triad Partners include EPA, Argonne National Laboratory, USACE, U.S. Navy, U.S. Air Force, State of New Jersey, and Interstate Technology Regulatory Council.



Triad - Field Technologies

- ❖ Field analyses make dynamic work plan strategies possible
- ❖ Real-time decisions are made using real-time data
- ❖ Field-based methods are cost effective
- ❖ Laboratory data are not replaced, but supplemented

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Notes:

Purpose of Slide

- Introduce the Triad approach's integration of real-time measurement technologies.

Key Points

- The goal of the Triad approach is to manage decision uncertainty, that is, to increase confidence that project decisions (about contaminant presence, location, fate, exposure, and risk reduction choices and design) are made correctly and cost-effectively. Field analyses allow decisions to be made in a dynamic manner.
- Methods that provide data in the field, allow real-time decisions to guide further investigation and decisions.
- A focus on real-time measurement systems using field-based methods may allow more sampling data to be obtained than using conventional approaches because each sample can be collected/analyzed less expensively than a typical sample for off-site laboratory analysis.
- Laboratory analysis is not replaced, but is supplemented by the use of field technologies.

References

- Multi-Agency Web Site. Triad Web Site. Triad Partners include EPA, Argonne National Laboratory, U.S. Army Corps of Engineers, U.S. Navy, U.S. Air Force, State of New Jersey, and Interstate Technology Regulatory Council.



Practical Field Sampling and Analysis Methods

- ❖ Colorimetric Test Kits
- ❖ Immunoassay Methods
- ❖ Membrane Interface Probe (MIP)
- ❖ Direct Push Technology
- ❖ Mobile Laboratories
- ❖ Passive Diffusion Bags

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Notes:

Purpose of Slide

- List assessment procedures for evaluating and reevaluating the presence and distribution of contaminants (for example, DNAPLs) as a component of the Triad approach.

Key Points

- A range of field sampling and analysis approaches support sound characterization of sites.
- Colorimetric test kits are self-contained analytical kits that use chemical reactions to produce color proportional to chemical concentration.
- Immunoassays methods use antibodies developed to bind with a target compound or class of compounds. Concentrations are identified through colorimetric reaction.
- Membrane Interface Probes (MIP) can be used to detect VOCs in soil/groundwater. The VOCs in the soil/groundwater rapidly diffuse through the heated polymer membrane of the MIP and then are swept by a nitrogen carrier gas to the land surface where VOCs are measured by detectors (e.g., photoionization detectors (PIDs) or flame ionization detectors (FIDs)).
- Direct Push Technology (DPT) uses hydraulic pressure and a rotary hammer to advance sampling devices into the subsurface to collect a series of soil, soil gas, or groundwater readings/samples at different target depths.
- Passive Diffusion Bags (PDBs) are comprised of polyethylene bags containing deionized (DI) water. Each bag is suspended on a weighted line next to the well screen where contaminants in the well water diffuse through the bag into the DI water until equilibrium is reached. The bag is then retrieved and emptied into sample bottles for analysis – preferably in a mobile laboratory.
- Mobile laboratories allow some analytical techniques to be performed on-site, providing data that can support decisions regarding further investigation in a shorter time frame.
- We review the MIP technology on the following slides.

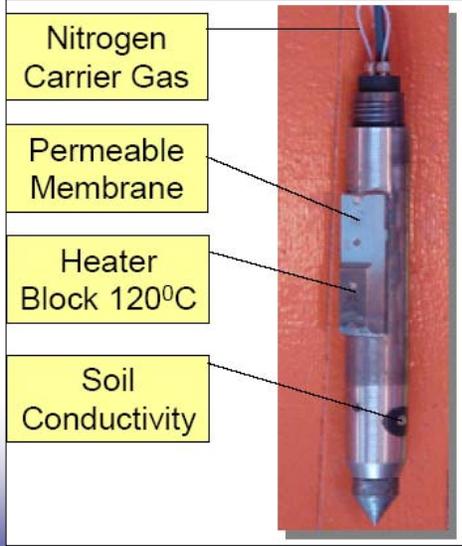
References

- ITRC. 2003. An Introduction to Characterizing Sites Contaminated with DNAPLs. September.
- Multi-Agency Web Site. Triad Web Site. Triad Partners include EPA, Argonne National Laboratory, U.S. Army Corps of Engineers, U.S. Navy, U.S. Air Force, State of New Jersey, and Interstate Technology Regulatory Council.



