

Module 01
Introduction and Course Overview



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



February 2009 Module 1 - Introduction and Course Overview 1

Notes:

Purpose of Slide

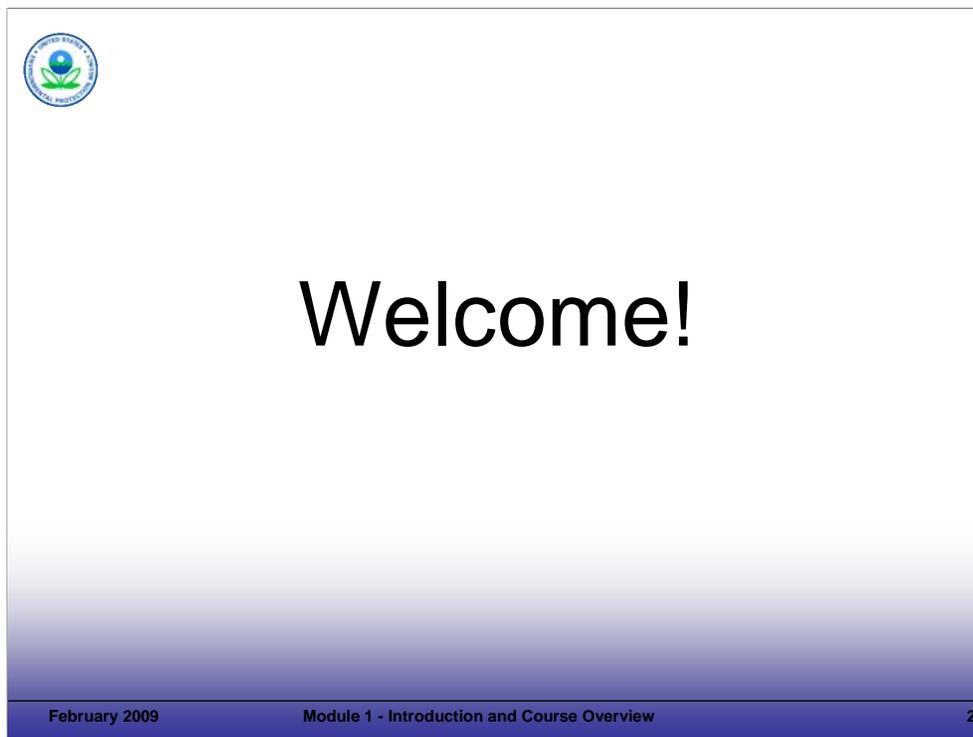
- Holder slide for opening of the training program.

Key Points

- Holder slide, no specific key points.

References

- None.



Notes:

Purpose of Slide

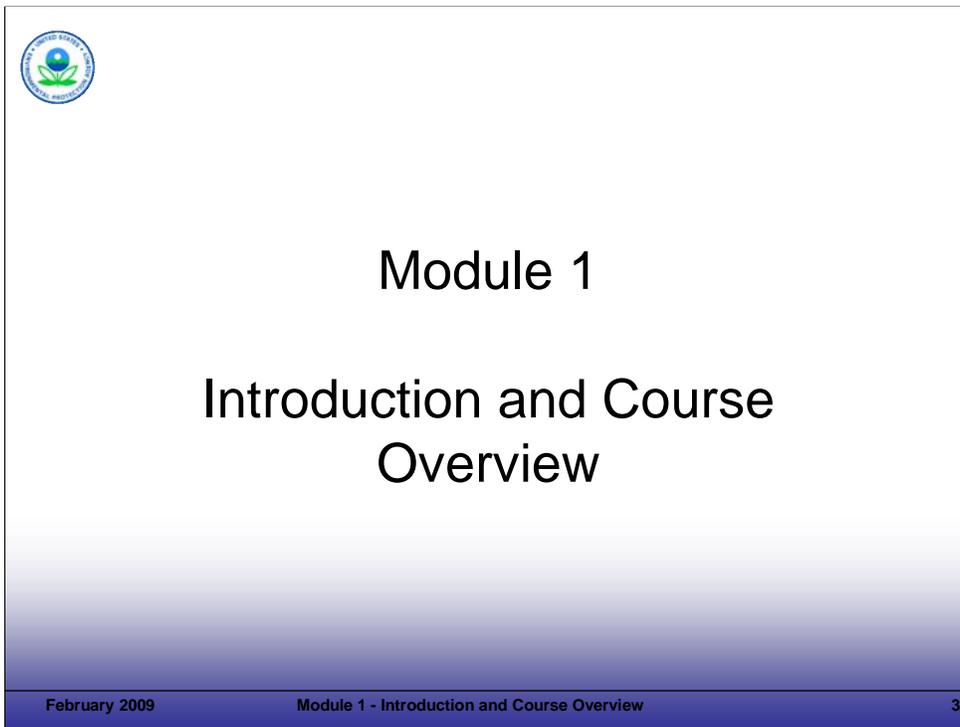
- Holder slide to welcome participants.

Key Points

- The mission of this course is to develop and enhance the skills of qualified personnel who will implement corrective actions for their sites by the year 2020 that are protective of human health and the environment while encouraging revitalization – we will talk more about the purpose and the objectives of the course later in this module. This course is designed for experienced personnel.
- Significant preparation has gone into the course. The development of this training was managed by U.S. Environmental Protection Agency (EPA) Headquarters (HQ), with input from EPA Regional, and state representatives. State input and involvement is critical because the states will play a major role in future progress. This course will focus on supporting achievement of EPA's Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) goals and vision. We have a lot of material to cover and will do so in a focused manner.
- The training course and training documents do not create any legally binding requirements on the EPA, states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of RCRA or of EPA's regulations and views.

References

- None.



Notes:

Purpose of Slide

- Transition from the general welcome to first module.

Key Points

- None.

References

- None.



Introduction and Course Overview

- ❖ Introductions
- ❖ Course mission
- ❖ Training objectives
- ❖ Training approach
- ❖ Logistics
- ❖ Road map and agenda

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Notes:

Purpose of Slide

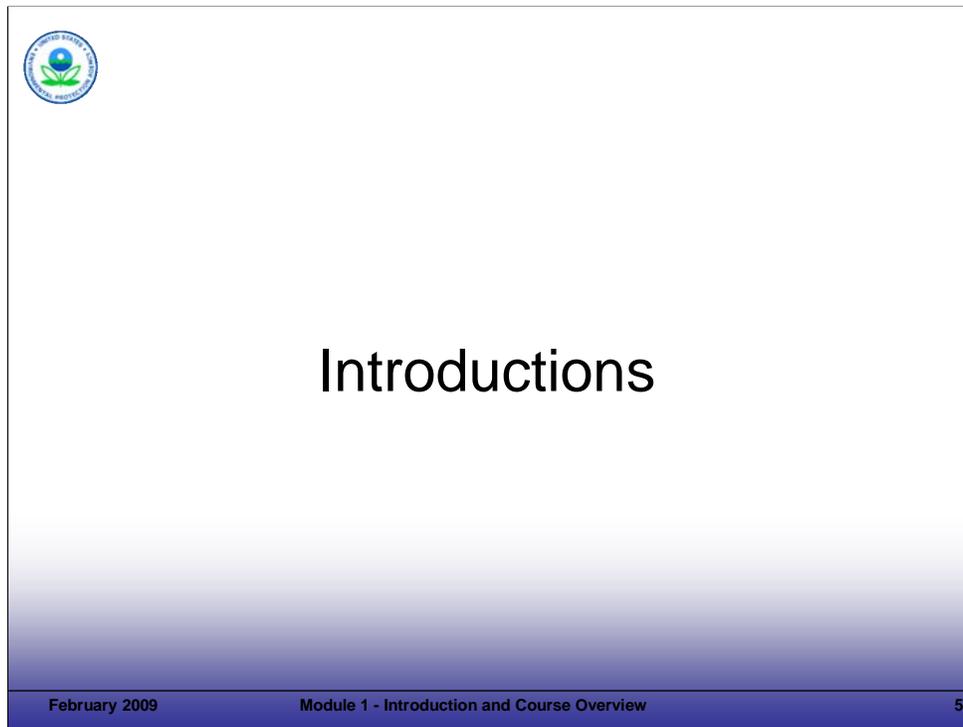
- Overview the module's content.

Key Points

- This introduction and course overview provides an opportunity for the class to get to know each other and understand the mission, objectives, approach, logistics, and agenda for the course.
- This module addresses introductory material, including the elements shown above.

References

- None.



Notes:

Purpose of Slide

- Holder slide for participant and instructor introductions (if instructor introductions not provided previously).

Key Points

- Introductions will be made.

References

- None.



Course Mission Statement

- ❖ *To develop and enhance the skills of qualified personnel who will implement corrective actions for their sites by the year 2020 that are protective of human health and the environment while encouraging revitalization.*

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Notes:

Purpose of Slide: Communicate the mission of the course.

Key Points

- EPA carefully considered the reason for doing this new national training program. Resources are tight and must be spent wisely. However, given the ambitious goals for RCRA CA progress, this national course was developed (1) to focus on enhancing skills, (2) to provide a forum to review and discuss means to support rapid RCRA CA progress, and (3) to highlight EPA's emphasis and resources to encourage revitalization.
- The mission statement above was developed by RCRA EPA HQ and Regional representatives, as well as state program personnel. It reflects the strong body of program experience developed over time. That experience now needs to be applied to achieve progress towards EPA's goals and vision for the RCRA CA program. This course builds on the existing body of knowledge and is designed for personnel with experience in the RCRA CA program.
- This training course builds on the strong program knowledge that has been developed over the years. It stresses practical approaches that support progress -- while achieving on-going protection of human health and the environment and long-term environmental stewardship.
- You will notice that this course includes a strong focus on revitalization. EPA is focusing on revitalization across its cleanup programs (1) as a tool to accelerate cleanups at facilities with current redevelopment interest and (2) to ensure that remedies at other facilities are selected with reasonably anticipated future uses in mind (as opposed to leaving facilities fenced and inactive).
- Revitalization is defined broadly for this course to include land reuse and redevelopment efforts including: continued use of facilities (also known as, operating facilities) and/or reuse of a property for new purposes (for example, commercial, residential, ecological, public, or industrial). The importance of revitalization is recognized throughout this training program and Module 6 provides specific information on EPA's revitalization efforts, goals, and resources.
- In addition to reviewing regulatory requirements and guidance -- the training program will also present facility considerations and perspectives. These facility considerations include things like budgeting for major environmental projects, managing cash flow, and trying to achieve cost savings and benefits. Generally, understanding the facility perspective will help you collaborate and work with facilities to achieve CA progress; however, a more enforcement-oriented approach may be necessary for those facilities that are not willing to work collaboratively.

References

- None.



Training Objectives

- ❖ Enhance the existing skills and knowledge of federal, state, and other personnel to support Resource Conservation and Recovery Act (RCRA) corrective action (CA) progress
- ❖ Demonstrate and share approaches that have been successful in supporting CA efforts
- ❖ Share examples and lessons learned
(continued)

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Notes:

Purpose of Slide

- Provide the training objectives as shown on Slide 7 (this slide) and Slide 8 (next slide).

Key Points

- Discuss how the overarching mission of the course is now translated into specific objectives for the training program and highlight the objectives which are provided on this slide and the next.

References

- None.



Training Objectives

Course participants will be able to:

- ❖ Explain the background and future of the RCRA CA Program
- ❖ Focus efforts on progress, rather than process
- ❖ Describe and apply successful approaches to achieve RCRA CA goals
- ❖ Identify and use available tools and resources to support RCRA CA progress
- ❖ Understand and document progress towards RCRA CA milestones

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Module 1 - Introduction and Course Overview

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Notes:

Purpose of Slide

- Continue the review of training objectives.

Key Points

- Continue the review of training objectives.
- Remember that the course discussions and materials do not substitute for official EPA regulations, policy, and guidance or create or negate any requirements specified in those regulations, policies, or guidance.

References

- None.



Training Approach

- ❖ Use an interactive approach (all have lessons and challenges to share)
- ❖ Mix lectures, discussions, exercises, and real-world examples
- ❖ Maximize shared learning
- ❖ Increase information retention (next two slides)

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Notes:

Purpose of Slide

- Review the training approach. This slide (Slide 9) and the following two slides (Slides 10 and 11) focus on the general approach to training and the topic-specific approach for sharing knowledge related to RCRA CA.

Key Points

- This training course is designed in a manner that recognizes that the course is not a straight “teacher/student” situation.
- Experience shows that the best way to enhance learning and information retention is through the use of interactive approaches, lectures, discussion, and exercises.
- The emphasis on a two-way sharing of knowledge through interactive approaches recognizes that participants in this class already have training and experience to share. This experience may be in the area of RCRA CA or other related environmental management areas that can provide ideas and lessons learned to support RCRA CA progress. Whenever we can, we want to build on what is working and avoid repeating approaches that do not work well.
- The instructors have many years of field experience as regulators, industry personnel, and/or consultants -- specifically focused on RCRA CA policies and guidance, site investigation, and remediation. However, participants in the class also have a range of experience and real-world knowledge to share. In addition, class participants will know best what is happening in their own regions and states and will be able to identify current situations/issues/challenges that can be discussed during the course.
- Our goal is to create a cooperative and comfortable learning environment, which increases information retention and your ability to implement the concepts we will present.

References

- None.



Information Retention

Adults retain:

- ❖ 10% of what they read
- ❖ 20% of what they hear
- ❖ 30% of what they see
- ❖ 50% of what they see and hear
- ❖ 70% of what they talk over with others
- ❖ 80% of what they use and do in real life
- ❖ 95% of what they teach someone else to do

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Notes:

Purpose of Slide

- This slide ties to the last bullet on the previous slide.

Key Points

Adults learn and retain information in a number of ways (and unfortunately, do not absorb information as well as children -- for example, this is why children are quick at learning new languages).

- This course recognizes that listening to 2.5 days of lecture and reading hundreds of slides, will not maximize learning. Therefore, the course includes discussion, exercises, and examples.
- Even with a course designed to maximize learning, we likely will not achieve full information retention. Therefore, it is critical that this training event be followed by real-world implementation of the concepts and principles discussed. This will include subsequent use of the resources and tools we provide. In addition, we hope that the course will help you develop your own network of practitioners focused on progress, with whom you can share ideas long after the course is over.
- To support networking, we are asking you to complete a sign up list with your contact information to share with the group. The list will be shared when the course is completed. In addition, the instructor names and contact information will be on that list.
- We will be asking for examples and input to improve this course over time and we are always willing to discuss RCRA CA. In addition, we encourage you to mingle with others during your time here -- grab lunch or dinner, discuss issues you are dealing with, and otherwise network to increase the sharing of ideas and knowledge.
- Ultimately, this course can only provide information, ideas, and a framework for future progress -- the hard work will be up to you when you return to your day-to-day work supporting RCRA CA efforts.

References

- None.



Topic-Specific Approach

- ❖ Focus on progress for CA
- ❖ Implement 3 days of progressive training
 - Daily themes
 - Early modules provide foundation for later lessons
- ❖ Confirm learning through group discussion
- ❖ Obtain feedback to improve the course

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Notes:

Purpose of Slide

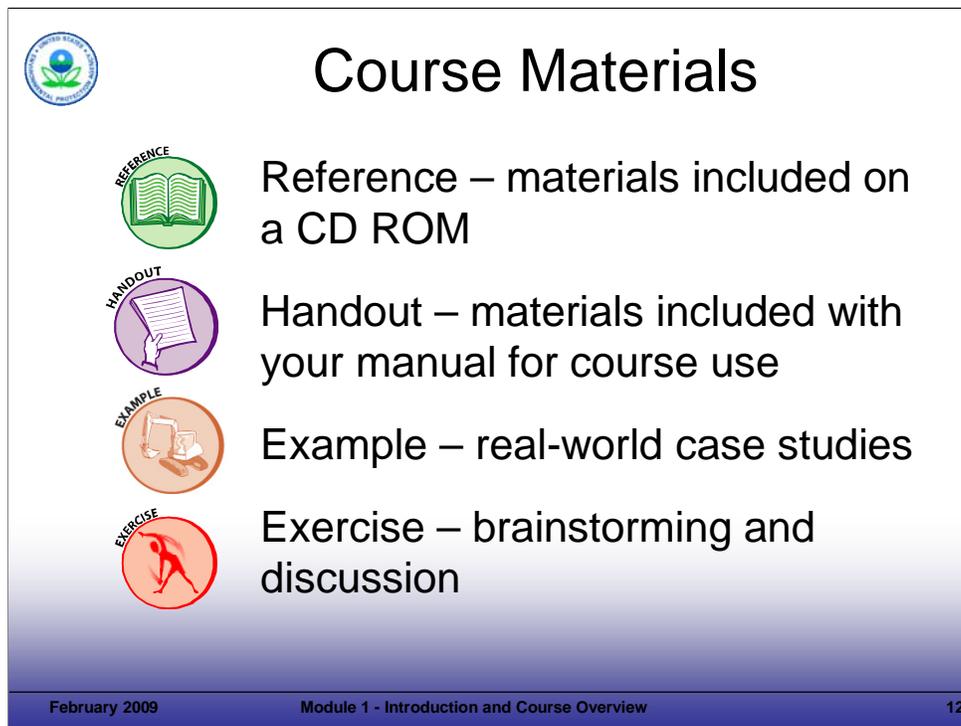
- Provide the specific approach developed to present the RCRA CA Course.

Key Points

- We have talked about the general course approach, which is designed to maximize information retention and sharing of knowledge.
- In structuring the specific approach to this course, we considered the large volume of material to be covered and the mission of the course.
- We then identified groupings of information to provide a clear focus, or theme, for each day.
- This approach also breaks the course into sections that are more manageable and that build on each other as the course progresses.
- Finally, we would appreciate your feedback on the course. We will provide evaluation forms at the end of the course; please keep notes as thoughts occur to you during the course. You can then talk to instructors at the end of each day or add your input to the evaluation form on Day 3.

References

- None.



The slide features a blue header with the RCRA logo on the left and the title "Course Materials" in the center. Below the title, four icons are listed vertically, each with a corresponding text description. The icons are: a green book labeled "REFERENCE", a purple hand holding a document labeled "HANDOUT", an orange backhoe labeled "EXAMPLE", and a red person thinking labeled "EXERCISE". The footer of the slide is a dark blue bar containing the date "February 2009", the module title "Module 1 - Introduction and Course Overview", and the page number "12".

Course Materials

-  Reference – materials included on a CD ROM
-  Handout – materials included with your manual for course use
-  Example – real-world case studies
-  Exercise – brainstorming and discussion

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Notes:

Purpose of Slide

- Review icons that will be used during the course.

Key Points

- The reference icon highlights information discussed on a particular slide and included as a key reference on the CD ROM included in your participant manual. Many of these references are available through the internet. However, participants in past courses have indicated that they like to have all of the key references in one location. A list of the references is included in your manual.
- The handout icon indicates that material on the slide is supplemented by a handout included at the end of the module. Handouts provide additional detail to support a topic, exercise, or discussion. For this module, you will see that a handout of the Road Map for RCRA CA is provided.
- The backhoe icon indicates site-specific examples that illustrate the application of concepts presented in a module. Over time, we hope to collect additional real-world examples from participants and integrate them into the course.
- The exercise icon illustrates a point where an activity or question is posed to stimulate thought and discussion.

References

- None.



Course Logistics

- ❖ Facilities
- ❖ Cell phones/E-mail tools
- ❖ Breaks
- ❖ Lunch
- ❖ Schedule

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Notes:

Purpose of Slide

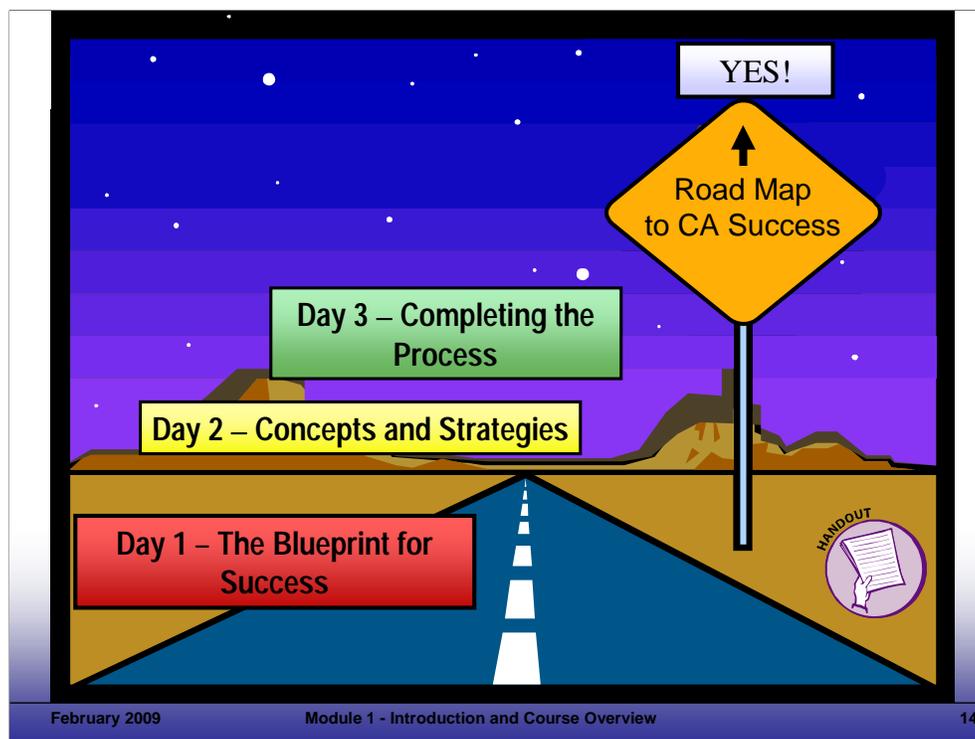
- Provide a holder to discuss logistical items for each specific delivery of the course.

Key Points

- The instructors will review course logistics.

References

- None.



Notes:

Purpose of Slide

- Present the road-map approach to the course. The handout for this slide is a course overview chart developed to illustrate the CA topics addressed by the course.

Key Points

- As stated previously, we thought carefully about how to cover the wide range of materials required for this training program in a manner that is logical and manageable.
- In thinking through the material, EPA and the development team identified that RCRA CA can be thought of as progress toward specific goals; this progress relies on logical decision points, sign posts, and directions. This helped us develop a road map for the course.
- Within this framework, each day will have a theme and we will cover certain topics related to that theme. We will build on the lessons from one day as we move into the next.
- The road we are on leads to RCRA CA Success. As you can see on this slide, we are moving to a YES for key decision milestones that are being measured and for getting sites ready for anticipated uses. We will discuss the "Yes" concept in greater detail in Module 2.
- This slide shows each daily theme. The next three slides (15, 16, and 17) show the detailed agenda for each day.

References

- None.



Day 1 – The Blueprint for Success

- ❖ Module 1 – Introduction and Course Overview
- ❖ Module 2 – How to Achieve the 2020 Vision
- ❖ Module 3 – CA Authorities and Guidance
- ❖ Module 4 – Starting with the End in Mind: Building an Exit Strategy
- ❖ Module 5 – Achieving Success: Practical Solutions to CA Challenges
- ❖ Module 6 – CA and Facilitating Land Revitalization

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Notes:

Purpose of Slide

- Overview content of Day 1.

Key Points

- The first day of the course focuses on (1) the Goals and Vision for CA; (2) the regulations, guidance, and policies that provide the framework for RCRA CA; (3) the importance of keeping end goals in mind through the CA process; (4) practical approaches to support CA implementation; and (5) EPA programs and resources to support revitalization and associated land revitalization indicators and performance measures.
- Day 1 presents the basic framework of CA and overviews where we are and where the program is headed.
- The course emphasis is on concepts and approaches to achieve CA progress.

References

- None.



Day 2 – Concepts and Strategies

- ❖ Module 7 – Selecting and Approving a Protective Remedy
- ❖ Module 8 – Remediation Technologies
- ❖ Module 9 – Managing Remediation Waste
- ❖ Module 10 – CA Optimization Tools and Challenge Exercise

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Notes:

Purpose of Slide

- Overview content of Day 2.

Key Points

- The second day of training builds on the first; it addresses elements that are common to RCRA CA sites and are important to implementing the CA process successfully.
- Module 7, *Achieving an Effective and Protective Remedy*, reviews factors that support the selection of a remedy. These concepts include cleanup criteria and related matters. In addition, land revitalization opportunities are relevant to remedy selection.
- Module 8, *Remediation Technologies*, provides information on a range of remediation technologies that are important to remedy implementation.
- Module 9, *Managing Remediation Waste*, reviews common issues and practical solutions related to planning and implementing the management of investigation and cleanup-related residuals at RCRA CA sites.
- Module 10, *CA Optimization Tools and Challenge Exercise*, will include a facilitated discussion of options to support CA. This will reinforce concepts presented on Days 1 and 2.

References

- None.



Day 3 – Completing the Process

- ❖ Module 11 – Maintaining Effective Remedy Performance
- ❖ Module 12 – CA Complete
- ❖ Module 13 – Challenge Exercise
- ❖ Module 14 – Wrap Up

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Notes:

Purpose of Slide

- Overview content of Day 3.

Key Points

- Module 11, Maintaining Effective Remedy Performance, considers factors that are important after the remedy is selected. These factors include implementing and maintaining engineering and institutional controls, implementing and achieving remedy operation and maintenance, focusing on remedy optimization, and monitoring and adjusting the remedy over time (if appropriate).
- Module 12, CA Complete, reviews the documentation required to show that CA is complete.
- Module 13, Challenge Exercise, allows time for participants to work in groups to review example challenges and site-specific needs. This will allow participants to share their knowledge and brainstorm regarding how some of the course principles can be applied.
- Finally, in Module 14, we will wrap up the course and get your feedback so that we can improve the course for future deliveries. Your feedback is very important to planning for future deliveries of the course.

References

- None.



Summary

- ❖ EPA's goals and vision for RCRA CA are ambitious.
- ❖ This course provides guidance, tools, and approaches to assist in achieving RCRA CA results.
- ❖ The active participation of everyone present will increase the value of our time together.

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Module 1 - Introduction and Course Overview

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Notes:

Purpose of Slide

- Review key points included in Module 1, Introduction and Course Overview.

Key Points

- This slide summarizes key points addressed in Module 1.

References

- None.



Corrective Action Universe (3,746 Facilities)



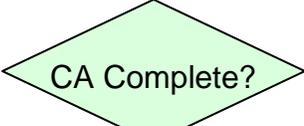
Yes

No

Document Remedy Decision and Remedy Construction CA 400 and CA 550



Operate and Maintain Remedy - Evaluate Effectiveness



Yes

No

Document CA Criteria Met (CA 900) and/or CA Terminated (CA 999)

Design and Implement Remedy - Modify As Necessary

Science

- Site Characterization
- Risk Management

Engineering

- Pilot Studies
- Remedy Design and Construction
- Engineering Controls

Policy and Field Considerations

- Threshold and Balancing Criteria
- Facility Operations
- Location and Weather
- Institutional Controls

Remediation Waste



Yes

No

Contact Facility/ Discuss Alternatives

Voluntary or Facility-Lead Agreement

Order or Permit

Develop Long-term Exit Strategy

Include:

- 2020 Vision for CA
- Public Participation
- Financial Assurance
- Anticipated Land Use Considerations
- Focus on Revitalization

- Day 1
- Day 2
- Day 3

Course Overview

Module 02
How to Achieve the 2020 Vision



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



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Notes:Purpose of Slide

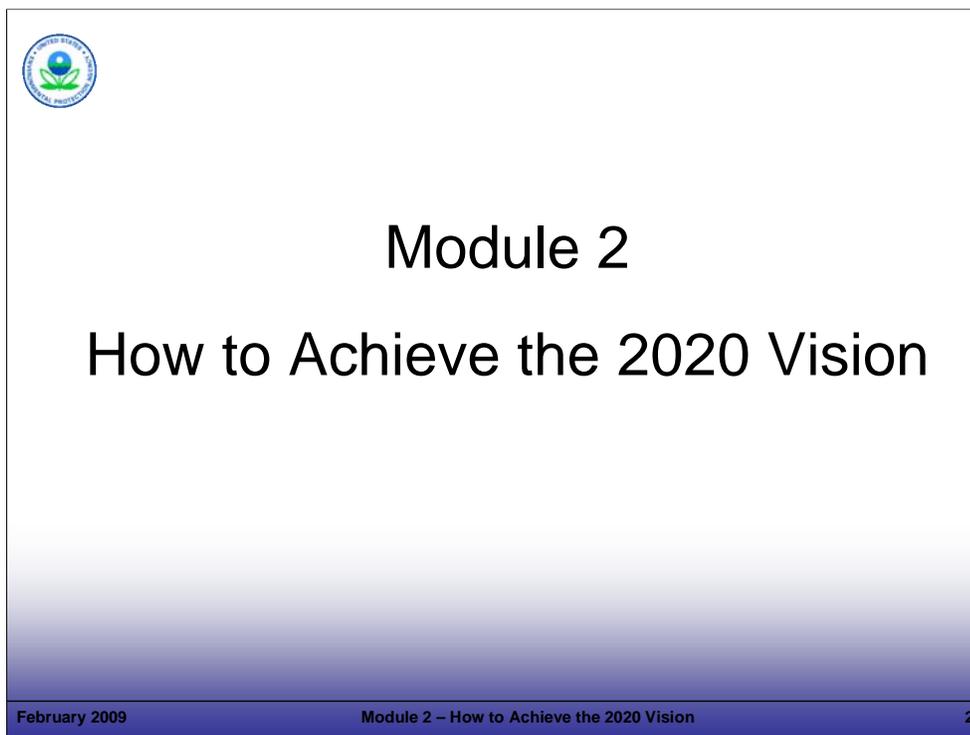
- Holder slide for Module 2, How to Achieve the 2020 Vision.

Key Points

- No specific key points.

References

- None.



Notes:

Purpose of Slide

- Transition slide to the next topic, Module 2, How to Achieve the 2020 Vision.

Key Points

- This module lays the foundation for where we are and where we are headed.
- The module is presented in two parts:
 - First – A representative of the U.S. Environmental Protection Agency (EPA) will present an update on progress toward meeting the 2008 Goals and the 2020 Vision, including the status of, and approach to, the 2020 universe of facilities.
 - Second – The instructors will present how this course is designed to help CHANGE how CA implementation proceeds. It focuses on the regulatory framework for corrective action (CA), illustrates the inherent flexibility in the Resource Conservation and Recovery Act (RCRA) CA process, and presents key principles that skilled professionals can apply to support rapid CA progress.
- This presentation will show that meeting the RCRA CA goals and vision will require rapid progress. This course was designed to provide concepts and tools that can support that progress.

References

- None.



Module Overview

- ❖ Where we are and where we are headed
 - 2008 Goals for Corrective Action (CA)
 - 2020 Vision for CA
 - Status of CA Baseline (2008) and Universe (2020) for Measuring Progress
- ❖ How we can achieve the 2020 Vision

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Module 2 – How to Achieve the 2020 Vision

3

Notes:

Purpose of Slide

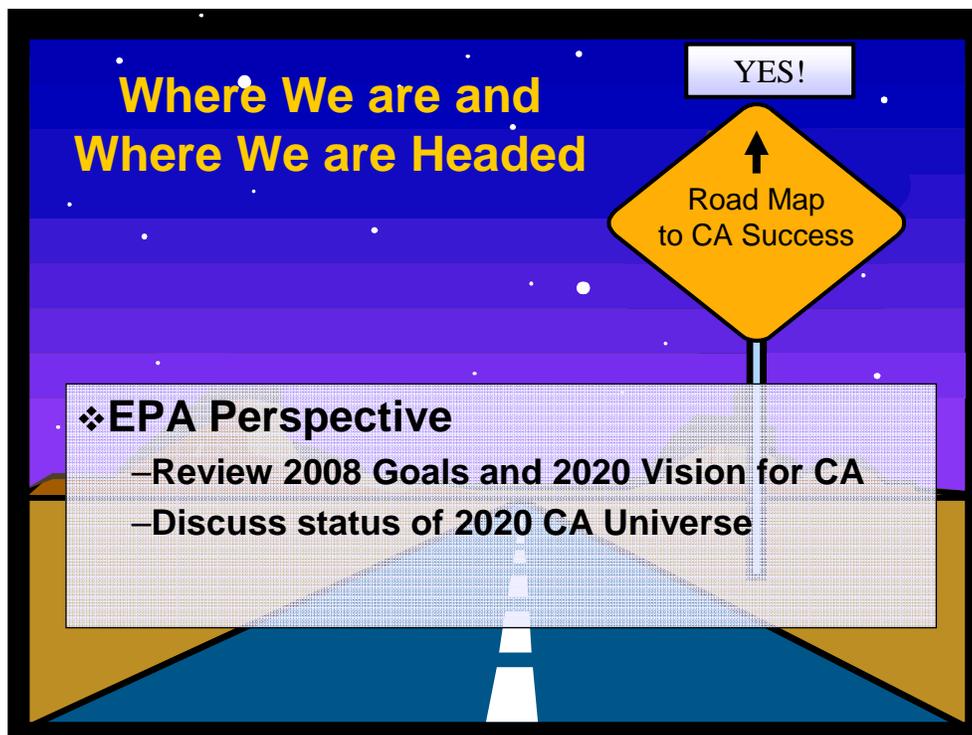
- Overview slide for Module 2, How to Achieve the 2020 Vision.

Key Points

- This module lays the foundation for Day 1 – Establishing a Blueprint for Success.
- The module is presented in two parts: (1) EPA will present information regarding the CA universe and goals/vision, which lays the foundation for changing our approach to RCRA CA implementation and (2) the instructors will present principles that will support regulatory representatives and the regulated community to achieve the RCRA CA 2008 Goals and 2020 Vision for CA.

References

- None.

**Notes:**Purpose of Slide

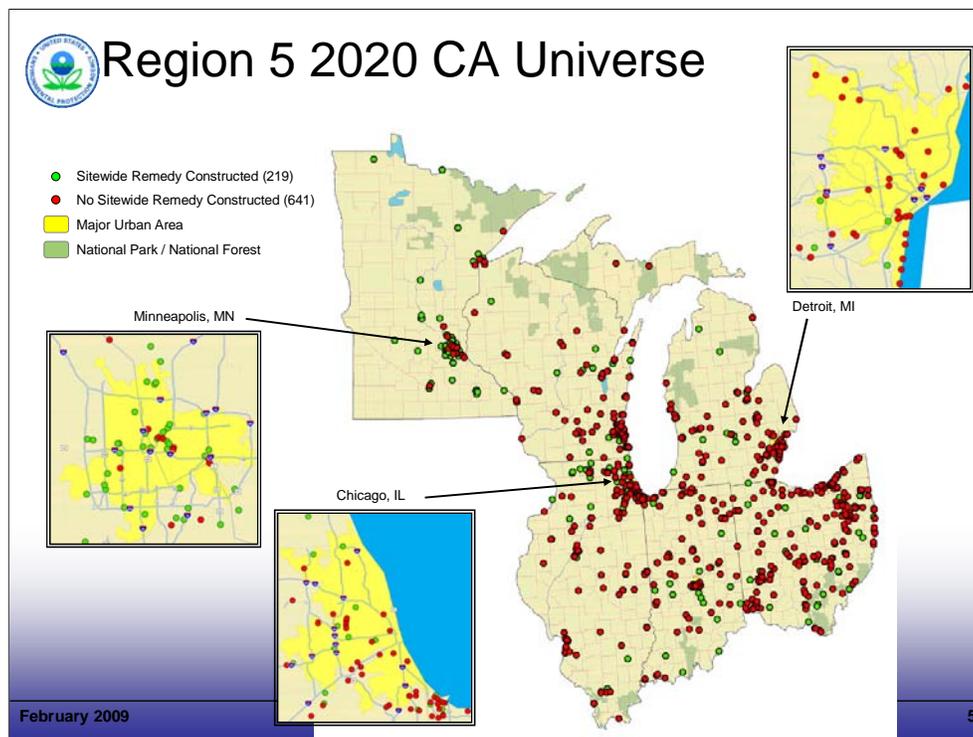
- Transition slide.

Key Points

- This slide provides a transition to the discussion of the background for the vision and goals and the current status of the 2020 CA Universe.

References

- None.



Notes:

Purpose of Slide

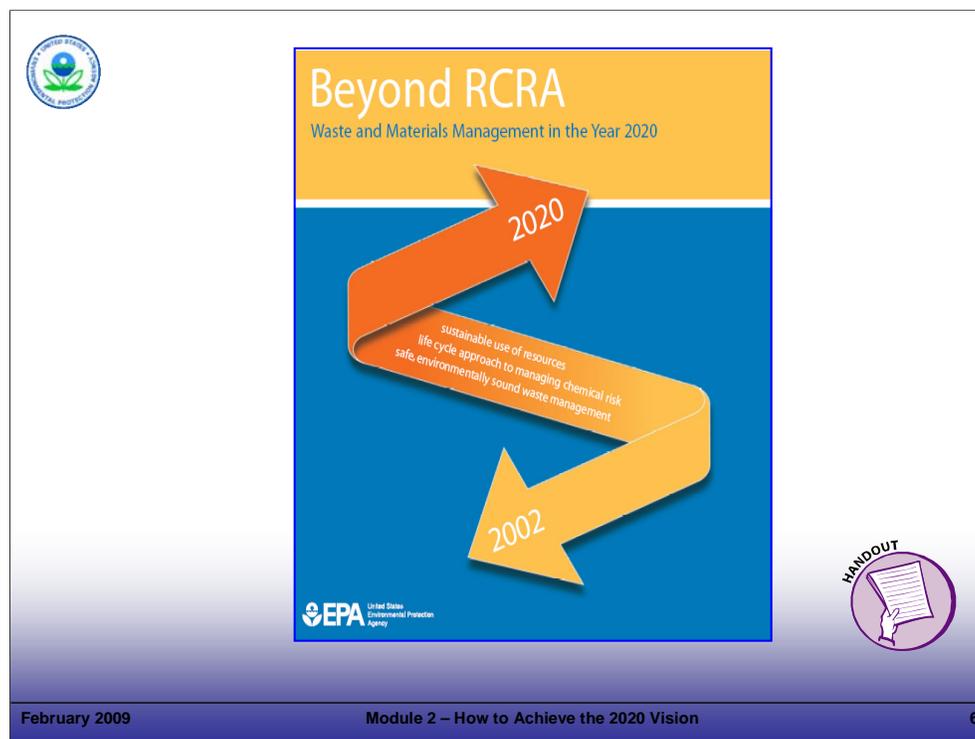
- Show how many facilities need to be addressed in this Region; a regional EPA and/or state representatives can speak here.

Key Points

- An EPA Regional and/or state representative(s) will overview the Regional and local challenges and approaches to meeting the 2020 Vision.
- This slide will be modified for each regional delivery of the course. Data current through January 1, 2009.

References

- EPA. 2009. Slide Updated by Office of Resource Conservation and Recovery. January.



Notes:

Purpose of Slide

- Introduce EPA's White Paper that describes the CA 2020 Vision and how it aligns with the course approach.

Key Points

- Beyond RCRA: Waste and Materials Management in the Year 2020* is a discussion paper which was developed jointly by EPA and state environmental agencies. It aims to open and inspire dialogue on what the future could hold for the RCRA program. The paper identifies a number of trends that could affect the future of waste and materials management, resource conservation, and human and environmental health. The paper also suggests certain general strategies and tools that might be used to build a new vision for the future of the RCRA program.
- The excerpt below is from the 2020 Vision:

The year is 2020, and America's wasteful ways are a thing of the past. New technologies and a changed economic climate, combined with enlightened government policies and a pronounced shift in societal and corporate attitudes have resulted in dramatic decreases in the volumes and toxicity of industrial wastes generated by the country's industries. Materials that were once considered wastes suitable only for landfilling are now continually reused and recycled, and "industrial ecology" has become the mantra of corporate executives across the nation. Landfills are becoming obsolete – the small volumes of wastes that actually need disposal are carefully managed under an efficient and environmentally protective system that features a mix of economic incentives, voluntary measures, and regulatory controls. Cleanup of most contaminated sites has been largely completed, and thousands of areas once known as Brownfields have been put back into productive use.

References

- EPA. 2002. *Beyond RCRA: Waste and Materials Management in the Year 2020*.



2020 Vision for CA

By the year 2020, cleanup of existing contamination problems at RCRA-regulated facilities will largely be complete.

February 2009 Module 2 – How to Achieve the 2020 Vision 7

Notes:

Purpose of Slide

- Explain the relationship between the 2020 Vision and the specific goals for RCRA CA.

Key Points

- 2020 Vision Goal 3 – “Manage wastes and cleanup chemical releases in an environmentally sound manner.”
- Goal 3 states that “Ideally, of course, all wastes would be used and reused in a continuous cycle, in much the same way natural ecological systems work.”
- Achieving the vision involves meeting individual goals; the RCRA CA goal is one of these and is presented as follows: *“By the year 2020, cleanup of existing contamination problems at RCRA-regulated facilities will largely be complete.”*
- The owner/operator (o/o) has a statutory obligation to conduct CA. In some cases, enforcement approaches will be necessary to ensure that this obligation is fulfilled.
- The RCRA CA goal established in the White Paper leads to the specific Government Performance and Results Act (GPRA) goals of achieving Remedy Decision and Remedy Construction.
- The 1993 GPRA holds federal agencies accountable for using resources wisely and achieving program results. GPRA requires agencies to develop plans for what they intend to accomplish, measure how well they are doing, make appropriate decisions based on the information they have gathered, and communicate information about their performance to Congress and to the public. Additional information is available at: <http://www.epa.gov/ocfo/planning/gpra.htm>.

References

- EPA. 2002. Beyond RCRA: Waste and Materials Management in the Year 2020.



Measuring Progress

- ❖ Environmental Indicators
- ❖ Performance Measures
- ❖ Resource Conservation and Recovery Act (RCRA) Info Event Codes

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Notes:

Purpose of Slide

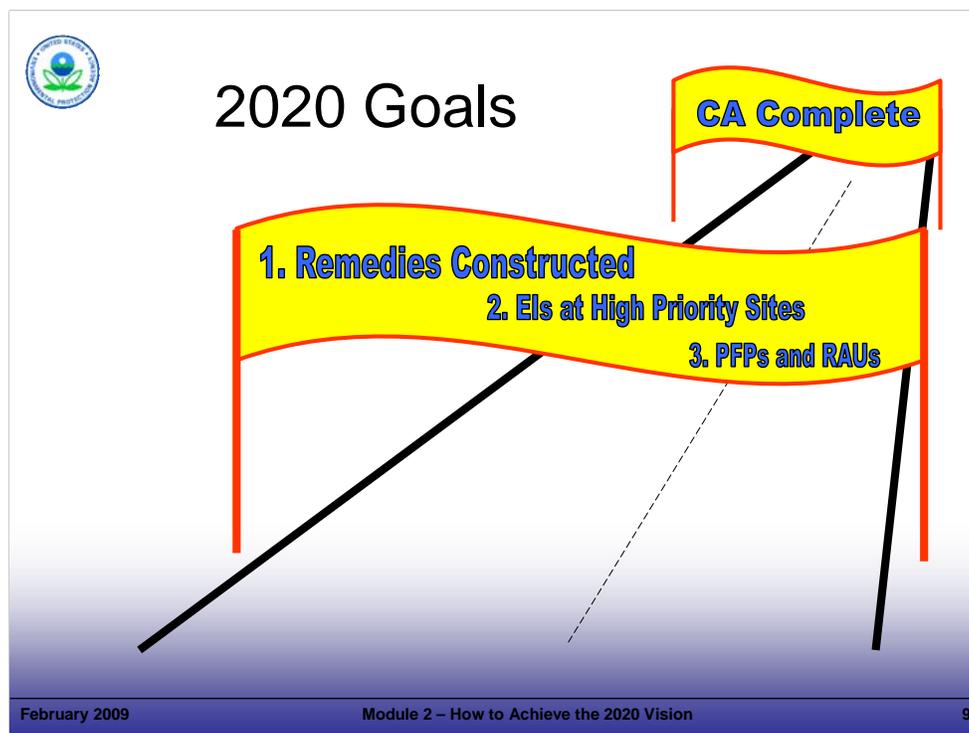
- Review how EPA measures progress at RCRA-regulated facilities and how this relates to the 2008 and 2020 goals for CA.