Membrane Interface Probe

- ❖ Measures VOCs in soils and groundwater
- ❖ VOCs diffuse through heated permeable membrane
- ❖ Collected VOCs swept by carrier gas to land surface and measured by detectors



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Notes:Purpose of Slide

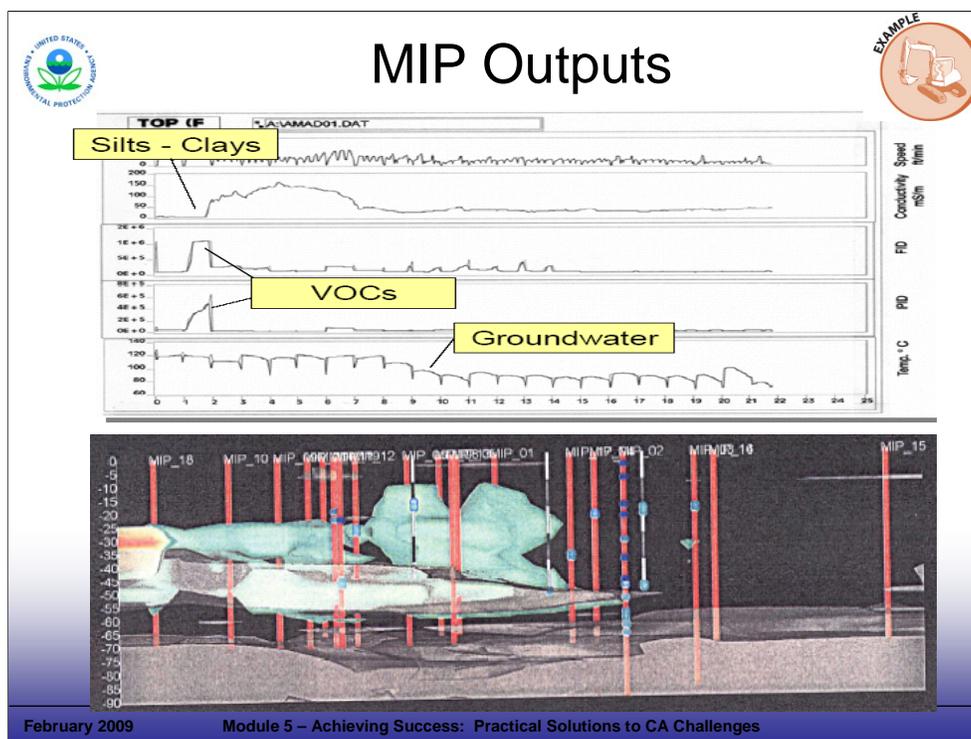
- Show and describe a MIP.

Key Points

- The technique is a rapid method for collecting quantitative VOC concentration data.
- The MIP probe is advanced using DPT to the target sampling depth.
- The MIP is often combined with a soil conductivity probe to interpret lithology.
- VOCs diffuse through a heated permeable membrane and then are swept by nitrogen carrier gas to the surface where they are measured by VOC detectors (photo ionization detector, flame ionization detector).
- When paired with analytical data, the method is reasonably accurate and can be considered semi-quantitative.

References

- ITRC. 2003. An Introduction to Characterizing Sites Contaminated with DNAPLs. September.



Notes:

Purpose of Slide

- Provide an example of the chromatograms and other data that can be developed using the MIP technology and other logging equipment advanced using DPT.

Key Points

- Data obtained using the MIP technology combined with other logging data can produce a rapid and near real-time picture of the subsurface and contaminant distribution.

References

- ITRC. 2003. An Introduction to Characterizing Sites Contaminated with DNAPLs. September.



Advantages of Field Technologies

- ❖ Rapid sample turn-around (real time)
- ❖ Low cost
- ❖ Large number of samples collected
- ❖ Ease of use (varies)
- ❖ Little or no investigation derived waste (IDW)

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Notes:

Purpose of Slide

- Describe some advantages and disadvantages of the field technologies included in the previous slides.

Key Points

- The key advantages of these types of technologies include: real-time sample results, reduced costs, increased speed, and little if any investigation derived waste (IDW).
- Disadvantages include that these technology may be appropriate for only limited depths, may require additional or specialized training, and the data are not quantitative.

References

- ITRC. 2003. An Introduction to Characterizing Sites Contaminated with DNAPLs. September.



Summary

- ❖ To achieve progress, focus on practical solutions that protect HH&E.
- ❖ Practical solutions consider current and reasonably anticipated uses.
- ❖ Triad and field-based investigation approaches are available to support progress.

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Notes:

Purpose of Slide

- Review key points included in Module 5, Achieving Success: Practical Solutions to CA Challenges.

Key Points

- Review the key points from the module.

References

- None.