Key Points

- Remediation of the highest-priority sites involves numerous steps and often takes years. To document stabilization of these sites prior to a final remedy, the CA Program created two Environmental Indicators (EIs):
 - The Current Human Exposures Under Control EI (also known as RCRA event code CA 725) documents that people near a particular site are not exposed to unacceptable levels of contaminants.
 - The Migration of Contaminated Groundwater Under Control EI (also known as RCRA event code CA 750) documents that contaminated groundwater does not spread and further contaminate groundwater resources.
- EPA also established land revitalization performance measures in 2007 to improve EPA's ability to promote and communicate cleanup and revitalization accomplishments and associated benefits/values to society.
 - The Protective for People under Current Conditions (PFP) measure recognizes the near-term progress associated with preventing human exposures based on current uses at the site.
 - The Ready for Anticipated Use (RAU) measure enables EPA and States to track acres determined to be protective for current and reasonably anticipated uses.
- RCRA Info is a database used to track progress at RCRA-regulated facilities according to a series of event codes. The 2020 CA Vision is based on progress in achieving EIs, performance measures, and the following event codes:
 - Remedy Decision (CA 400), which is when a facility-wide remedy is selected.
 - Remedy Construction (CA 550), which is when construction of the facility-wide remedy is complete.

References

- EPA. 1999. Interim Final. RCRA Corrective Action Environmental Indicator (EI) RCRIS Code (CA725) Current Human Exposures Under Control and (CA 750) Groundwater Migration Controlled. February 5.
- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



Notes:

Purpose of Slide

- Discuss the 2020 Vision in terms of the specific goals to be achieved.

Key Points

- Progress is measured when facilities meet milestones. EPA has designated RCRA Event Codes for some of the milestones. Remedy decision (CA 400) is covered in Module 7 and Remedy Construction (CA 550) is covered in Module 11. PFP and RAU are addressed in Module 6. CA Complete (CA 900 or 999) is covered in Module 12. RCRA CA progress is tracked in the RCRA Information System (RCRIS) using RCRA Info Status Codes that tie to each event code.
- Remedy Decision (CA 400) – *the event when the State or EPA formally selects a remedy designed to meet RCRA CA long-term goals of protection of human health and the environment. This event code also applies when no further RCRA CA is required because stabilization measure(s) have already been implemented or because the site characterization has demonstrated attainment of the long-term RCRA CA goals. When the site-wide remedy decision has been made, Remedy Decision must be linked to the "Entire Facility." Phased or partial remedies, or other remedy decisions pertaining only to specific areas of the facility, are to be linked only to the specific areas of implementation and not to the "Entire Facility."*
- Remedy Construction (CA 550) – *reflects that a RCRA facility has completed and certified construction of its final remedy and that the remedy is fully functional, whether or not final cleanup levels or other requirements have been achieved.*
- EPA has designated RCRA Event Codes for various Els.
- PFP – *same as the Current Human Exposures Under Control EI, but allows tracking by acres as well as by facility (not entire facility).*
- RAU – *The following criteria are necessary to meet the RAU measure: (1) criteria for PFP are met; (2) cleanup goals have been achieved for media that may affect current and reasonably anticipated future land uses of the facility so that there are no unacceptable risks; and (3) all institutional or other controls identified as part of a response action or remedy as required to help ensure long-term protection, are in place.*
- CA Complete (CA 900 or 999) – *The following criteria are necessary to meet the CA complete measure: (1) full set of corrective measures is defined; (2) the facility has completed construction and installation of all required remedial actions; and (3) site-specific media cleanup objectives, which were selected based on current and reasonably anticipated future land use, and maximum beneficial groundwater use, have been met.*

References

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.
- EPA. 2007. Guidance for Documenting and Reporting RCRA Subtitle C Corrective Action Land Revitalization Indicators and Performance Measures. February 21.
- Federal Register (FR). 2003. Final Guidance on Completion of Corrective Action Activities at RCRA Facilities. 68 FR 8757. February 25.



2008 and 2020 Measures

Measure	Year	
	2008	2020
Facilities	1,968 facilities	3,746 facilities
Remedy	❖ 708 (36%) Remedy Decision ❖ 531 (27%) Remedy Construction	❖ 3,559 (95%) Both
Environmental Indicators (EIs)	❖ 95% Human Exposures ❖ 81% Groundwater Migration Controlled	❖95% Both

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Notes:

Purpose of Slide

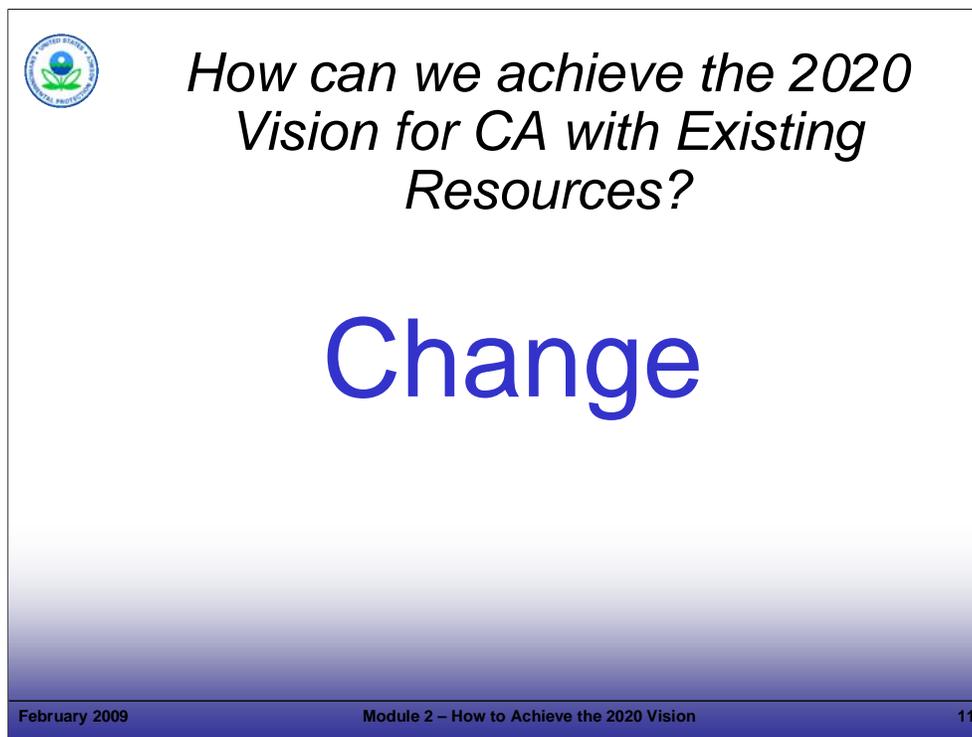
- Show how many facilities need to be addressed. Emphasize the difference between the 2008 CA Baseline and 2020 CA Universe.

Key Points

- Explain how the 2008 Baseline and 2020 Universe were established. These facilities were identified and evaluated under the National Corrective Action Prioritization effort in the 1990s.
 - 2008 Baseline: all of the high priority RCRA CA facilities
 - 2020 Universe: all of the high, medium, and low priority RCRA CA facilities
- The speaker will review the above numbers. The 2020 CA Universe is posted on EPA's web site. Regions that may now have 20% complete based on the 2008 CA Baseline will have far less of a percentage complete based on the 2020 CA Universe, which is much larger than the 2008 CA Baseline. This 2020 CA Universe represents all facilities that EPA and States will address as part of working towards the 2020 Vision.
- The universe of facilities to be addressed and the amount of work to be accomplished are significant.
- This presents a significant challenge for the RCRA CA program, considering the resources we expect to be available.

References

- EPA. EPA Corrective Action Web Site. 2020 Universe. Accessed On-line at: <http://www.epa.gov/epaoswer/hazwaste/ca/facility.htm>.



 *How can we achieve the 2020
Vision for CA with Existing
Resources?*

Change

February 2009 Module 2 – How to Achieve the 2020 Vision 11

Notes:

Purpose of Slide

- Emphasize that CHANGE is absolutely necessary to achieve the 2020 Vision for CA.

Key Points

- The 2020 CA Universe (3,746 facilities) is much larger than the 2008 CA Baseline (1,968 facilities); however, personnel and resources to manage the additional workload likely will not have a proportional increase. Therefore, each Project Manager will be responsible for more facilities and it will be necessary to manage those facilities efficiently.
- If we continue at the current pace, EPA estimates it will take until the year 2060 (or longer) for construction to be complete at most RCRA CA facilities.
- It will not be possible to meet the 2020 Vision for CA if we continue with the traditional approach of moving in a sequential manner, including, for example: detailed review-comment cycles for each report before moving on to the next step, evaluating each well installed and sampled, and examining the flow rate of each recovery well.
- It will be necessary to move toward a more holistic and results-based approach to evaluating and achieving cleanups, supported by performance standards.
- We will need to CHANGE to achieve the ambitious goals laid out for the RCRA CA program, and we will present 8 principles in this course that will facilitate the change required.

References

- None.



Why is it O.K. to Change?

Because we've learned through our collective experience

February 2009 Module 2 – How to Achieve the 2020 Vision 12

Notes:

Purpose of Slide

- Point out that the RCRA CA process has evolved and matured; many facilities have advanced beyond the initial stages of RCRA CA – so the focus can, and should, change. Acknowledge that RCRA CA can be handled in a more efficient, effective manner.

Key Points

- We have more than 20 years of experience in CA – we do not need to reinvent the wheel at each facility.
- For characterization activities, EPA and many states have standard operating procedures (SOPs), so detailed work plans (e.g., specifying drilling and sampling methods, etc.) are generally not necessary.
- There are numerous expedited site characterization techniques that can be used; a good resource for these techniques is at <http://clu-in.org/char1.cfm>.
- We have developed a number of presumptive remedies for sites. Therefore, it is generally not necessary to report a laundry list of remedies, evaluate each remedy in detail, and present the selection method for the remedy, as in the traditional Corrective Measures Study (CMS) approach. We can streamline the investigation and remedy selection process.
- Remedies are easier for facilities to select and agencies to approve because there is a better understanding of how much information (for example, hydrogeology and chemistry data for a site) is sufficient to proceed with remedy selection and design. We also have more experience in implementing remedies for different types of facilities and uses (operating, multiple land uses) and for a variety of contamination scenarios (different media, chemicals, and contaminant levels) using available information.
- Over time, we have found that it is often more cost effective to install a remediation system and then make system modifications in response to effectiveness monitoring data – than it is to require exhaustive site investigations, engineering evaluations, and design iterations in an attempt to predict exactly how a system will operate over time.

References

- None.



How Can We Achieve the 2020 Vision for CA?

Follow 8 principles, beginning with:

1. Get an Exit Strategy established.

(continued)

February 2009

Module 2 – How to Achieve the 2020 Vision

13

Notes:

Purpose of Slide

- Introduce the concept of an Exit Strategy and explain how development of an Exit Strategy will help to focus cleanup and provide measurable milestones and endpoints against which to evaluate progress.

Key Points

- An Exit Strategy is established based on current and reasonably anticipated use of the facility. Future use dictates a range of factors that should be considered in implementing CA (including the schedule, appropriate cleanup criteria, etc.).
- Knowing whether a site will be revitalized for a new use or continue to operate as an active facility will support planning decisions regarding effective CA implementation.
- It is important to establish metrics as part of the Exit Strategy. Metrics may be technical, such as groundwater concentrations or mass removed from groundwater, or metrics may be regulatory, such as meeting performance measures (e.g., remedy decision or remedy construction). Establishing these metrics will help to meet the 2020 Vision for CA.
- Once milestones and endpoints are established, informed and timely decisions on a project path can be made. For example, if a portion of a facility is ready for a new use (with its associated potential exposure pathways evaluated), while the remainder of the facility continues operating, more aggressive remedial technologies may be chosen for the area designated for a new use, while passive technologies may be considered for the continued use area (though the passive approach likely will require institutional controls and monitoring to ensure current uses and exposure assumptions remain valid).
- Reaching consensus is easier when an Exit Strategy supported by all stakeholders is available. For example, if the strategy is long-term with passive technologies to be implemented, parties are more likely to agree on less frequent sampling than for an Exit Strategy that calls for rapid cleanup. Having a clear end point and Exit Strategy at the facility can assist communication and understanding between multiple stakeholders.

References

- None.



How Can We Achieve the 2020 Vision for CA?

2. Environmental cleanup to protective levels is the goal.

(continued)

February 2009

Module 2 – How to Achieve the 2020 Vision

14

Notes:

Purpose of Slide

- Emphasize that cleanup, not the cleanup process, is the goal. In other words, clean water, soil, sediment and air are the goals – not completion of RCRA Facility Investigation Reports (RFIs), CMSs, etc. By “protective levels,” we mean levels that are protective of human health and the environment for current and reasonably anticipated uses. Cleanup is a statutory obligation (as we will discuss in Module 3); however, the process is flexible – it is not necessary to follow a particular sequence of activities or develop a series of reports; in some cases, institutional controls (ICs) may need to be in place.

Key Points

- One of the basic operating principles of RCRA is that it should focus on achieving “environmental cleanup,” which, in the context of RCRA CA, refers to meeting cleanup criteria that are protective of human health and the environment for current and reasonably anticipated uses. Thus, EPA expects cleanup criteria for facilities that will continue to operate to be different than for facilities that will be reused for residential or other purposes. In some cases, ICs will be associated with cleanups where cleanup criteria are associated with a particular anticipated land use (e.g., continued industrial use); we discuss ICs in detail in later modules.
- Innovative approaches to management and oversight are encouraged.
- The concept of the RCRA CA program focusing on results is not new:
 - The 1996 Advance Notice of Proposed Rulemaking (ANPR) encouraged program implementers to focus on cleanup results rather than cleanup processes.
 - The 1999 RCRA Cleanup Reforms reiterated the emphasis on flexibility and encouraged implementers to foster maximum use of program flexibility and practical approaches to achieving cleanup results.
 - The 2003 Results-Based CA and Tailored Oversight Guidance encourages flexible approaches that focus on environmental progress, rather than on the reporting process.
 - EPA’s Handbook of Groundwater Protection and Cleanup Policies for RCRA CA, first published in 2001, encourages flexible approaches and states that the process is flexible.

References

- FR. 1996. Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities; Advance Notice of Proposed Rulemaking (ANPR). 61 FR 19432. May 1.
- EPA. 1999. RCRA Cleanup Reforms. EPA 530-F-99-018 (Fact Sheet #1). July.
- 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.
- 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. EPA 530-R-04-030. Update. April.
- EPA. 2006. Interim Guidance on OSWER Cross-Program Revitalization Measures. October 20.
- EPA. 2007. Guidance for Documenting and Reporting RCRA Subtitle C Corrective Action Land Revitalization Indicators and Performance Measures. February 21.



How Can We Achieve the 2020 Vision for CA?

3. Think performance standards.

(continued)

February 2009

Module 2 – How to Achieve the 2020 Vision

15

Notes:

Purpose of Slide: Emphasize the importance of using performance standards to streamline the RCRA CA process.

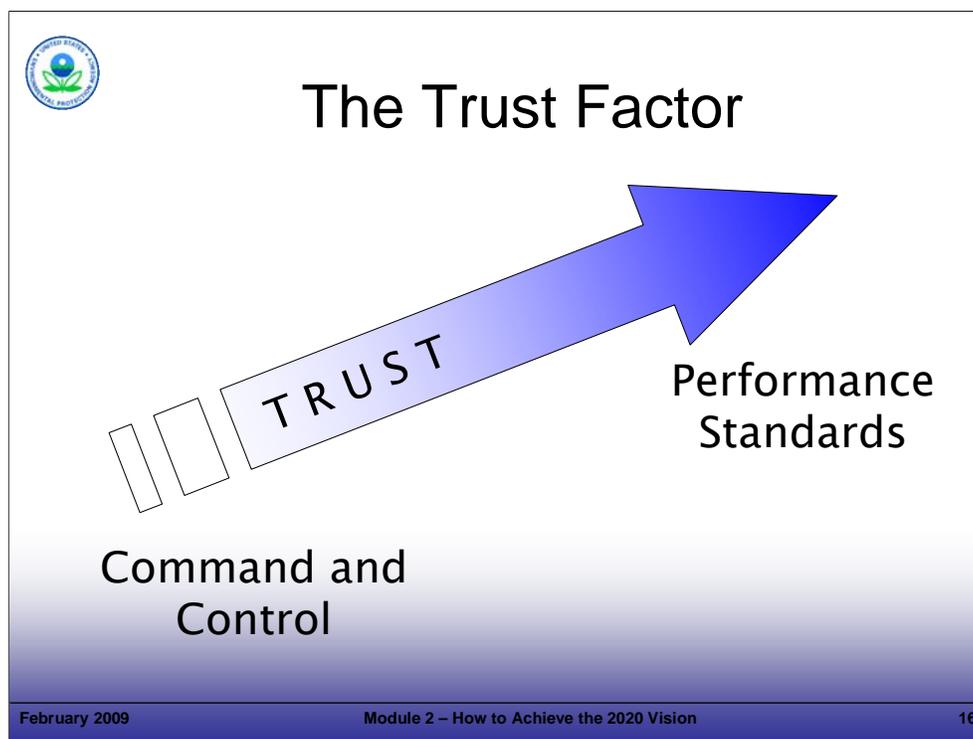
Key Points

- The effective use of performance standards can reduce the traditional comment-response cycle between the regulator and the facility. As long as clear, specific performance standards are established by the regulator and facility, the facility can proceed with CA implementation without separate approvals for each task, as long as the standards are met. In other words, the facility has the flexibility to decide how to meet the performance standard.
- Specific examples of performance standards and how they can be used are provided in later modules. However, just as an example, EPA's threshold criteria can serve as the basis of performance standards. These threshold criteria include:
 - Protect human health and the environment;
 - Attain media cleanup objectives; and
 - Control sources of release.
- Here is an example of replacing a technical standard with a performance standard:
 - Technical Standard: Monitor the following wells on a quarterly basis: PW-1 to PW-20.
 - Performance Standard: Maintain a groundwater monitoring system that adequately characterizes the lateral and vertical extent of contamination over time.

The regulatory agency evaluates whether the performance standard is being achieved through communication with the facility and review of technical reports and documentation.
- EPA's support of performance standards spans two decades:
 - *EPA favors performance-based approaches provided that the remedial goals for the facility are clear, the oversight during remedy implementation is appropriate to the complexity of the facility-specific circumstances, and the public is substantively involved* (FR. 1996. ANPR, page 19448).
 - *Performance-based permitting will now be the preferred approach, wherever feasible and appropriate, for all of EPA's permitting programs, and State, tribal, and local governments will be provided the flexibility and guidance to implement similar approaches* (EPA. 1996. Permit Improvement Team's Concept Paper and Task Force Recommendations).
- Other performance standards can be developed for final remedies or to streamline other phases of RCRA CA (e.g., assessment). It is the Project Manager's responsibility to establish clear, reasonable, and protective performance standards. It is the o/o's responsibility to meet the established performance standards.

References

- FR. 1996. ANPR. 61 FR 19432. May 1. Page 19448.
- EPA. 1996. Permits Improvement Team Final Draft of Concept Paper on Environmental Permitting and Task Force Recommendations. July.
- 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.



Notes:

Purpose of Slide

- A level of trust between the facility and regulatory agency is important when developing and implementing effective performance standards. As described in EPA's Tailored Oversight guidance, effective oversight of corrective action requires a clear, documented understanding of facility-specific cleanup goals.

Key Points

- A command and control approach tends to be used when trust is lacking. This approach can slow down the CA process significantly, especially when it consists of only actions such as formal document exchanges and the associated lengthy comment cycles.
- The degree to which one party trusts another is a measure of belief in the honesty, and competence of the other party. Placement of trust allows actions to be conducted based on incomplete information and, as we know, CA decisions are often made in the face of incomplete information.
- A key to building mutual trust between regulators and a facility, and thereby streamlining the CA process, is communication. Regular, informal discussions and other information exchanges are important in communicating expectations, issues, and uncertainties associated with establishing and implementing performance-based standards. Working out these details informally helps to build a rapport between the regulators and facility as well as serving to streamline the review and approval of submitted documents.

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.



How Can We Achieve the 2020 Vision for CA?

4. Tailor sustainable solutions considering risk management and revitalization.

(continued)

February 2009

Module 2 – How to Achieve the 2020 Vision

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Notes:

Purpose of Slide

- Emphasize that decisions relating to final remedies evaluate the human and ecological risk posed by the contaminants at the site – this is risk management.
- Stress that decisions relating to final remedies should consider current and reasonably anticipated uses – that is, whether the site will continue operating or if redevelopment for other uses is planned. In addition, a robust tailored risk management approach should consider long-term stewardship (LTS) implications, authorities, limitations, costs, and responsibilities.

Key Points

- At continued use sites (e.g., operating facilities), it is often reasonable to take a long-term approach to cleanup (including monitoring only or natural attenuation), as long as:
 - there are no unacceptable risks given current use and exposure scenarios;
 - contamination is not spreading to the extent it will create human or ecological risk and media cleanup criteria will eventually be achieved, especially after the facility closes in the future; and
 - sources are controlled to protect humans and prevent ecological exposure.
- Sustainable solutions relate to wise energy and resource use.
- Facilities undergoing revitalization are commonly under tight time schedules. Property sales, closing dates, and leasing agreements all require a quick turnaround on decisions. Therefore, it is important for the regulatory agency to be aware of these constraints in order to tailor the solution, as appropriate.
- Land development will often affect cleanup decisions. Generally, it is prudent to allow remedies to move forward on a fast track under these circumstances, as long as (1) the decisions are backed by registered professionals – for example, Professional Geologists (PGs), Professional Engineers (PEs), or state-licensed professionals (e.g., Licensed Site Professionals in MA or Licensed Environmental Professionals in CT) and (2) the site cleanup meets the State's or EPA's criterion of being protective of human health and the environment.

References

- EPA. 2000. Final Remedy Selection for Results-Based RCRA Corrective Action (Fact Sheet #3). March.
- EPA. 2000. Results-Based Approaches to Corrective Action. July 26.



How Can We Achieve the 2020 Vision for CA?

5. Okay for remedy to change over time to improve overall performance.

(continued)

February 2009

Module 2 – How to Achieve the 2020 Vision

18

Notes:

Purpose of Slide

- Make the point that a remedy can be selected and constructed without perfect site characterization data, because the remedy can be modified based on how it performs.

Key Points

- A remedy is designed based on predictions of how the hydrogeology and chemistry of a site will react to some external influence – for example, pumping, chemical additives, or the injection of air. Therefore, it is common to modify the operating conditions of a remedy after it is installed and is operating, based on evaluations of its effectiveness. For example, a pump and treat system may yield more or less water than anticipated, so flow rates and treatment systems are adjusted accordingly. As another example, air sparge wells may have a different radius of influence than expected and systems may need to be adjusted to achieve the desired radius. In short, improvements through modifications to a technology or remedy, once installed and operating, are not uncommon.
- Other changes may be longer-term. For instance, pump and treat systems may reduce concentrations by orders of magnitude for several years – but over time, concentration changes may reach asymptotic levels. At this point, a different technology may be appropriate. These longer-term changes or improvements to the remedy or a technology are often identified through Remedial System Evaluation or Remedial System Optimization, which is discussed in Module 11. The most effective remedies may require the most changes; as cleanup occurs, site conditions no longer meet the design parameters.
- A remedy also may change due to land use changes, which can lead to modifications of cleanup goals.
- Effective long-term stewardship of both engineering and ICs will help identify changes that may be needed to maintain remedy effectiveness.
- The bottom line is that all efforts and resources should not focus only on selecting the remedy, because the remedy can be adjusted over time – and likely will need to be.

References

- EPA. 2002. Elements for Effective Management of Operating Pump and Treat Systems. Fact Sheet. OSWER 9355.4-27FS-A. 542-R-02-009. December.
- Interstate Technology and Regulatory Council (ITRC). 2004. Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation. September.



How Can We Achieve the 2020 Vision for CA?

6. Yield to changes in focus:

- ❖ From assessment to remediation
- ❖ From procedures to results

(continued)

February 2009

Module 2 – How to Achieve the 2020 Vision

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Notes:

Purpose of Slide

- Point out the need for implementers to change their focus -- from assessment to operation -- *and* -- from procedures to results.

Key Points

- The focus should be (1) to get a remedy operating (including passive remedies, such as monitored natural attenuation [MNA]) once sufficient characterization data are available and (2) to evaluate the effectiveness of the remedy over time.
- Constructing and implementing a remedy prior to complete characterization is often environmentally and economically beneficial. This approach may shorten the CA timeline by focusing early on areas of higher concentration, which in turn can reduce contaminant migration.
- Changing focus requires the Project Manager to be a Risk Manager, approving investigations and cleanup plans in the face of uncertainties. A critical component of risk evaluation and risk management, which is the basis of CA, is that uncertainties associated with environmental investigation and remediation are inherent (e.g., are there enough wells to demonstrate a plume is not migrating?, is there another source of contamination?). Basing CA on risk recognizes the need to strive for the appropriate balance between reducing uncertainties via data collection and managing uncertainties via remedial action and contingencies.
- For years now, EPA has emphasized that results are more important than procedures. EPA made this point strongly as part of the RCRA Reforms in 1999 and has reiterated this message in its courses and conferences since that time.

References

- FR. 1996. ANPR. 61 FR 19432. May 1.
- EPA. 1999. RCRA Cleanup Reforms. EPA 530-F-99-018 (Fact Sheet #1). July.
- EPA. 2001. RCRA Cleanup Reforms 2. EPA 530-F-01-001 (Fact Sheet #2). January.
- 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.
- 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. EPA 530-R-04-030. Update. April.
- EPA. 1999. RCRA CA Workshop on Results-Based Project Management. June 10. Accessed On-line at: <http://www.epa.gov/osw/hazard/correctiveaction/workshop/>.

	Regulatory Mechanism Negotiation	Assessment and Interim Measures	Remedy Selection/ Construction	Remedy Operation
Agency Staff Time				
Facility Costs	\$\$\$	\$\$\$\$\$\$	\$\$\$\$\$\$\$\$ \$\$\$\$	\$\$\$\$\$\$\$\$ \$\$\$\$\$\$\$\$
Public Participation				
Human Health & Environmental Benefit				

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Notes:

Purpose of Slide

- Illustrate that most of the regulatory agency time and focus has traditionally been on site characterization; however, the largest facility expenditures and greatest environmental benefits occur during remedy selection/construction and remedy operation.

Key Points

- Project Managers should strive to achieve a balance between having sufficient information to proceed with remedy selection and gathering additional information that adds to the overall understanding of the site.
- Some considerations for moving forward with less than perfect site information include:
 - The Pareto Principle – chasing down the last 20% of characterization information may eat up 80% of the budget without positively affecting the remedial design;
 - Interim remedial measures can be used to focus on source areas, where relative cleanup benefits are generally the greatest compared to overall site cleanup costs (e.g., \$ per pound of contaminant removed);
 - At many facilities, successful interim measures have been converted to final measures;
 - If a remedy is implemented as a pilot or in a phased approach, the remedy’s design can be improved as it is expanded over time; and
 - Even selected final remedies may change over time to achieve more efficient operation and better results.

References

- None.



How Can We Achieve the 2020 Vision for CA?

7. Engineering and Science are the solution (not reports!)

(continued)

February 2009

Module 2 – How to Achieve the 2020 Vision

21

Notes:

Purpose of Slide

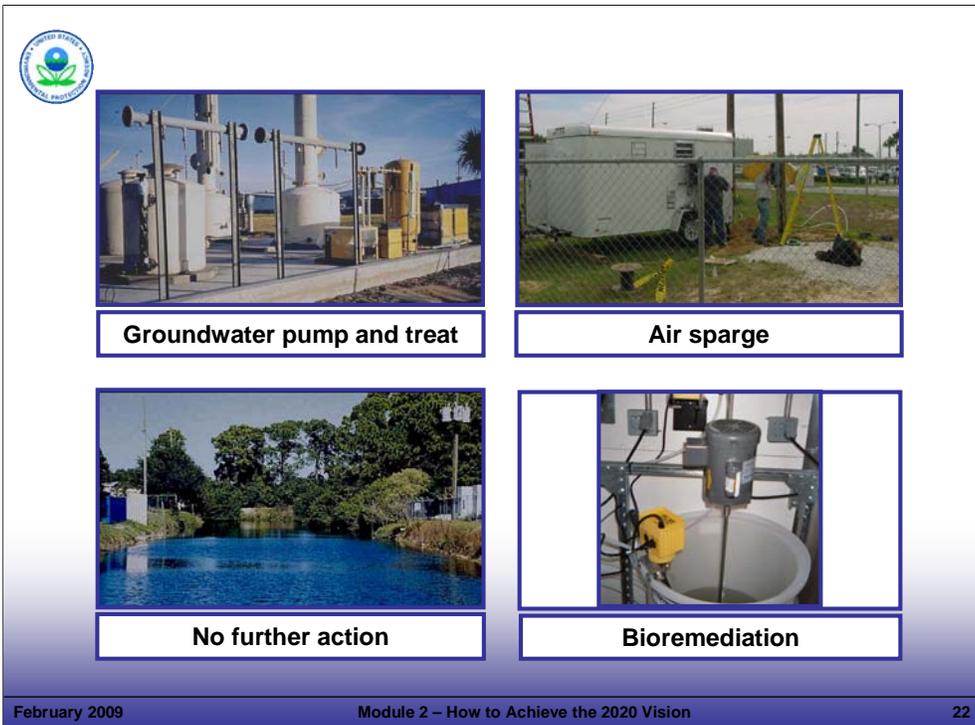
- Environmental remediation does not occur through the preparation and review of reports – it occurs through the design and implementation of effective remedies, which are based on sound engineering and science.

Key Points

- The Agency requires certain documentation for decision-making purposes. In addition, reports are necessary for planning, communicating, and documenting decisions. However, in themselves, reports and documents do not remediate a site.
- Engineering and scientific results drive decisions related to risk and support remedy implementation.

References

- None.



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Notes:

Purpose of Slide

- Point out that the best way to meet the 2020 CA Vision is by focusing on science, engineering, and construction – not on process and reports.

Key Points

- Achieving Remedy Decision and Remedy Construction measures requires that remedial solutions (e.g., pump and treat, air sparge, no further action, bioaugmentation) be selected, engineered, and constructed. The Project Manager can help streamline this process by keeping the focus on remediation goals, including land revitalization. Reports and other documents support this effort and are necessary, but in themselves, are not the driving force behind an effective cleanup.
- Real environmental progress occurs when the remedy is constructed, not when the report is completed.
- However, we should remember that while reports may not drive progress, regulatory agency decision makers need adequate and sound documentation to support their actions.

References

- None.



How Can We Achieve the 2020 Vision for CA?

8. Success – document it!

February 2009 Module 2 – How to Achieve the 2020 Vision 23

Notes:

Purpose of Slide

- Implementation of these principles will lead to environmental successes – Remedy Decision and Remedy Construction – and while we don't want to *focus* on process, we still need to document those successes.

Key Points

- The Project Manager should document the achievement of Remedy Decision (CA 400) and Remedy Construction (CA 550) following the actual date each measure is met.
- The "actual date" for the Remedy Decision measure is defined as follows:
The date that the EPA or State decision maker signs the Remedy Decision and Response to Comments or other appropriate document.
- The "actual date" for the Remedy Construction measure is defined as follows:
(1) The date the State or EPA acknowledges, in writing, that any necessary physical construction of the last corrective measure is complete and all remedial systems are fully functional as designed, whether or not final cleanup levels or other requirements have been achieved, or (2) the scheduled date for the remedy decision if no further physical construction of a remedy is needed.
- The Agency requires sufficient documentation from the o/o to support these decisions.
- We will focus more on these specific measures in later modules.
- Ultimately, success is achieved when sites are cleaned up for continued or new uses.

Reference

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



Get an Exit Strategy

Environmental cleanup to protective levels is the goal

Think performance standards

Tailor sustainable solutions considering risk management and revitalization

Okay for remedy to change

Yield to changes in focus

Engineering and science are the solution

Success – document it!

February 2009 Module 2 – How to Achieve the 2020 Vision 24

Notes:

Purpose of Slide

- Review the 8 principles identified in this module.

Key Points

- This slide summarizes the principles associated with achieving CHANGE and RCRA CA progress.

References

- None.



The slide features the RCRA logo in the top left corner, which includes a globe and the text "UNITED STATES ENVIRONMENTAL PROTECTION AGENCY". The main title "Get to YES!" is centered in a large, blue, serif font. To the right of the title is a purple circular icon with a hand holding a document, labeled "HANDOUT". The footer contains the text "February 2009", "Module 2 – How to Achieve the 2020 Vision", and the page number "25".

Notes:Purpose of Slide

- Generate enthusiasm for meeting the 2020 goals and vision for CA and encourage all to take the challenge!

Key Points

- The rest of the course provides information, tools, and resources that can be used to achieve RCRA CA progress, meet RCRA CA goals, and ensure the RCRA CA Vision is achieved.
- We will return to the "Get to YES!" principles as we progress.

References

- None.

Module 03
Corrective Action Authorities and Guidance



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



February 2009 Module 3 - Corrective Action Authorities and Guidance 1

Notes:

Purpose of Slide

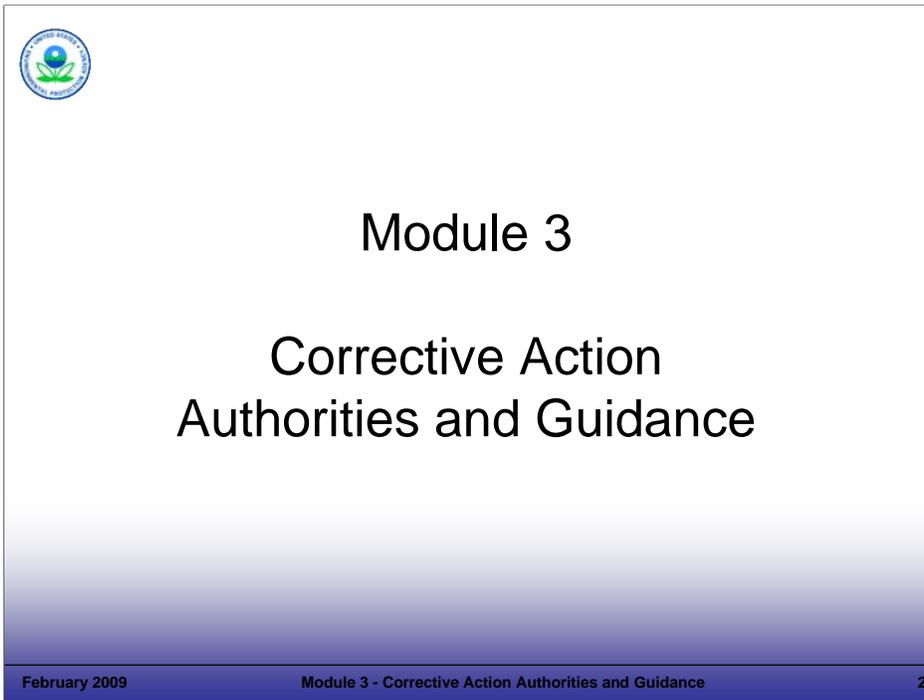
- Holder slide for Module 3, Corrective Action Authorities and Guidance.

Key Points

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

References

- None.



Notes:

Purpose of Slide

- Holder slide for Module 3, Corrective Action Authorities and Guidance.

Key Points

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

References

- None.



Module Overview

- ❖ Review legal authorities used to implement Resource Conservation and Recovery Act (RCRA) corrective action (CA)
- ❖ Examine RCRA CA cleanup reforms and results-based guidance for CA
- ❖ Trace the evolution of the legal and policy framework for CA

February 2009

Module 3 - Corrective Action Authorities and Guidance

3

Notes:

Purpose of Slide

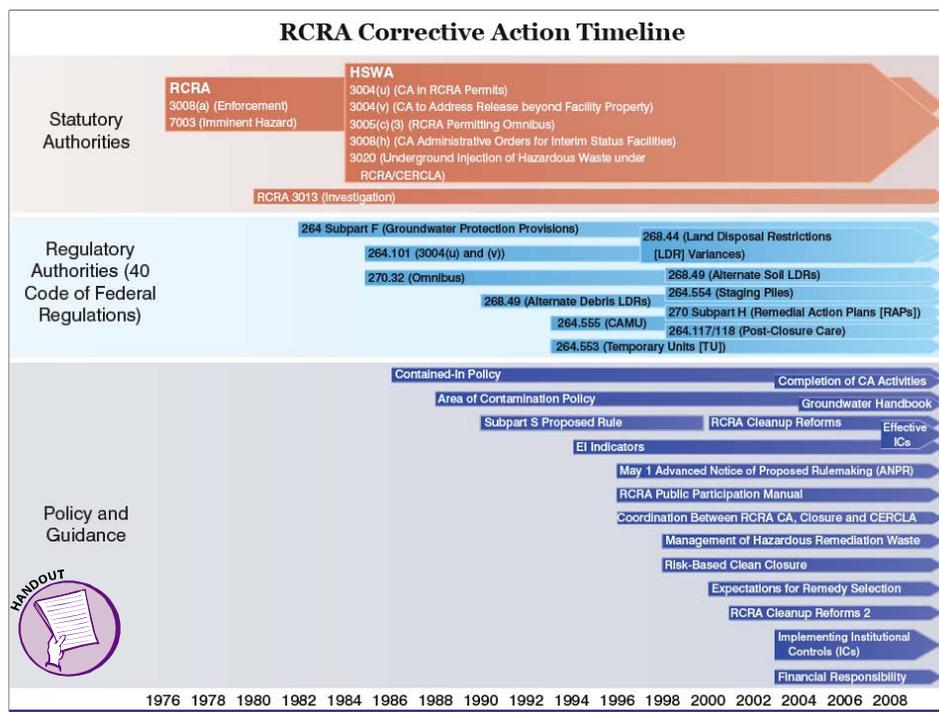
- Provide an overview of the topics covered by this module.

Key Points

- The first part of the module reviews the legal authorities and mechanisms used to implement corrective action (CA) at Resource Conservation and Recovery Act (RCRA) facilities. Various authorities and mechanisms are available to implementers in administering CA. We will briefly review the statutory and regulatory authorities for RCRA CA established by the original RCRA statute and by authorities added by the Hazardous and Solid Waste Amendments (HSWA) to RCRA. The EPA and state define the means for CA, but the end is the key. We will discuss several key terms which apply specifically to RCRA CA. We also will examine other legal authorities, primarily including various types of state cleanup programs (including voluntary cleanup programs) that may be used to address cleanup obligations at RCRA facilities.
- The second part of the module examines the RCRA reforms and results-based guidance for implementing CA.
- In addition, this module reminds participants of the public involvement and financial assurance requirements of RCRA CA and the important role these play in successfully achieving RCRA CA progress.
- Regulations and state programs provide the means; the end is a protective cleanup. As long as the site is being addressed adequately, as required by RCRA, neither the authority used nor the agency overseeing the cleanup is important. The various authorities allow implementers to be flexible and creative in administering CA.

References

- None.



Notes:

Purpose of Slide

- Provide a historic overview of the statutory authorities, regulatory authorities, and policies and guidance that provide the framework for RCRA CA.

Key Points

- This slide provides a historic view of the evolution of the RCRA CA program.
- The following slides provide more detail on these authorities and policy/guidance.
- The instructor will review these materials with the class, based on the level of experience of participants. The timeline is also provided as a handout and ties to references included with the Reference CD ROM, which participants can use as a resource after the course is over.

References

- Derived from the references cited in the remainder of this module.



Pre-HSWA Statutory Enforcement Authorities

- ❖ 1976
 - Section 7003 provides judicial authority to compel any person to abate conditions that present an imminent and substantial endangerment to human health or the environment
- ❖ 1980
 - Section 3013 added (provides administrative authority to compel investigations)
 - Section 7003 amended (provides administrative authority to abate conditions that **may** present)

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Notes:

Purpose of Slide

- Review two of the statutory authorities contained in RCRA (prior to HSWA) for compelling owner/operators (o/o's) to perform CA. These authorities remain in effect and may be used where appropriate.

Key Points

- Prior to HSWA, CA was not required at RCRA-regulated facilities (except at regulated units); however, the U.S. Environmental Protection Agency (EPA) did have information-gathering and cleanup authorities.
- Section 3013 of RCRA provides authority to require monitoring, testing, analysis, and reporting at hazardous waste treatment, storage and disposal facilities (TSDFs) to address potentially substantial hazards to human health or the environment. Under this authority, EPA could issue an administrative order to require testing, monitoring, analysis, and reporting. While Section 3013 authority is triggered by the presence or release of hazardous waste that may present a substantial hazard, Section 3013 refers to the statutory definition of hazardous waste, which is broader than the regulatory definition at 40 Code of Federal Regulations (CFR) 261.3. Section 3013 applies to the current o/o or potentially the most recent previous o/o who could be expected to know about the presence or potential release of the hazardous waste (it only applies to the most recent previous o/o if the current o/o could not be expected to know this information).
- Section 7003 provides EPA authority to initiate judicial action or issue administrative orders to any person to require action as necessary to protect human health and the environment. This action can include investigation and cleanup in situations that may present imminent and substantial danger to human health and the environment. Courts have repeatedly recognized that the endangerment standard of Section 7003 is quite broad. The associated guidance defines an "endangerment" as an actual, threatened, or potential harm to health or the environment. Section 7003 also applies to potential endangerments caused by materials that meet RCRA's statutory definition of solid waste. EPA may enforce and seek penalties against violators of Section 7003 orders in appropriate United States district courts.
- EPA retains enforcement authority under Sections 3013 and 7003 in authorized states.

References

- Code of Federal Regulations (CFR). 40 CFR 261.3.
- EPA. 1984. Issuance of Administrative Orders under Section 3013 of RCRA. September 26.
- EPA. 1997. Guidance on the Use of Section 7003 of RCRA. October 20.
- EPA. 2005. Model RCRA Section 7003 Administrative Order on Consent. October 28.



Pre-HSWA Statutory Enforcement Authorities

- ❖ Section 3008(a) authorizes administrative orders and judicial actions to address non-compliance with any requirement of RCRA Subtitle C
- ❖ Subtitle C requirements include CA provisions in RCRA permit
- ❖ EPA may assess penalties for each day of violation
- ❖ State can take enforcement action under analogous state authority if authorized for CA

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Notes:

Purpose of Slide

- Overview enforcement approaches for CA.

Key Points

- Section 3008(a) authority is used to require any person that is not in compliance with the requirements of RCRA Subtitle C to take steps immediately or within a stated time period (that is, a schedule) to return to compliance.
- Subtitle C requirements include CA provisions in RCRA permits.
- The order can contain penalty provisions up to \$32,500 per day per violation and can suspend or revoke a facility's permit or interim status. When EPA issues a compliance order, the person issued the order can request an administrative hearing on the factual provisions of the order. If no hearing is requested, the order becomes final 30 days after it is issued.
- Section 3008(a) is Federal, but states have comparable authorities. EPA would look to the state to take enforcement action for non-compliance with CA requirements in a permit if the state is authorized for CA.

References

- CFR. 40 CFR 261.3.
- EPA. 1984. Issuance of Administrative Orders under Section 3013 of RCRA. September 26.
- EPA. 1997. Guidance on the Use of Section 7003 of RCRA. October 20.
- EPA. 2005. Model RCRA Section 7003 Administrative Order on Consent. October 28.



Pre-HSWA Regulatory Authority

- ❖ Established in 1982 as part of groundwater monitoring and protection regulations for hazardous waste land disposal units
- ❖ Requires o/o to implement CA program for release of hazardous constituents into groundwater from “regulated units”
- ❖ Only implemented as a permit condition

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Notes:

Purpose of Slide: Review the original CA regulatory authority established under RCRA Subpart F groundwater monitoring regulations for o/o's of hazardous waste land disposal facilities.

Key Points

- Prior to HSWA, “RCRA CA” referred to the removal or treatment of Appendix VIII hazardous constituents in groundwater. Under the original groundwater monitoring requirements established in 40 CFR Part 264 Subpart F for o/o's of TSDFs, the o/o must develop and implement a CA plan to address the release of hazardous constituents into groundwater from “regulated units” at levels above the groundwater protection standard (GWPS) or alternative concentration limits (ACLs). The CA requirement is the third step of a three-phased program for detecting, characterizing, and responding to releases to the uppermost aquifer from regulated units. This requirement remains in effect and may be used where appropriate.
- 40 CFR 264.90 defines a “regulated unit” as any land disposal unit (for example, a surface impoundment, waste pile, land treatment unit, or landfill) that received hazardous waste on or after July 26, 1982.
- This regulatory authority only addresses releases of hazardous constituents into groundwater (not other environmental media) from “regulated units” and is part of the base RCRA program.
- The requirements of 40 CFR 264.100 are implemented under an o/o's permit.
- Note that the post-closure rule allows the integration of groundwater and other cleanup at “regulated units” with facility-wide CA.

References

- CFR. 40 CFR 264.100.
- CFR. 40 CFR 264.90.
- Federal Register (FR). 1982. 47 FR 32274. July 26.
- FR. 1998. Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities; Post-Closure Permit Requirement and Closure Process; Final Rule. 63 FR 56710. October 22.



HSWA Authorities - §3008(h)

- ❖ Authorizes CA administrative orders for o/o's subject to interim status requirements
- ❖ EPA may issue an order based on a determination of a release
- ❖ Versatile authority
- ❖ Not delegated to states; however, many states have similar authorities
 - EPA should consult and give notice to states before issuing orders
 - Pursue unilateral enforcement only if other avenues fail

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Notes:

Purpose of Slide: Introduce the authority for interim status CA orders.

Key Points

- Section 3008(h) authority for interim status CA orders provides authority for requiring CA at non-permitted, interim status RCRA facilities. Interim status is the period during which the o/o of a TSDF is treated as having been issued a RCRA permit even though a final determination on the permit has not yet been made by the regulator. O/o's of TSDFs in existence on November 19, 1980, or brought under Subtitle C regulation due to a legislative or regulatory change, may continue to operate as if they have a permit until their permit is issued or denied as long as they comply with specific requirements. Congress created "interim status" under section 3005(e) of RCRA.
- Section 3008(h) authorizes EPA to issue CA administrative orders and to initiate civil actions for facilities currently under interim status, facilities that once had interim status, or facilities that should have had interim status. A Section 3008(h) order may be issued whether the facility is operating (prior to receiving a permit), is closing, or is closed.
- EPA may issue the order based on determination of a release of hazardous waste or hazardous constituents from the facility into the environment.
- CA orders under Section 3008(h) may be issued unilaterally by EPA (unilateral administrative order [UAO]) or issued as consent agreements between the o/o and the Agency (administrative orders on consent [AOC]). A UAO is a non-negotiated, and usually, adversarial proceeding under which the o/o is ordered to act. EPA may use its administrative order authority without going through the federal courts. Also, EPA may choose to obtain a 3008(h) order by commencing a civil action in the U.S. district court.
- The Section 3008(h) authority is versatile and can be crafted as needed to implement CA for releases at a particular facility. All types of CA activities at a RCRA facility can be performed under an order, including: interim measures, investigation and assessment, controls of facility operations, and long-term cleanup work. In the case where a permit is issued to the facility after an order is already in place, EPA (1) may require the o/o to continue all or some of the activities under the order or (2) may incorporate the requirements of the order into the RCRA permit. EPA expects equivalent results whether CA is performed under an order or permit.
- EPA has issued guidance to EPA employees on Section 3008(h) model consent orders. The guidance discusses potential consent order provisions, including: definitions, guidance on work to be performed, alternative dispute resolution, termination and satisfaction, and stipulated penalties for AOCs. EPA has recently issued additional guidance on model consent orders regarding cost estimates and financial responsibility. Note that UAOs do not include stipulated penalties, procedures for dispute resolution, and *Force Majeure* clauses.
- The Section 3008(h) authority is Federal, but many states have comparable authority. States that desire such authority must enact parallel statutory enforcement authorities. For example, MI and CO have established legal authority to issue CA consent orders. If a State is authorized, EPA expects the State to implement the CA program and take enforcement actions, as necessary.
- It is advisable that EPA and the State should confer prior to issuance of an order to help ensure all facts about the facility are well known, to avoid misunderstandings, and to inform the State of the conditions requiring response and the actions EPA will take.

References

- EPA. 1985. Memorandum from J. Winston Porter, OSWER Assistant Administrator, to Regional Administrators. Interpretation of Section 3008(h) of the Solid Waste Disposal Act. December 16.
- EPA. Undated. Memorandum from J. Winston Porter, OSWER Assistant Administrator, to Regional Administrators. Use of §3008(h) Orders or Post-Closure Permits At Closing Facilities. OSWER Directive 9502.00-7. March 8.
- EPA. 1989. Guidance on Administrative Records for Section 3008(h) Orders. July.
- EPA. 1993. Final RCRA Section 3008(h) Model Consent Order OSWER Directive #9902.5A. December 15.
- EPA. 2006. Model Provisions for Cost Estimates and Financial Responsibility for Use in Section 3008(h) Administrative Orders on Consent. February.
- FR. 1985. 50 FR 28702. July 15; FR. 1985. 50 FR 38946. September 25; FR. 1988. 40 CFR Part 24. 53 FR 12256. April 13; and FR. 1999. 64 FR 40138. July 23. Preamble to the Consolidated Rules of Practice for 40 CFR Part 22.
- 40 CFR Part 22. Consolidated Rules of Practice.



HSWA Authorities - §3004(u)

- ❖ Requires that RCRA permits issued after November 8, 1984, include CA for releases from solid waste management units (SWMUs) within the facility boundary
- ❖ Requires financial assurance for CA
- ❖ Codified at 40 CFR 264.101

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Notes:

Purpose of Slide: Review the permitting authority for CA at TSDFs added by HSWA.

Key Points

- HSWA substantially expanded CA authorities for both permitted RCRA facilities and facilities operating under interim status.
- Section 3004(u) of RCRA, as amended by HSWA, requires that any permit issued to a TSDF under Section 3005(c) after November 8, 1984, address CA for releases of hazardous wastes or hazardous constituents from any solid waste management unit (SWMU) at the facility. Permits subject to CA requirements include post-closure permits and permits issued to operating hazardous waste management facilities.
- Under Section 3004(u), o/o's are required to demonstrate financial responsibility for completing the required CAs. EPA has not issued regulations on financial assurance for CA, but has provided guidance. EPA is also considering if any further tools are warranted to support program implementers addressing financial assurance requirements.
- Section 3004(u) was codified as a regulatory requirement at 40 CFR 264.101. We will discuss financial assurance in a little more detail later in this module.

References

- CFR. 40 CFR 264.101.
- FR. 1985. 50 FR 28702. July 15.
- FR. 1987. 52 FR 45788. December 1.
- FR. 1996. Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities; Advance Notice of Proposed Rulemaking (ANPR). 61 FR 19432. May 1.



HSWA Authorities - §3004(v)

- ❖ Requires o/o to perform CA to address releases beyond facility's boundary
- ❖ Codified in 40 CFR 264.101
- ❖ Implemented as a permit condition

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Notes:

Purpose of Slide

- Review the CA authority created under Section 3004(v) of RCRA, as amended by HSWA.

Key Points

- Section 3004(v) requires EPA to amend the CA standards for TSDFs to require CA for releases that have migrated beyond the facility boundary where necessary to protect human health and the environment, unless the o/o demonstrates to the satisfaction of EPA that, despite the o/o's best efforts (which could include paying reasonable sums of money and making reasonable communication efforts), the o/o was unable to obtain permission to undertake the required actions. An example of a situation where required actions are not able to be undertaken includes if the o/o can demonstrate that it could not obtain access to properties beyond the facility boundary to implement the chosen remedy.
- This provision applies to releases from all SWMUs, including releases to the uppermost aquifer from regulated units.
- Section 3004(v) requirements have been codified at 40 CFR 264.101.

References

- CFR. 40 CFR 264.100 and 264.101.
- FR. 1985. 50 FR 28702. July 15.
- FR. 1987. 52 FR 45788. December 1.



CA Permits

- ❖ One tool for implementing CA and achieving completion
 - Forty-two states and territories now authorized
- ❖ Provide broad regulatory authority
- ❖ EPA and states may also use “omnibus” authority to implement cleanup activities at RCRA permitted facilities

(continued)

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Notes:

Purpose of Slide

- Overview RCRA CA permits.

Key Points

We will discuss other approaches for CA later in this module (for example, facility-lead agreements and post-closure mechanisms).

- CA permits are one tool for implementing CA and achieving CA completion, by EPA and authorized states. The statutory language of Section 3004(u) requires EPA to issue a RCRA permit with a schedule of compliance (if CA has not been addressed) for investigating and correcting releases rather than delay issuance of permit until cleanup has been completed. Schedules of compliance, which are enforceable components of the permit, are the primary vehicle by which EPA specifies procedural and technical requirements that the o/o's must follow to achieve compliance with their CA obligations.
- Forty-two states and territories are authorized to implement CA. In states without authorization, EPA continues to implement RCRA CA authorities. However, in many of these states (not authorized for CA), the states oversee much of the CA work through a work sharing agreement with EPA. The relationship between state cleanup programs and RCRA CA is discussed in more detail later in this module.
- EPA and states have a number of authorities under the hazardous waste program to compel o/o's to address releases of hazardous waste and hazardous constituents from SWMUs throughout the facility. The requirement found at 40 CFR 264.101 (and state equivalent requirements) specifies that o/o's: “must institute CA as necessary to protect human health and the environment for all releases...”
- HSWA created section 3005(c)(3) that requires EPA and authorized states to establish conditions in a facility's RCRA permit as needed to protect human health and the environment. Referred to as the “omnibus” authority, EPA occasionally has used this authority to implement cleanup activities at RCRA-permitted facilities. Similarly, states with authorized RCRA programs have used state omnibus authorities. For example, EPA or an authorized state could use the omnibus authority to require the o/o to investigate the release of hazardous constituents from a source that was not defined as a SWMU. This authority is codified at 40 CFR 270.32(b)(2).

References

- CFR. 40 CFR 270.32(b)(2).
- FR. 1985. 50 FR 28702. July 15.
- FR. 1987. 52 FR 45788. December 1.



CA Permits

- ❖ Majority of new and operating facilities typically perform CA under permits
- ❖ CA requirements included in the permit can and should be performance-based

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Notes:

Purpose of Slide

- Continue discussion of CA permits.

Key Points

- In general, facilities seeking a new permit or active operating facilities with regulated units will generally perform CA activities under conditions included in their RCRA permit. As noted earlier, Section 3004(u) was codified in 40 CFR 264.101; however, this requirement is not prescriptive, but is performance-based.
- In regards to CA permits, remember Principle No. 3 from Module 2 - "Think Performance Standards."
- The instructor will discuss how CA requirements in permits can be performance-based; performance-based approaches are discussed further in other modules.

References

- CFR. 40 CFR 264.101.



Alternate State Cleanup Programs

- ❖ Most states are authorized to implement CA program in lieu of EPA
- ❖ States also use alternate cleanup programs and authorities to support cleanup at RCRA facilities
 - State Superfund programs (e.g., NY)
 - One Cleanup programs (e.g., WI)
 - Brownfields programs (e.g., CT)
 - Voluntary programs (e.g., IL)
 - Other programs (e.g. Regional Water Quality Boards in CA)

(continued)

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Notes:

Purpose of Slide: Overview alternate State program authority for CA at TSDFs and stress the importance of state cleanup programs.

Key Points

- Alternate State cleanup programs may play an important role for RCRA CA facilities.
- Most states and territories are authorized to implement CA. In states without authorization, EPA continues to implement RCRA CA authorities. However, in many cases, the states oversee much of the CA work through work sharing agreements with EPA although EPA continues to have enforcement authority over CA. States also use other authorities to support cleanup.
- Many states have voluntary cleanup programs (VCPs) and other alternate cleanup authorities to speed cleanup at, for example, lower risk sites that may not be subject to other authorities – and to foster redevelopment. Eligibility and procedures vary among states. Participants commonly pay oversight costs. For example, the IL Voluntary Site Remediation Program (SRP) provides remediation applicants the opportunity to receive IL EPA review, technical assistance, and no further remediation (NFR) determinations. The program is designed to be flexible and responsive to the needs of the remediation applicants; the goals and scope of actions at these sites are normally defined by the Remediation Applicants. Under the program, IL EPA issues NFR letters to the Remedial Applicants who have successfully demonstrated, through proper investigation and remedial action (when warranted), that environmental conditions at their site do not present a significant risk to human health or the environment. The NFR letter signifies a release from further responsibilities under the Illinois Environmental Protection Act.
- States will often use their alternate cleanup programs to accelerate cleanups at facilities subject to RCRA CA. For example, a RCRA facility may have 45 SWMUs identified, but only 20 SWMUs are currently subject to a CA order issued by the EPA Region. The State or owner or operator could choose to address the remaining 25 SWMUs, not covered by the order, under an alternate state cleanup mechanism instead of a RCRA permit.
- EPA and several states have entered into non-binding Memoranda of Agreement (MOA) to recognize the use of alternate cleanup programs to address CA at lower priority RCRA TSDFs.
- The use of alternate state cleanup programs is one of the tools that may be used to meet the 2020 cleanup goals.

References

- IL Environmental Protection Agency. IL Environmental Protection Agency, Bureau of Land Web Site. Information on IL Voluntary State Remediation Program. Accessed On-line at: <http://www.epa.state.il.us/land/more-info-about-bol.html>.



Alternative State Cleanup Mechanisms

- ❖ States will typically have a number of cleanup mechanisms that provide varying degrees of flexibility, including:
 - Voluntary cleanup programs or property transfer laws
 - Operating permits
 - Post-closure plans, permits, or orders
 - Compliance orders on consent
 - Unilateral compliance orders

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Notes:

Purpose of Slide

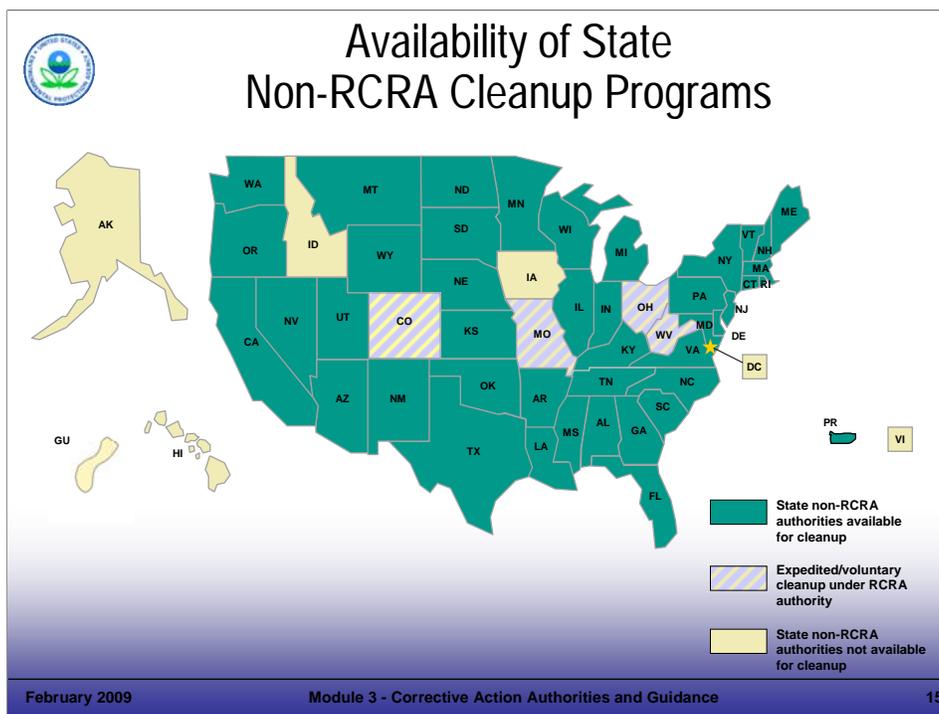
- Briefly discuss available and flexible options State programs typically have for implementing RCRA CA.

Key Points

- RCRA CA at a facility may be performed under one or a number of the mechanisms noted on this slide. Such mechanisms provide a structured, yet flexible, process for holding parties responsible for completing cleanup activities. They also ensure that a process is available to resolve any disputes that may arise during the course of the CA process. The facility benefits by having a defined process that may aid in planning, budgeting resources, obtaining insurance, and informing management of long-term commitments.
- An o/o may propose a mechanism under which it will perform the work; however, the final decision to accept that proposal or select an alternate mechanism rests with regulatory authority.
- The next slide shows a map of States that use alternate cleanup authorities at RCRA TSDFs; however, the map does not distinguish between the type of TSDFs (e.g., permitted, interim status, high priority, low priority).

References

- None.



Notes:

Purpose of Slide

- Overview of alternate State program authority for CA at TSDFs.

Key Points

- This map shows the availability of alternate state cleanup programs that may support remediation efforts at RCRA sites.
- This map is current as of October 2008.

References

- 2008. Map provided by EPA Office of Solid Waste and Emergency Response, Office of Resource Conservation and Recovery (ORCR).



Summary of Mechanisms

- ❖ Agreements
 - Permits
 - Consent orders
 - Voluntary actions
- ❖ Unilateral actions (administrative and judicial)
- ❖ Enforcement for non-compliance

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Notes:

Purpose of Slide

- Summarize the key points of the first half of the module.

Key Points

- A variety of mechanisms are available to achieve CA.
- A Regional representative will speak to mechanisms and approaches used in your area.

References

- None.



RCRA CA Cleanup Reforms and Guidance

- ❖ This part of the module reviews EPA policy and guidance to support CA results, including:
 - RCRA Cleanup Reforms and Goals
 - Results-Based Guidance for CA
 - Public Participation
 - Financial Assurance

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Notes:

Purpose of Slide

- This part of the module reviews how EPA has integrated an emphasis on results into RCRA CA program guidance.

Key Points

- The first part of this module served to review the statutory and regulatory authorities and mechanisms that regulators use to implement CA at RCRA facilities. While these statutes and regulatory authorities provide EPA and states the means for CA, the end is the key. With that in mind, EPA has prepared many guidance and policy statements over the years; this second part of Module 3 examines RCRA reforms and results-based guidance for implementing CA.
- In addition, this module reminds participants of the public involvement requirements of RCRA CA and the important role that public involvement plays in successfully achieving RCRA CA progress.
- Financial assurance requirements are also reviewed.
- Regulations and state programs provide the means; the end is a protective cleanup. As long as the site is being addressed adequately, as required by RCRA, neither the authority used nor the agency overseeing the cleanup is important. The various authorities allow implementers to be flexible and creative in administering CA.

References

- None.



RCRA Cleanup Reforms

- ❖ 1999 Cleanup Reforms
- ❖ 2001 Cleanup Reforms

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Notes:

Purpose of Slide

- Introduce the background and purpose of the RCRA Cleanup Reforms.

Key Points

- In response to the Government Performance and Results Act of 1993 (GPRA), EPA established national goals for the RCRA CA program. GPRA holds federal agencies accountable for using resources wisely; it requires federal agencies to establish strategic plans and methods to measure the performance of the programs they administer.
- Partly in response to GPRA, EPA introduced the RCRA Cleanup Reforms in 1999. These initial reforms were EPA's comprehensive effort to address key impediments to cleanup at RCRA facilities, maximize program flexibility, and spur progress toward the national cleanup goals established for GPRA. The reforms are designed to achieve faster, more efficient cleanup at RCRA CA sites.
- In 2001, EPA implemented a second round of reforms. The 2001 Reforms reflected ideas and comments that EPA obtained from implementers and stakeholders involved in the RCRA CA Program.

References

- EPA. Web site link to GRPA Guidance. Accessed On-line at: <http://www.epa.gov/ocfo/planning/gpra.htm>.
- EPA. 1999. RCRA Cleanup Reforms. EPA 530-F-99-018 (Fact Sheet #1). July.
- EPA. 2001. RCRA Cleanup Reforms 2. EPA 530-F-01-001 (Fact Sheet #2). January.



Goals of the 1999 and 2001 RCRA Cleanup Reforms

- ❖ Provide results-oriented guidance with clear objectives
- ❖ Foster practical approaches
- ❖ Enhance community involvement

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Notes:

Purpose of Slide

- Discuss specific objectives and goals of the RCRA Cleanup Reforms.

Key Points

- Both the 1999 and 2001 RCRA Cleanup Reforms included the following goals:
 - Provide new results-oriented guidance with clear objectives. We will discuss examples of this guidance later in this module.
 - Foster practical approaches through training, outreach, and new uses of enforcement tools.
 - Enhance community involvement. EPA's reforms include a focus on providing public access to information on cleanup progress.
- Currently, as well as in the past, EPA has provided national and regional training to explain and foster the use of practical and results-oriented approaches for implementing RCRA CA.

References

- EPA. 1999. RCRA Cleanup Reforms. EPA 530-F-99-018 (Fact Sheet #1). July.
- EPA. 2001. RCRA Cleanup Reforms 2. EPA 530-F-01-001 (Fact Sheet #2). January.
- EPA. 1999. RCRA CA Workshop on Results-Based Project Management. June 10. Accessed On-line at: <http://www.epa.gov/osw/hazard/correctiveaction/workshop/>.



Additional Goals of the 2001 Cleanup Reforms

- ❖ Pilot innovative approaches
- ❖ Promote cultural change
- ❖ Provide more effective access to cleanup information
- ❖ Encourage implementers and stakeholders to capitalize on redevelopment potential

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Notes:

Purpose of Slide

- Highlight additional goals and activities identified in the 2001 RCRA Cleanup Reforms.

Key Points

- The 2001 Reforms built on the 1999 Reforms and focused specifically on:
 - Piloting innovative approaches implemented by EPA regions and states, such as using innovative site characterization technologies and applying state cleanup programs, where appropriate, to achieve national goals.
 - Moving toward a culture of implementation by focusing on results, and not process, and by encouraging partnerships and increased dialogue between implementers and stakeholders.
 - Providing the public with better access to cleanup information, such as increasing support of Technical Outreach Services to Communities (TOSC) and posting information on the web.
 - Encouraging redevelopment and reuse of RCRA sites. Module 6 will discuss RCRA CA and Land Revitalization in greater detail – including, EPA's efforts and resources to support the incorporation of redevelopment and land reuse in RCRA CA cleanups.

References

- EPA. 2001. RCRA Cleanup Reforms 2. EPA 530-F-01-001 (Fact Sheet #2). January.



Primary EPA Guidance for RCRA CA

- ❖ The 1990 proposed Subpart S Rule (most of this rule was withdrawn by EPA in 1999)
- ❖ The 1996 Advance Notice of Proposed Rulemaking (ANPR) serves as the primary guidance for RCRA CA

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Notes:

Purpose of Slide: Identify EPA's primary guidance for implementing RCRA CA.

Key Points

While the goals of the Cleanup Reforms focus on fostering practical approaches and cultural change, RCRA CA guidance supporting these approaches has been in place for many years. The primary guidance includes the following:

- On July 27, 1990, EPA proposed new CA regulations (known as the Subpart S Rule) designed to help with implementation of a comprehensive regulatory framework for the CA statutory authorities under Sections 3004(u) and 3004(v). The Subpart S Rule was developed by EPA in response to HSWA and provided a comprehensive CA program (40 CFR 264 Subpart S [55 FR 30798, July 27, 1990]). Subpart S CA was to apply to releases to any media from any SWMU at a TSD. CA requirements under the proposed Subpart S Rule were imposed through permit conditions or, for interim status facilities, through a RCRA Section 3008(h) order.
- In 1996, EPA issued its Advance Notice of Proposed Rulemaking (ANPR) related to RCRA CA requirements for releases from SWMUs at hazardous waste management facilities.
- On October 7, 1999, as part of the RCRA Cleanup Reforms, EPA withdrew most provisions of the July 27, 1990, Proposed Subpart S Rule. EPA took this action because it determined that the existing regulations and guidance allow the Agency and states to implement a CA program that is protective of human health and the environment. While most provisions of the rule were withdrawn, the Corrective Action Management Unit (CAMU) and temporary unit (TU) regulations that had been finalized earlier, remain in effect.
- The end result of EPA's withdrawal of the Proposed Subpart S Rule is that the May 1, 1996, ANPR provides the primary guidance for the RCRA CA program.
- EPA does not currently anticipate issuing federal regulations for implementing the RCRA CA Program. However, if information becomes available to indicate that regulation may be appropriate for certain aspects of CA, EPA will consider issuing such regulations.

References

- EPA. 1999. Environmental Fact Sheet: EPA Discontinues Action on 1990 Subpart S Proposal. EPA 530-F-99-042. October.
- FR. 1990. Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities; Proposed Rule. 55 FR 30798. July 27.
- FR. 1996. ANPR. 61 FR 19432. May 1.
- FR. 1999. Withdrawal of Subpart S Proposed Rule. 64 FR 54604. October 7.



Results-Based Approaches to CA

- ❖ Encourages technical and administrative innovation to achieve cleanups
- ❖ Emphasizes outcomes and results in cleanups rather than the process used
- ❖ Offers benefits that include:
 - Greater focus on end goals
 - Faster results
 - Fewer resources used

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Notes:

Purpose of Slide

- Introduce and discuss EPA's results-based approaches to CA.

Key Points

- To provide guidance supporting the cleanup reforms, in September 2003, EPA issued Results-Based Approaches and Tailored Oversight Guidance to provide a framework for implementers to run programs that most effectively use available RCRA CA cleanup tools and private party resources to address environmental problems.
- The results-based approaches identified in the guidance reflect the collective experience of EPA and the states in implementing RCRA CA and other cleanup programs. The approaches are intended to help program implementers without placing an undue focus on the detailed procedures and steps originally established in earlier EPA guidance and in the Proposed Subpart S Rule (which has since been withdrawn).
- A key to the results-based approaches to CA is that program implementers consider practical approaches to achieve environmental results without necessarily following rigid administrative procedures. Benefits can include a greater focus on end goals, faster results, and fewer resources used.

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.



Overarching Approaches to Results-Based CA

- ❖ Establish tailored oversight for each facility
- ❖ Use a holistic approach to address environmental problems at the facility
- ❖ Develop performance standards for the o/o to achieve
- ❖ Tailor data gathering strategies to the purpose for which data will be used

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Notes:

Purpose of Slide

- Provide more detail on EPA's results-based approaches to CA.

Key Points

- Tailored oversight refers to an oversight plan that is developed cooperatively by the Project Manager and the o/o. It considers facility-specific conditions such as site complexity, compliance history, and the financial and technical capability of the o/o.
- A holistic approach emphasizes that implementers examine the overall conditions at a facility and prioritize and address environmental problems based on overall risk, rather than focusing on the cleanup of individual SWMUs or other units. Implementers need to focus on overall environmental results rather than following a rigid set of procedural steps to ensure that RCRA CA activity directly supports cleanup goals at a site.
- It is also recommended that the regulatory agency and the o/o work to develop performance standards that prescribe the scientific, technical, and administrative requirements that the o/o must fulfill to complete RCRA CA.
- Data gathered should support the selection and implementation of appropriate responses at the facility, such as data required to evaluate the status of environmental indicators (EIs). EIs are discussed further later in this module.
- Data Quality Objectives (DQOs), rather than a pre-determined set of sampling requirements, should guide the determination of data needs and quality.

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.



Supplemental Approaches to Results-Based CA

- ❖ Use presumptive remedies
- ❖ Incorporate innovative technologies and approaches, where appropriate
- ❖ Phase CA to achieve greater efficiency
- ❖ Expedite cleanups using facility-lead agreements
- ❖ Coordinate post-closure and facility-wide CA

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Notes:

Purpose of Slide: Discuss supplemental approaches identified in EPA guidance.

Key Points

- EPA has developed presumptive remedies under the Superfund program to streamline cleanups and these should be considered as potential remedies at appropriate RCRA CA facilities. Using presumptive remedies is an effective way to tailor CA oversight to individual facilities through the use of EPA and the states' collective experience in implementing these remedies at other sites. Information regarding presumptive remedy policies and procedures can be found on the EPA Superfund Web site (see references below).
- Where presumptive remedies are not available or appropriate, regulatory agencies and o/o's should consider innovative technologies that offer comparable or superior treatment performance, fewer adverse impacts, and lower costs for acceptable levels of performance compared to conventional technologies.
- O/o's should also consider phased approaches that focus on areas that pose the greatest near-term threat to human health and the environment. Moreover, o/o's should focus on RCRA CA activities that achieve EIs and subsequently develop remediation time frames for achieving final cleanup goals. A phased approach may be particularly useful where the o/o wants to redevelop, reuse, or sell part of the property.
- Facility-lead agreements are a tool and, where appropriate, should be considered at facilities in advance of issuing a permit or order requiring CA. Facility-lead agreements are discussed in more detail elsewhere in this module and in other modules included in this training program.
- Where facilities have post-closure requirements for hazardous waste management units, regulatory agencies and o/o's should seek to coordinate those requirements with facility-wide CA where appropriate.

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.
- EPA. 1996. Guidance on Coordination Between RCRA CA, Closure, and CERCLA Site Activities. September 24.
- EPA. Superfund Web site: Presumptive Remedies Policies and Procedures. Accessed On-line at: <http://www.epa.gov/superfund/policy/remedy/presump/pol.htm>.



Final Rules Providing Practical Approaches for CA

- ❖ Corrective Action Management Unit (CAMU) and Temporary Unit (TU) rules
- ❖ Phase IV Land Disposal Restrictions (LDR) Rule (alternate LDR treatment standards for contaminated soils)
- ❖ Post-closure Care Rule
- ❖ Hazardous Waste Identification Rule (HWIR)-media rule – Remedial Action Plans

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Notes:

Purpose of Slide

- Identify final rulemakings promulgated by EPA to enhance flexibility in implementing RCRA CA (previous slides have discussed guidance). Note that the specific requirements included in these rulemakings will be discussed in greater detail as part of other modules included in this training course.

Key Points

- On February 16, 1993, EPA promulgated a final rule for two new types of units (CAMUs and TUs) used to manage remediation wastes. As noted earlier, these rules were originally part of the Subpart S Proposed Rule. On January 22, 2002, EPA issued a final rulemaking on CAMUs in response to a court settlement concerning issues raised in association with the 1993 CAMU rulemaking.
- While EPA had previously established alternate treatment standards for contaminated debris (August 18, 1992), on May 26, 1998, EPA promulgated the Phase IV Land Disposal Restriction (LDR) Rule, which established alternative treatment standards for hazardous contaminated soils.
- On October 22, 1998, EPA promulgated regulations that provide flexibility for implementation of the post-closure care requirements. These regulations removed the requirement to obtain a permit for the post-closure care period. It also allowed EPA and authorized states to use available authorities to address post-closure needs at regulated units in conjunction with the implementation of facility-wide RCRA CA.
- On November 30, 1998, EPA promulgated the Hazardous Waste Identification Rule for Contaminated Media (HWIR-media). This rule (1) provided a permitting approach for managing remediation wastes (that is, Remedial Action Plans (RAPs)), (2) created another new unit for managing remediation wastes (that is, a staging pile), (3) exempted certain dredged materials from RCRA regulation, and (4) streamlined authorization procedures for State RCRA programs to incorporate such rulemakings into their programs. RAPs and staging piles are discussed in more detail in Module 9, Managing Remediation Waste.

References

- FR. 1993. CAMUs and TUs. 58 FR 8658. February 16.
- FR. 1992. Land Disposal Restrictions (LDR) for Newly Listed Wastes and Hazardous Debris. 57 FR 37194. August 18.
- FR. 1998. LDR Phase IV; Final Rule. 63 FR 28556. May 26.
- FR. 1998. Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities; Post-Closure Permit Requirement and Closure Process; Final Rule. 63 FR 56710. October 22.
- FR. 1998. Hazardous Remediation Waste Management Requirements (HWIR-Media); Final Rule. 63 FR 65874. November 30.
- FR. 2002. CAMU; Final Rule. 67 FR 2961. January 22.



Additional Tools

- ❖ Environmental Indicators (EIs)
- ❖ Coordination between RCRA CA, RCRA Closure and CERCLA Site Activities
- ❖ Risk-Based Clean Closure

(continued)

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Notes:

Purpose of Slide

- This slide and the next one, identify additional guidance issued by EPA on implementation of RCRA CA authorities. We'll discuss some of these in this module and discuss others in later modules.

Key Points

- At the close of Module 2, we briefly introduced EIs. In 1994, EPA established two EIs as measures for CA to help site decision-makers focus on cleanup outcomes rather than the administrative processes. On February 5, 1999, EPA issued updated guidance for evaluating sites to determine whether they met the two EIs. The EIs focus on (1) documenting that current human exposures are controlled and (2) evaluating if the migration of contaminated groundwater has been controlled.
- On September 24, 1996, EPA issued guidance to address coordination between RCRA CA, RCRA closure, and CERCLA site activities. This guidance focuses on: (1) acceptance of decisions made by other remedial programs; (2) deferral of activities and coordination among RCRA, CERCLA, and state and tribal cleanup programs; and (3) coordination of standards and administrative requirements for closure with other cleanup efforts. This policy reiterated the general principle that RCRA and CERCLA cleanups will achieve similar environmental results and therefore, cleanups under one program will be acceptable to the other program.
- On March 16, 1998, EPA issued a memorandum that provided guidance on risk-based clean closure, and confirmed that RCRA-regulated units may be clean-closed to protective, risk-based, media cleanup levels.

References

- EPA. 1987. Memorandum from J. Winston Porter, Assistant Administrator OSWER to Regional Administrators. "RCRA Permit Requirements for State Superfund Actions." November 16.
- EPA. 1994. Memorandum from Michael Shapiro, Director OSW to Regional Waste Management Division Directors. "RCRIS Corrective Action Environmental Indicator Codes CA 725 and CA 750." July 29.
- EPA. 1995. Memorandum from Susan Parker, Corrective Action Program Branch Chief to Regional Corrective Action Contacts. "Environmental Indicator Fact Sheet." July 26.
- EPA. 1999. Interim Final. RCRA Corrective Action EI RCRA Code (CA725) and Current Human Exposures Under Control and (CA750) Groundwater Migration Controlled. February 5.
- EPA. 1996. Guidance on Coordination Between RCRA CA, Closure, and CERCLA Site Activities. September 24.
- EPA. 1998. Memorandum from Elizabeth Cotsworth, Acting Director Office of Solid Waste to RCRA Senior Policy Advisors and Regions I-X. Risk-Based Clean Closure Guidance. March 16.



Additional Guidance

- ❖ Public Participation
- ❖ Financial Assurance
- ❖ Handbook of Groundwater Protection and Cleanup Policies for RCRA CA
- ❖ Managing Remediation Waste (Module 9)
- ❖ CA Completion (Module 12)

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Notes:

Purpose of Slide: Identify additional guidance issued by EPA on the implementation of RCRA CA authorities. The following slides discuss public participation, financial assurance, and the Handbook of Groundwater Protection and Cleanup Policies for RCRA CA in more detail, while the other guidance is discussed in later modules.

Key Points

- EPA's overall public participation policy calls for meaningful public involvement in all EPA programs.
- Under Section 3004(u), o/o's are required to demonstrate financial responsibility for completing the required CA. EPA has not issued regulations on financial assurance for CA, but has provided guidance. EPA is also considering if any further tools are warranted to support program implementers addressing financial assurance requirements; two meetings of the 2020 work group were dedicated to this issue. (Note: this training course will be modified to include new guidance if it is issued).
- In 2001, EPA issued the Handbook of Groundwater Protection and Cleanup Policies for RCRA CA that integrates 15 topics into an overall Groundwater Protection and Cleanup Strategy that emphasizes a phased, results-based approach to cleaning up contaminated groundwater. In 2004, EPA issued an updated Handbook. Topics addressed in the Handbook are discussed in more detail in subsequent slides in this module and in subsequent modules.
- On October 14, 1998, EPA issued guidance that consolidated and explained existing statutes, regulations, policies, and guidance that can be used to tailor the RCRA hazardous waste requirements for application to remediation wastes. Examples of the 18 approaches addressed in this guidance include: the area of contamination policy, permit waivers, the "contained-in" policy, and LDR treatment variances. Additional detail on the management of remediation waste at RCRA CA facilities is provided in Module 9, Managing Remediation Waste.
- On February 25, 2003, EPA issued final guidance on CA completion. The purpose of this guidance is to address significant issues and procedures to determine when CA activities at a site are complete. This guidance is discussed in more detail in Module 12.

References

- EPA. 1996. RCRA Public Participation Manual. Chapter 4: Public Participation in RCRA Corrective Action under Permits and Section 3008(h) Orders. Office of Solid Waste, Permits Branch.
- EPA. 1998. Memorandum on Management of Remediation Waste. EPA 530-F-98-026. October 14.
- 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. EPA 530-R-04-030. Update. April
- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.
- EPA. 2003. Interim Guidance on Financial Responsibility for Facilities Subject to RCRA Corrective Action. September 30.



Public Participation During RCRA CA

- ❖ Begin early
- ❖ Identify, communicate, and listen
- ❖ Involve stakeholders throughout decision process
- ❖ Develop options
- ❖ Design site-specific programs

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Notes:

Purpose of Slide

- Convey general EPA public involvement principles.

Key Points

- The fundamental premise of EPA's public participation policy is meaningful public involvement in all EPA programs and that EPA consistently looks for new ways to enhance public input. EPA seeks input reflecting all points of view and should carefully consider this input when making decisions. EPA also works to ensure that decision-making processes are open and accessible to all interested groups, including those with limited financial and technical resources, English proficiency, and/or past experience participating in environmental decision-making. Such openness to the public increases EPA's credibility, improves the Agency's decision-making processes, and supports the Agency's final decisions. EPA's principles for public participation call for the following:
 - EPA should involve the public early and often throughout the decision-making process.
 - EPA should identify, communicate with, and listen to affected sectors of the public. To do this, Agency officials should plan and conduct public involvement activities that provide equal opportunities for individuals and groups to be heard. Where appropriate, Agency officials should give extra encouragement and consider providing assistance to sectors, such as minority and low-income populations, small businesses, and local governments, to ensure that they have opportunities to be heard and, where possible, access to technical or financial resources to support their participation.
 - EPA should involve members of the public as alternatives are developed, when possible, and seek the public's opinion on alternatives before decisions are made.
 - The Agency should use public input to develop options that facilitate resolution of differing points of view.
 - EPA should make every effort to tailor public involvement programs to the complexity of the facility, potential controversy in regards to certain issues, the segments of the public affected, the time frame for decision making, and the desired outcome.
 - EPA should work in partnership with state, local and tribal governments, community groups, associations, and other organizations to enhance and promote public involvement.

References

- EPA. RCRA Corrective Action Tools and Techniques Presentation. Accessed On-line at: <http://epa.gov/epawaste/hazard/correctiveaction/curriculum/caover.htm>.
- EPA. 1996. RCRA Public Participation Manual. Chapter 4: Public Participation in RCRA Corrective Action under Permits and Section 3008(h) Orders. Office of Solid Waste, Permits Branch.



Financial Assurance

- ❖ Financial assurance requirements (CFR 264.101)
- ❖ Proposed financial assurance regulations (1986)
 - Permissible instruments
 - Timing guidelines
- ❖ Subpart S proposal (1990)
 - Use 1986 proposal as guideline
- ❖ ANPR (1996)
 - Flexibility
 - Goal: Ensure remedy proceeds expeditiously
- ❖ Interim Guidance (2003)

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Notes:

Purpose of Slide

- Present an overview of financial assurance requirements and provide references on the subject.

Key Points

- CFR 264.101 codifies the statutory requirement that each "permit will contain...assurances of financial responsibility for completing ... CA."
- On October 24, 1986, the Agency proposed detailed regulations for financial assurance for CA. (51 Federal Register (FR) 37854). The proposed rule was not finalized. The 1986 proposed rule provided permissible instruments to demonstrate financial assurance for CA and guidelines on critical issues (such as, the timing of financial assurance for CA).
- In the July 27, 1990 Subpart S proposal, the Agency stated its intent to use the 1986 proposed regulations as general guidelines for financial assurance for CA (55 FR 30798, page 30801).
- In the 1996 Subpart S ANPR (61 FR 19432), the Agency restated its general principles for financial assurance for CA in the absence of final rules. The Agency emphasized that program implementers and facility owner/operators have the flexibility to tailor financial responsibility requirements to facility-specific circumstances (61 FR 19432, page 19454). In response to industry concerns that financial assurance requirements would divert resources from actual cleanup activities, the Agency stated that program implementers should apply financial assurance requirements flexibly and that their main goal should be to ensure that remedies proceed expeditiously (61 FR 19432, page 19455).
- The September 30, 2003, "Interim Guidance on Financial Responsibility for Facilities Subject to RCRA Corrective Action," provides additional guidance on the timing of financial assurance, cost-estimating, and available financial assurance mechanisms.

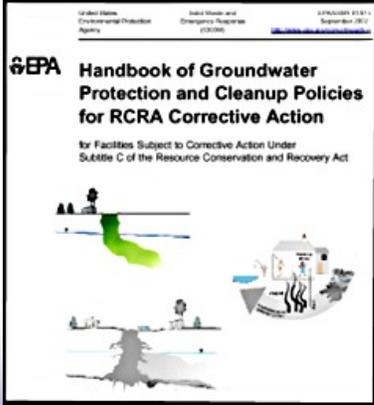
References

- FR. ANPR. 61 FR 19432. Page 19455. May 1.
- FR. 1990. Proposed Rule: Allowable Mechanisms. 55 FR 30799 (at 30856). July 27.
- EPA. 2003. Interim Guidance on Financial Responsibility for Facilities Subject to RCRA Corrective Action. Transmitted on September 30.



Handbook of Groundwater Protection and Cleanup Policies

- ❖ Comprehensive list of EPA policies on protecting and cleaning up groundwater at RCRA CA facilities
- ❖ Provides examples to illustrate application of policies



(continued)

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Notes:

Purpose of Slide

- Discuss EPA's Handbook of Groundwater Protection and Cleanup Policies.

Key Points

- The Handbook is designed to assist the regulator, the regulated community, and the public in finding and understanding EPA policies concerning groundwater protection and cleanup at RCRA facilities.
- The Handbook reflects EPA's latest thinking on groundwater policies and is a "living" document that is updated by adding new topics and new policies, by integrating changing policies or by clarifying existing policies. Examples are included to illustrate the application of principles discussed in the manual.

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. EPA 530-R-04-030. Update. April.



Handbook of Groundwater Protection and Cleanup Policies

- ❖ Overall goal with respect to groundwater is to prevent adverse effects to human health and the environment now and into the future
- ❖ Implementation strategy should be phased to define short, intermediate, and final cleanup goals and objectives

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Notes:

Purpose of Slide

- Continue discussion of EPA's Handbook of Groundwater Protection and Cleanup Policies for CA.

Key Points

- EPA believes that short-term prevention and long-term cleanup goals are both essential elements of a strategy designed to achieve the overall goal of preventing adverse affects to human health and the environment now and into the future.
- The Handbook states that the implementation strategy should address goals and objectives related to groundwater for the short-, intermediate-, and long- (final) term. Goals and objectives should clearly define "what, where, and when," as well as "who, why, and how."
 - For example, "what" indicates groundwater cleanup levels, "where" establishes specific points of compliance, and "when" specifies the estimated timeframe to achieve final cleanup levels.
 - Describing "who" performs an action helps communicate the different roles and responsibilities of the regulator and o/o to the public.
 - "Why" explains the relationship of particular actions and how they achieve goals.
 - Describing "how" ensures that stakeholders understand the techniques and approaches a facility will use to implement an activity.

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. EPA 530-R-04-030. Update. April.



Summary

- ❖ States and EPA have several statutory and regulatory authorities for CA.
- ❖ The authorities, regulations, policies, and guidance provide the framework—a protective cleanup is the end goal.
- ❖ Implementers should use judgment in crafting the best, most practical approach for a site to achieve compliance with CA obligations.

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Notes:

Purpose of Slide

- Summarize the key points of this module.

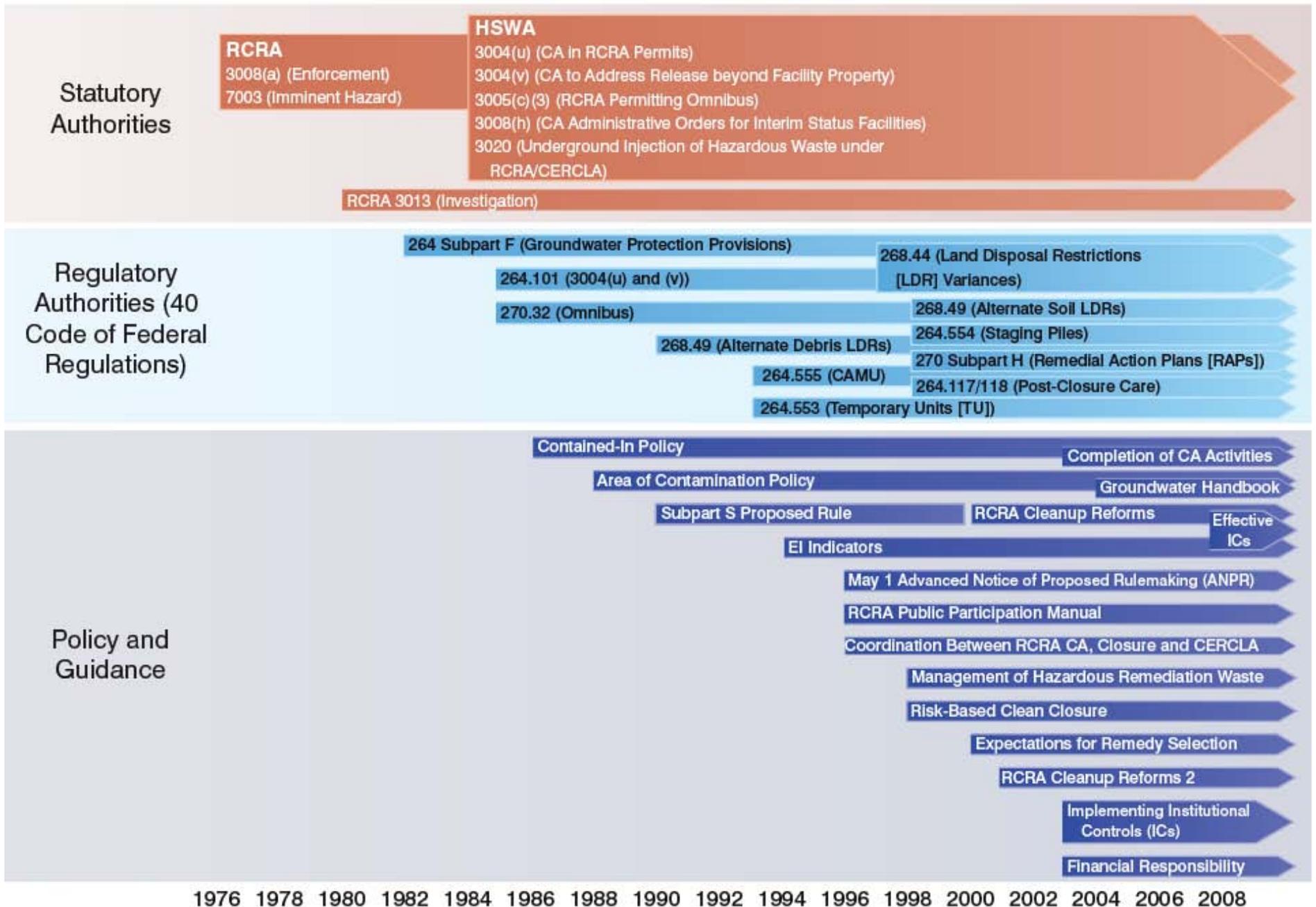
Key Points

- EPA and authorized states have a number of authorities under the hazardous waste program to implement RCRA CA at permitted and interim status facilities.
- Authorities, regulations, guidance, and state programs provide the means; the end is a protective cleanup. As long as the site is being addressed adequately, as required by RCRA, neither the authority used nor the agency overseeing the cleanup is important. The various authorities allow implementers to be flexible and creative in administering CA.
- Implementers should use judgment in crafting the best approach for a site to achieve compliance with CA obligations, implement a protective remedy, and meet CA goals.

References

- None.

RCRA Corrective Action Timeline



MODULE 3 HANDOUT

KEY DEFINITIONS FOR RCRA CORRECTIVE ACTION

DEFINITIONS

Facility - The definition of “facility” for RCRA CA is broader than the definition of “facility” for other RCRA purposes, such as permitting. For RCRA CA, a facility is defined as “all contiguous property under the control of the o/o seeking a permit under Subtitle C of RCRA.” A common scenario involves two parcels under common ownership that are connected by ditches, bridges, or other links under the control of the o/o; these would be considered part of the same facility. In Exxon Co., USA, RCRA Appeal No 94-8 (EAB May 17, 1995), the Environmental Appeals Board (EAB) noted that two parcels were a single facility where they were separated by a privately owned railroad line.

Release - The definition of “release” is construed to include releases as defined under CERCLA and so it includes spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping and disposing. The definition of release also includes abandoned or discarded barrels, containers, and closed receptacles containing hazardous waste or constituents, as well as releases permitted under other authorities such as the Clean Water Act. In the May 1, 1996, ANPR, EPA reaffirmed its interpretation that the definition of “release” is broad. Note that a “release” is not needed to invoke Section 3013 or 7003 authority.

Solid Waste Management Unit (SWMU) - With respect to a SWMU, EPA clarified in the May 1, 1996 ANPR that a one-time spill adequately cleaned up would not be a SWMU. However, routine and systematic releases, such as releases from activities at loading docks or other product transfer areas (such as wood preserving) may be addressed by CA as an “area of concern” under the omnibus authority at 40 CFR 270.32(b)(2). Remediation of non-SWMU related releases may be addressed under the omnibus authority.

Area of Concern - To reflect a more holistic approach, permits and orders often use the term Area of Concern to refer to releases which warrant investigation or remediation under CA authorities, regardless of whether they are associated with a specific SWMU (ANPR).

Hazardous Waste and Hazardous Constituent - In the May 1, 1996 ANPR, EPA discussed the Agency’s interpretation of the terms “hazardous waste” and “hazardous constituent” for the purpose of RCRA CA. For the purpose of CA under Section 3004(u) and 3008(h) of RCRA, “hazardous waste” refers to all hazardous wastes under the statutory definition in RCRA Section 1004(5), and not just those either listed or identified by EPA pursuant to Section 3001 of RCRA. The definition of “hazardous constituents” is interpreted to include constituents contained within hazardous and non-hazardous solid wastes.

REFERENCES

Code of Federal Regulations (CFR). 40 CFR 260.10.

CFR. 40 CFR 270.32(b)(2).

Federal Register (FR). 1985. 50 FR 28702. July 15; FR. 1987. 52 FR 45788. December 1; FR. 1996. ANPR. 61 FR 19432. May 1; and FR. 1999. 64 FR 54607. October 7.

Module 04
Starting with the End in Mind:
Building an Effective Exit Strategy



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



February 2009 Module 4 - Starting with the End in Mind: Building an Exit Strategy 1

Notes:

Purpose of Slide

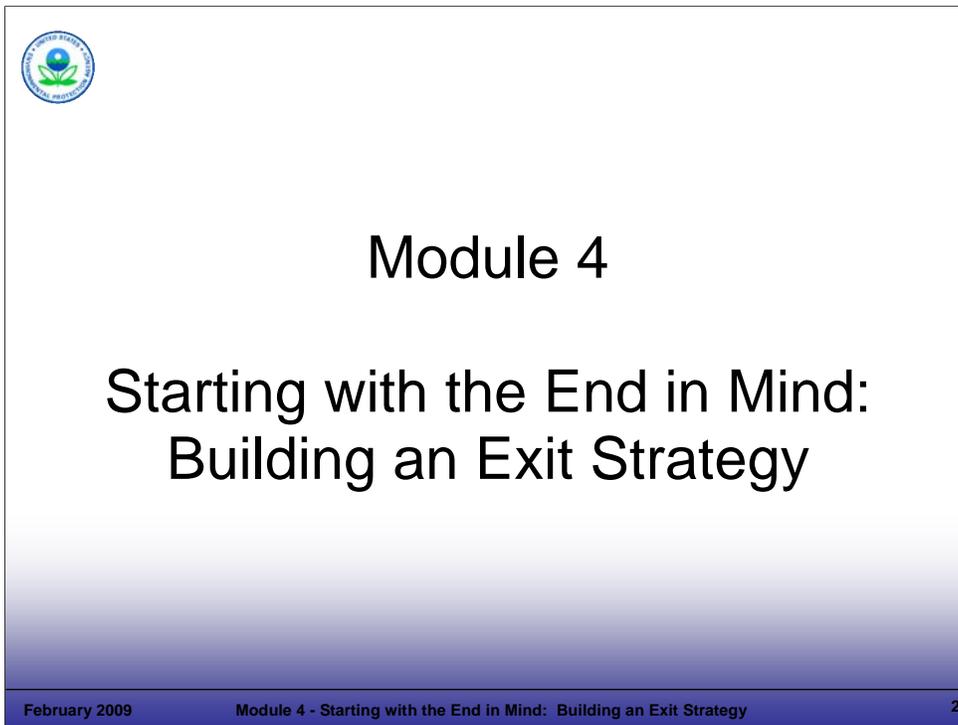
- Holder slide for Module 4, Starting with the End in Mind: Building an Exit Strategy.

Key Points

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

References

- None.



Notes:

Purpose of Slide

- Holder slide for Module 4, Starting with the End in Mind: Building an Exit Strategy.

Key Points

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

References

- None.



Module Overview

- ❖ Define Exit Strategy
- ❖ Identify the benefits of developing and implementing an Exit Strategy
- ❖ Consider different perspectives
- ❖ Review elements of a performance-based Exit Strategy
- ❖ Getting to YES with an Exit Strategy

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Module 4 - Starting with the End in Mind: Building an Exit Strategy

3

Notes:

Purpose of Slide: Introduce the module, which is placed at the beginning of the course to stress the importance of clear end goals in supporting rapid corrective action (CA) progress.

Key Points

- This module will introduce the concept of an Exit Strategy and identify the benefits of “starting with the end in mind.” An Exit Strategy can help streamline the CA process when all stakeholders agree to the Strategy. Also, it can integrate 2020 goals for CA.
- We will review the importance of understanding the perspectives of all the stakeholders, including the technical project manager, the regulator, the business owner, and the public.
- There is also a historical perspective. In the early days of Resource Conservation and Recovery Act (RCRA) CA, we tended to focus on the task at hand – preparing plans on how to install monitoring wells and sample those wells, evaluating technologies that would address the type of contamination present, writing work plans and reports, and responding to comments. In other words, we were process oriented because people (both the regulators and the regulated community) were not familiar with conducting cleanup. But now, our collective CA experience allows us to replace, in part, the process-driven approach with a results-based approach that accelerates the rate at which we address sites. Over time, we have come to realize that the best approach to CA (the results-based approach) addresses current and reasonably anticipated uses of a property. The results-based approach lends itself to development of an Exit Strategy for each site early in the CA process. The exit strategy will incorporate all phases of CA, including long-term stewardship when required. A facility that plans to change its use from industrial with historical hazardous waste disposal to a residential development or theme park will require a CA approach that is very different than if the same industrial facility intends to continue operating as an industrial plant. The Exit Strategy will reflect these plans.
- To illustrate how Exit Strategy use can support CA, we will provide examples of Exit Strategy implementation.
- ***Facilities can incorporate 2020 goals into Exit Strategies – hence, Getting to YES!***

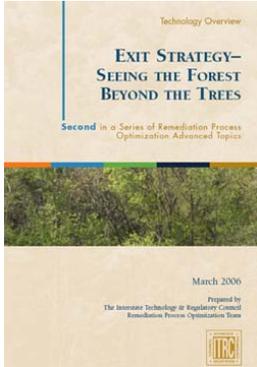
References

- None.



Definition of Exit Strategy

- ❖ A dynamic and succinct plan for accomplishing
- ❖ specific performance goals within a
- ❖ defined time period to
- ❖ assure protection of human health and the environment.



February 2009 Module 4 - Starting with the End in Mind: Building an Exit Strategy 4

Notes:

Purpose of Slide

- Provide a definition of Exit Strategy.

Key Points

- An Exit Strategy is a clear, forward-looking plan for a site. The Exit Strategy should be dynamic and refined over time as knowledge of the site improves. The Exit Strategy and site understanding should be reviewed and updated, as appropriate, through routine reviews to take advantage of lessons learned. Preferably, the Exit Strategy is developed and updated by the facility and regulatory agency working together.
- To the extent possible, the Exit Strategy for a facility should be performance-based, so that it focuses on progress toward achieving remedial action objectives (RAOs). To support the identification of specific performance goals, the Exit Strategy should be based on a sound technical understanding of site conditions and appropriate remediation technologies. The Exit Strategy should be constructed using objective metrics to describe how progress toward meeting RAOs will be measured (i.e., how success will be measured). Once metrics are established, course corrections can be made if a selected remedy fails to perform as expected.
- Finally, an Exit Strategy should be designed to assure protection of human health and the environment based on current and reasonably anticipated uses for the site. The Exit Strategy should emphasize the evaluation and optimization of remedy performance to assure timely and cost effective protection of human health and the environment.

References

- Interstate Technology and Regulatory Council (ITRC). 2006. Exit Strategy – Seeing the Forest Beyond the Trees. Second in a Series of Remediation Process Optimization Advanced Topics. ITRC Remediation Process Optimization Team. March.



Benefits of an Exit Strategy

- ❖ Builds consensus
- ❖ Puts an end in sight
- ❖ Measures progress
- ❖ Tightens schedule and budget
- ❖ Establishes a plan for “Getting to YES!”

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Module 4 - Starting with the End in Mind: Building an Exit Strategy

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Notes:

Purpose of Slide

- Outline the benefits of having a clear Exit Strategy.

Key Points

- Having a clear end point and Exit Strategy can assist communication and understanding among multiple stakeholders. Reaching consensus on CA decisions is easier when the Exit Strategy is supported by all stakeholders. For example, if the Exit Strategy calls for long-term remediation with passive technologies, the parties are more likely to agree on less frequent sampling than for a rapid cleanup. This is because contaminant concentrations will change more rapidly for an aggressive remedy with a technology approach and therefore, will need to be monitored more frequently.
- An Exit Strategy will allow informed and timely decisions on the project path; such a strategy would typically include milestones and endpoints. For example, if a portion of a facility will be revitalized for a new use, while the remainder of the facility remains in operation, more aggressive remedial technologies may be chosen for the area designated for redevelopment, while passive technologies may be considered for the continued use area.
- Once milestones and endpoints are established, the owner/operator (o/o) can judge the level of effort required and set aside appropriate resources to achieve timely implementation.
- An Exit Strategy allows the o/o to track its schedule and expenses relative to site progress (such as reaching key milestones) and will allow forward planning to address any necessary changes in the approach.
- An Exit Strategy can help industrial and government facilities with their budget planning processes and support their budget tracking. Financial assurance considerations can be taken into account. Publicly traded companies, for example, must comply with Sarbanes Oxley, which deals with fiscal accountability for environmental liabilities and proper and accurate estimation of anticipated costs. Government facilities must make budget requests for future years within prescribed budgeting timelines.
- A plan and schedule for meeting 2020 CA goals (Getting to YES) can be included in an Exit Strategy.

References

- None.



Elements of a Performance-based Exit Strategy

1. Schedule
2. Conceptual Site Model
3. Remedial Action Objectives (RAOs)
4. Remedies and performance expectations (means to achieve RAOs)
5. Performance metrics
6. Decision criteria

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Module 4 - Starting with the End in Mind: Building an Exit Strategy

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Notes:

Purpose of Slide

- Introduce the elements of a performance-based Exit Strategy.

Key Points

- A schedule is a key element of an Exit Strategy.
- The description of the environmental problem at a site typically takes the form of a conceptual site model (CSM), which is a summary of available information related to contaminant sources and release mechanisms, affected media, contaminant fate and transport, and receptor exposures.
- RAOs are CA completion criteria that must be met for a cleanup to be protective. RAOs are generally expressed in narrative form, sometimes with references to numerical standards.
- The remedy selected to achieve the RAOs may include treatment, contaminant containment, and receptor exposure controls (engineering and institutional controls). The remedy is generally expressed in a narrative form, although it may incorporate numeric cleanup goals. The description should include how the remedy is expected to perform over time.
- Performance metrics are the yardsticks against which progress (success/failure) toward meeting the objectives is measured.
- The decision criteria, in the form of a logic diagram or flowchart, can be a valuable component of an Exit Strategy. Examples of factors that can be incorporated into a decision logic diagram or flowchart include:
 - The number or frequency of "clean" samples required to terminate active remediation or to abandon monitoring wells;
 - The influent concentration required to eliminate treatment components, such as a second air stripper or off-gas treatment.

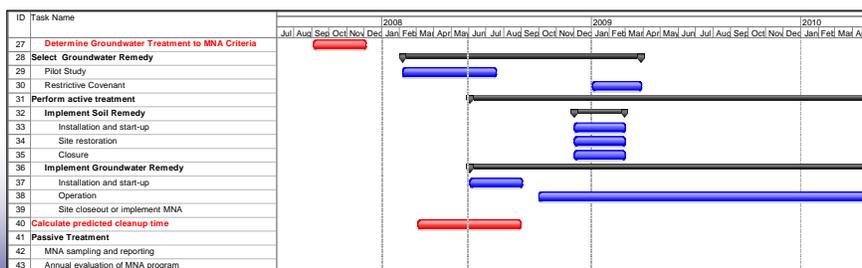
References

- ITRC. 2006. Exit Strategy – Seeing the Forest Beyond the Trees. ITRC Remediation Process Optimization Team. March.
- ITRC. 2004. Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation. September.



1. Schedule

- ❖ Start with the end
- ❖ Address present through CA Complete
- ❖ Develop with all stakeholders
- ❖ Understand that data gaps are okay



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Notes:

Purpose of Slide

- Present the importance of including a schedule as part of an Exit Strategy

Key Points

- Schedule development begins by establishing endpoints, which are based on the RAOs.
- Ideally, the schedule will incorporate the entire period of CA (although some may begin with a schedule that spans only through the CA construction or through the initial years of remedy operation). Developing an Exit Strategy schedule is useful even if CA has been ongoing for many years.
- It is best to develop the schedule with multiple stakeholders including the o/o and agency.
- Data gaps are expected. In fact, one advantage of developing a long-term schedule early in the CA process is to identify data gaps and direct activities towards addressing those gaps.

References

- None.



Basis of Exit Strategy Schedule

- ❖ Anticipated use and cleanup criteria
 - Operating facility: usually industrial
 - Revitalization: based on development plan
- ❖ Cost
 - Operating facility: life cycle costs, Net Present Value (NPV)
 - Revitalization: land value / use

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Notes:

Purpose of Slide

- Discuss the basis of an Exit Strategy (which is influenced by planned or potential uses for the facility).

Key Points

- The pace of cleanup can differ based on the anticipated site use and the schedule for that use. For example, monitored natural attenuation (MNA) may be selected as a remedy at a facility with ongoing operations where groundwater is not used for water supply, even though it might take decades to achieve final cleanup criteria (for example, drinking water standards) because MNA has the lowest life-cycle cost (total cost of remediation to achieve final cleanup criteria) and is protective for anticipated uses.
- On the other hand, a facility undergoing revitalization for a new use would likely be on a faster track for cleanup, even though many remedies can continue operating after the site is redeveloped. Often, groundwater treatment may continue, but source and contaminated soil removal is expedited to allow reuse of the land for new purposes. The life cycle cost of this approach may be higher compared to alternative remedies, but the value of the land for alternative uses may drive the remedy selection.
- Also, the complexity of a cleanup and the risks posed at a site may impact the cleanup schedule and the overall Exit Strategy.
- Annual operating costs, capital cleanup expenses, and life cycle remediation costs are important to operating facilities, which generally evaluate costs based on net present value (NPV). On the other hand, property values are critical to land owners and developers considering revitalization of facilities to support redevelopment; therefore, reuse considerations can significantly affect the pace of cleanup and the selection of technologies.
- Whether a site will be revitalized through a new use or remediated for continued use as an industrial facility, use of an Exit Strategy will support effective CA implementation.
- Determining current and anticipated uses of the property is important because these will dictate the RAOs, such as cleanup criteria and the cleanup schedule.

References

- None.



2. Conceptual Site Model (CSM)

- ❖ Indicates what is known or suspected:
 - Sources
 - Fate and transport
 - Exposure pathways
 - Potential receptors
- ❖ Organizes data in relation to project goals
- ❖ Focuses resources to fill data gaps

(continued)

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Notes:

Purpose of Slide

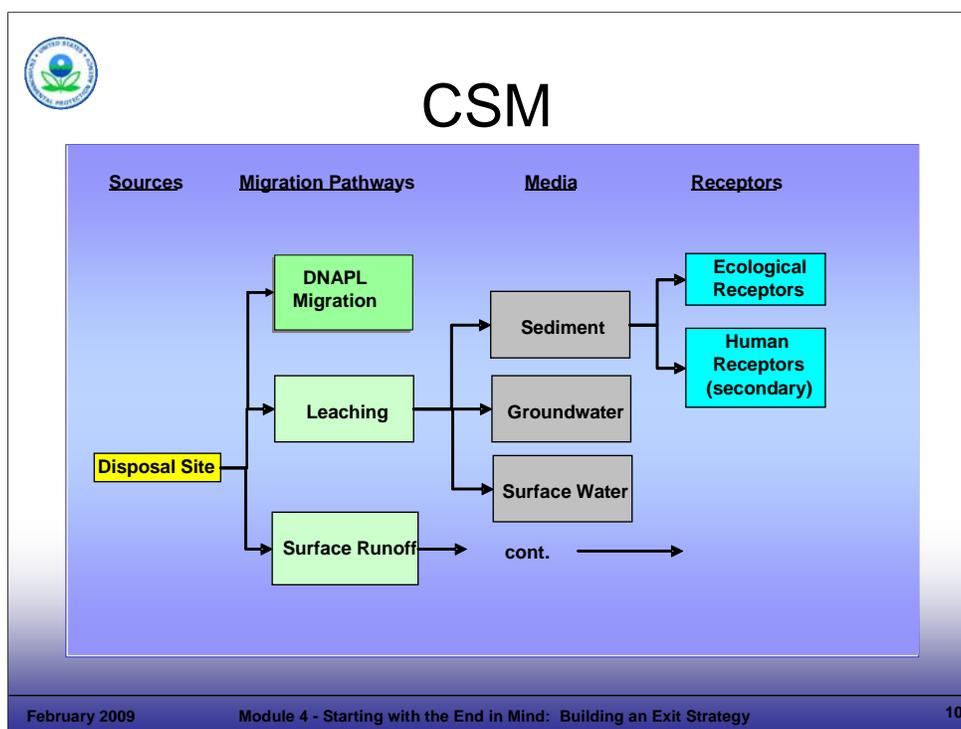
- Discuss the CSM and how it is used in developing and implementing an effective Exit Strategy.

Key Points

- The CSM identifies sources of contamination and how that contamination moves through the environment to receptors when the migration pathways are complete.
- A CSM is important for organizing known information, but also provides the framework to identify what is not known about the site and what decisions need to be made. The CSM focuses on identifying data gaps that must be closed to meet site goals.
- The CSM is dynamic and should be updated as new site information becomes available.

References

- EPA. 2001. Current Perspectives in Site Remediation and Monitoring: Using the Triad Approach to Improve the Cost Effectiveness of Hazardous Waste Site Cleanups. Author listed: DM Crumbling. EPA-542-R-01-016. October.



Notes:

Purpose of Slide

- Provide an example of a CSM.

Key Points

- A CSM can be presented in the form of graphs, cross-sectional maps, simple diagrams, tables, flowcharts, plan view maps, and/or verbal descriptions. The purpose is to identify sources, migration pathways, impacted media, and potential receptors.
- A CSM is also used to evaluate engineering controls and institutional controls (ICs) for their potential to prevent or limit exposure.
- A single project may have more than one CSM.
- The CSM is used to guide field work that gathers information to address data gaps.

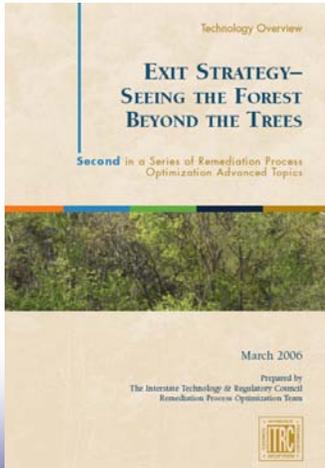
References

- EPA. 2001. Current Perspectives in Site Remediation and Monitoring: Using the Triad Approach to Improve the Cost Effectiveness of Hazardous Waste Site Cleanups. Author listed: DM Crumbling. EPA-542-R-01-016. October.



3. Remedial Action Objectives (RAOs)

- ❖ Completion criteria that must be achieved
- ❖ to reduce risks and hazards to potential receptors
- ❖ to acceptable levels under reasonable exposure scenarios



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Notes:

Purpose of Slide

- Provide an operating definition of RAOs.

Key Points

- RAOs are remediation completion criteria achieved to reduce risks and hazards to potential receptors to acceptable levels under reasonable exposure scenarios. An example of a RAO is to “prevent exposure of on-site workers to arsenic in soils above the applicable industrial soil cleanup criterion.”
- Well defined and achievable RAOs are vital to efficient site remediation. The Project Manager and facility should work to establish RAOs that are reasonably attainable as well as protective of human health and the environment.

References

- ITRC. 2006. Exit Strategy – Seeing the Forest Beyond the Trees. Second in a Series of Remediation Process Optimization Advanced Topics. ITRC Remediation Process Optimization Team. March.
- EPA. 2002. Elements for Effective Management of Operating Pump and Treat Systems. Fact Sheet. December.



RAO Considerations

- ❖ Exposure scenarios
- ❖ Facility operations
- ❖ Environmental conditions
- ❖ Timeframe (consider 2020)
- ❖ Remediation costs

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Notes:

Purpose of Slide

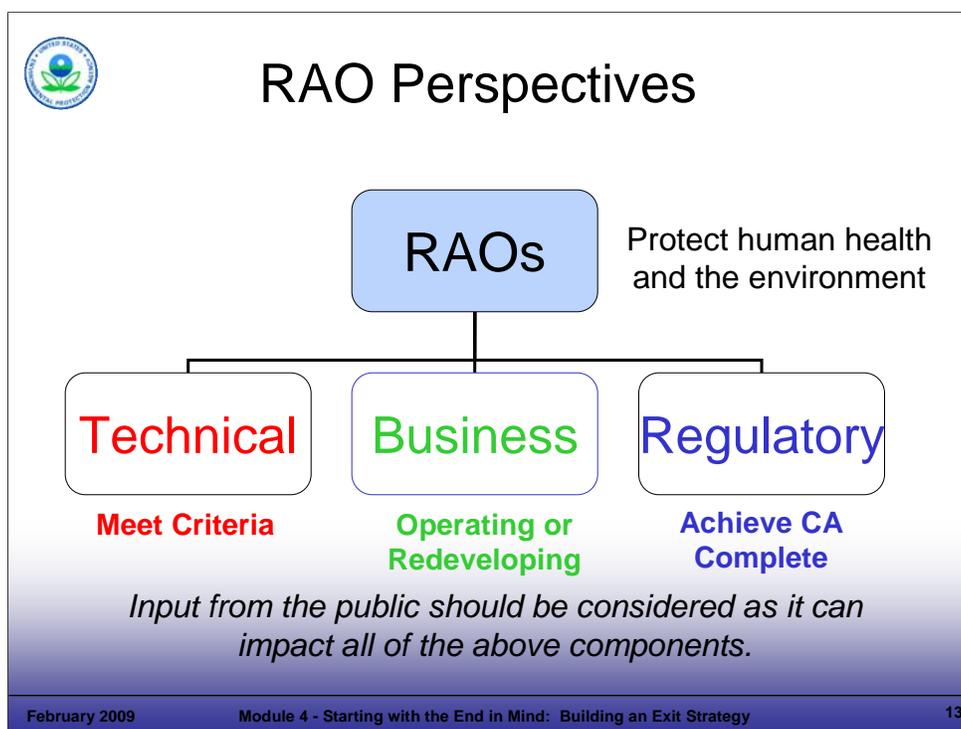
- Explain the basis of RAOs.

Key Points

- An understanding of current and anticipated *land* uses and exposure scenarios is important to identify acceptable cleanup levels under reasonable exposure scenarios. If there are no risks, remedial actions and RAOs are unnecessary.
- Facility operations, financial considerations, and the schedule for redevelopment, if applicable, are important in developing RAOs, which are tailored to each site's specific environmental conditions.
- RAOs should be achievable in a reasonable timeframe and in a cost effective manner. The 2020 Vision for CA and associated goals come into play here; they are important elements to consider in defining a reasonable end point. EPA's goal is to have remedies implemented by 2020 at facilities in the CA universe; however, while the remedy is implemented, all cleanup objectives may not be achieved by that year. For example, complex groundwater and non-aqueous phase liquid (NAPL) remedies could take many years for the goals to be achieved. Thus, the remedy construction goal can be met by 2020, with the cleanup criteria achieved over a longer time period. The ultimate goal for the facility is to complete CA and have CA obligations removed from the permit or have the CA order terminated, depending on the regulatory mechanism.
- The EPA Groundwater Handbook is a source that discusses reasonable timeframes as this concept relates to groundwater:
 - *After achieving short-term goals [eliminating unacceptable risks and preventing plumes from spreading], facilities can move toward final cleanup goals in a timeframe commensurate with the technical difficulties and potential risks.*
- Anticipated remediation costs and financial assurance are also considered in establishing RAOs.

References

- ITRC. 2006. Exit Strategy – Seeing the Forest Beyond the Trees. Second in a Series of Remediation Process Optimization Advanced Topics. ITRC Remediation Process Optimization Team. March.
- 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. EPA 530-R-04-030. Update. April.



Notes:

Purpose of Slide

- Point out that there are various ways of looking at RAOs or an Exit Strategy.

Key Points

- There are different ways of looking at an Exit Strategy and its components. These different perspectives might include those of the technical project manager, the regulator, and the facility owner. It is important to understand these perspectives because each of these stakeholders needs to take ownership of the Exit Strategy for it to work.
- The technical project manager looks for a technology that will address the contaminants that are present. His or her milestones and endpoints are technical, such as cleanup to a certain concentration level. He or she is also responsible for meeting certain performance metrics, such as discharge criteria. However, there are often multiple effective technologies for a family of contaminants, so other considerations, such as facility goals for reuse, also affect the technology selection.
- The regulator has different endpoints or RAOs that must be met, such as meeting CA Complete (CA 900 or CA 999).
- The owner has other factors to consider. For example, the owner may need to ensure a portion of a facility is ready for sale to a prospective purchaser by a given date. The anticipated use of that parcel can have direct consequences for remedy selection. For example, a facility may select capping for contaminated soil for continued industrial use of a parcel, but may select excavation with off-site disposal under a redevelopment scenario.
- When there are no imminent risks, the different perspectives and associated approaches to remedial decision making can have significant impacts on the remedial choices that are made.
- In developing the Exit Strategy, these various perspectives should be considered.

References

- None.

✓ Plume Stability
 ✓ No off-site contamination
 ✓ No SW discharge

Congratulations!
 CA 900 CA Complete w/ Controls

Technical Endpoint: Meet state criteria
Regulatory Endpoint: CA complete w/ controls
Business Endpoint: Donate land for county park

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Notes:

Purpose of Slide

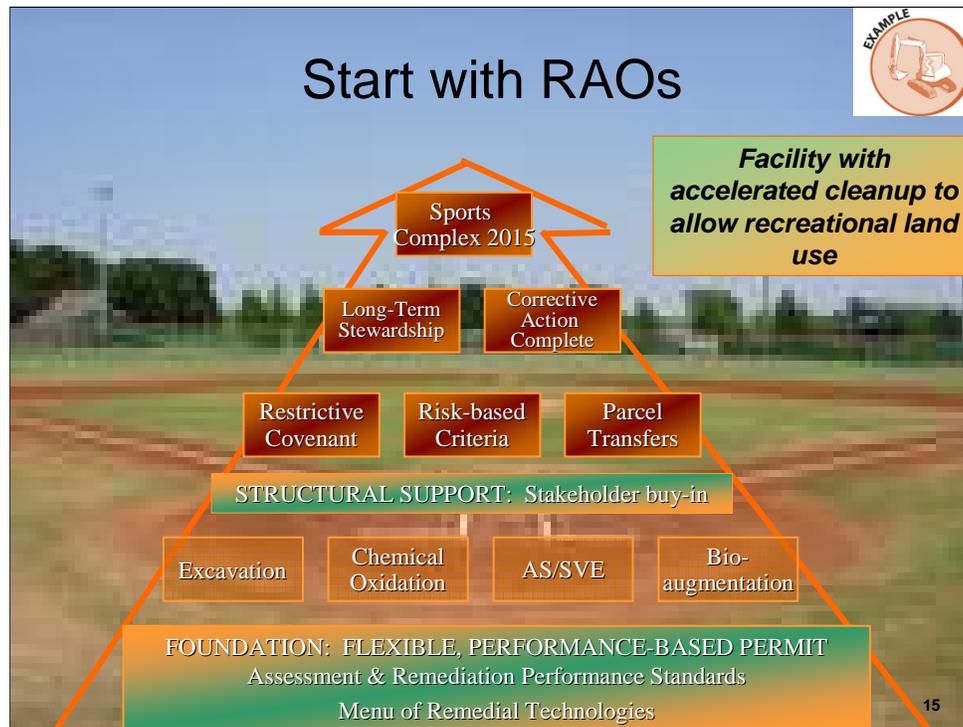
- Illustrate different perspectives or components of the Exit Strategy.

Key Points

- In this example, soil at a former fire training center has been excavated; all source material, including dense non-aqueous phase liquids (DNAPL), has been removed but the groundwater does not meet risk-based criteria. The endpoints, established based on technical, regulatory, and business perspectives, are identified in the Exit Strategy as the following:
 - The technical endpoint is to design a remedy that will meet the state criteria by 2012 within the available budget and consistent with financial assurance requirements.
 - The regulatory endpoint is to assure that sufficient monitoring data are available to support a permit modification for No Further Action (NFA) by 2015 (considerable lead time is necessary for permit modifications – for example, to accommodate public notice requirements). This will also constitute a CA Complete with Controls decision, based on meeting the state's criteria (such as plume stability) for NFA with ICs.
 - The business endpoint is to close out the liability associated with the property and donate the land to the County for use as a sports complex.

References

- None.



Notes:

Purpose of Slide

- Provide an example of an Exit Strategy. This strategy was developed “with the end in mind” – in other words, it is based on the anticipated use of the facility as a sports complex. 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 shows that the Exit Strategy begins with a rough conceptual blueprint of where the facility wants to go; it then incorporates regulatory concerns, issues, and milestones. The details of the Exit Strategy, such as cleanup goals (“the what, the where, and the when”, as we will discuss in more detail in Module 7) can then be developed. The Exit Strategy can take many forms, and it does not create a need for unnecessary or additional documentation. Rather, it is meant to provide a roadmap that helps to guide, justify, and track CA decisions.
- This facility wants to transfer ownership of land that was formerly used as a fire training center to the town government by the year 2015. It also wants to have all active remediation completed prior to property transfer.
- A RCRA CA permit is the regulatory mechanism governing the facility; this permit required renewal at about the same time the Exit Strategy was being developed.
- Because the final remedial technology had not been selected for the facility before the permit was renewed, a number of possible remedies were included in the new permit to avoid the need for multiple permit modifications and regulatory approval cycles when new technologies were implemented. The permit required that any remedy selected for implementation had to meet certain performance standards, which were established in the permit. So, the foundation of the Exit Strategy became a performance-based permit, which included a menu of potential technologies including those shown on the slide.
- The facility envisioned implementing one or more of the technologies after the permit was renewed, and anticipated that active remediation would be completed by the time the permit again required renewal. Anticipating that site cleanup criteria would be met following the second permit renewal, a number of forward-looking conditions were included in the permit, such as: performance standards and parcel transfer language. These permit conditions set the stage for completing CA and reaching the remediation endpoint according to the 2015 schedule.

References

- None.



4. Remedies and Expected Performance: *Redevelopment*



Business RAO: Mixed use development
Regulatory RAO: CA complete w/ controls
Technical RAO: plume stability, ecological sustainability




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Notes:

Purpose of Slide

- Discuss the selection of the remedy or remedies that will be used at a facility to meet the RAOs, which are related to the anticipated use of the facility. This example includes a combination of remedies established for a facility undergoing revitalization.

Key Points

- Identifying the remedy and anticipating how it will perform over time are important components of the Exit Strategy.
- In this example, a developer purchased a large tract of land (1,500 acres) where 5 industrial landfills were located. The remedies were (1) excavation of the landfills and the surrounding contaminated soil, (2) groundwater pump and treat, and (3) chemical oxidation. Closure is now linked to meeting non-numeric goals, such as plume stability, that the state has established for risk-based CA (RBCA).
- When the property was first purchased, RBCA was not an option; the cleanup standards for groundwater were maximum contaminant levels (MCLs). RBCA is now in place and ICs have been established.
- The land is considered a RCRA facility and regulated by a Hazardous and Solid Waste Amendments (HSWA) permit. Each landfill is a solid waste management unit (SWMU).
- The land will be developed in phases for mixed uses – including commercial, ecological, and residential.
- The remedy components are implemented in phases, as parcels are scheduled for redevelopment. Remedy implementation and performance are linked to development plans.

References

- None.

 **Remedy Components** 


Establish wildlife corridor for sensitive species


Excavate landfills


Stabilize plumes


Stabilize plumes

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Notes:

Purpose of Slide

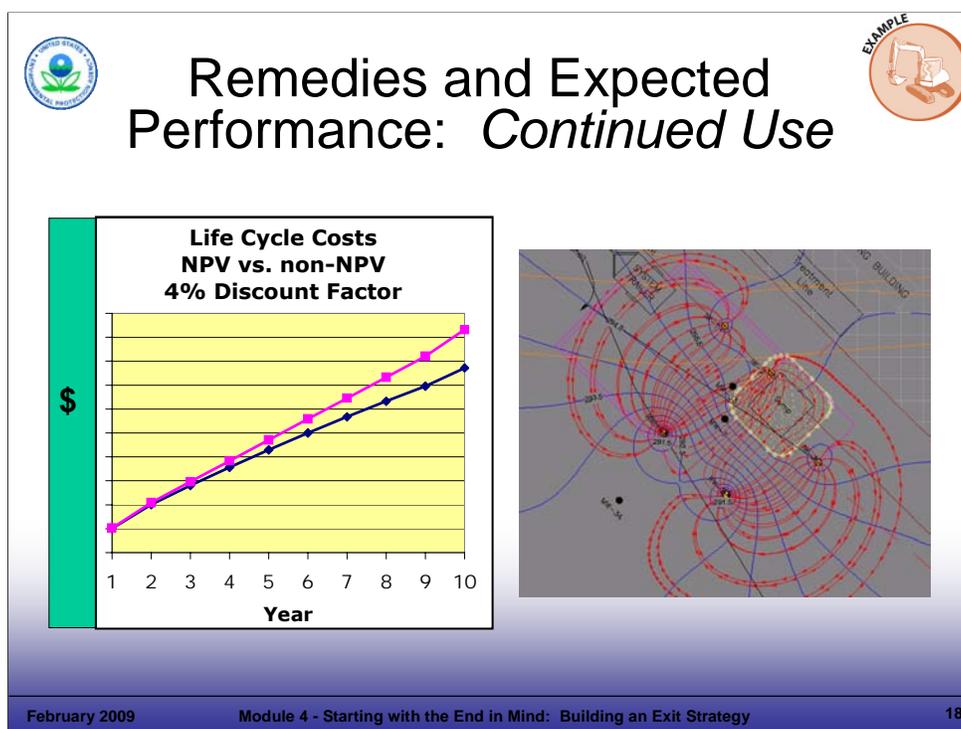
- Continue the remedy example from previous slide.

Key Points

- The selected remedy includes landfill excavation, horizontal recovery wells, and chemical oxidation.
- The CSM identified many potential ecological receptors and a decision was made to include development of an ecological corridor as part of the remedy.
- Completion of the remedy would be contingent on multiple tasks associated with developing the ecological corridor.

References

- None.



Notes:

Purpose of Slide

- Provide an example of developing a remedy for an operating facility, where timing often is not as critical as for sites undergoing property transfers and changing uses.

Key Points

- Operating facilities will often select a remedy from multiple environmentally sound options based on life cycle costs. Correctly anticipating performance is important because poor performance can increase costs substantially. Remedies need to be well-maintained once implemented to keep costs in check and maintain remedy performance. We discuss remedy performance further in Module 11.
- Life cycle costs are generally expressed as NPV, the long-term costs in terms of today's dollars.
- Plume stability – eliminating migration – is important for a variety of reasons, including attaining or maintaining Environmental Indicator (EI) 750 (groundwater migration under control) and avoiding third party issues with adjacent property owners. The figure on the right shows results from a groundwater fate and transport model developed to evaluate plume stability at an operating facility.
- The Exit Strategy should include a remedy that the facility and agency anticipate will meet the RAOs (including remediation completion criteria) associated with continued industrial use.

References

- None.



5. Performance Metrics

- ❖ Types:
 - Operational
 - Risk reduction
 - Response completion
- ❖ Timing:
 - “Fast track” (redevelopment)
 - Longer-term cleanups (operating facilities)
 - 2020 milestones

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Notes:

Purpose of Slide

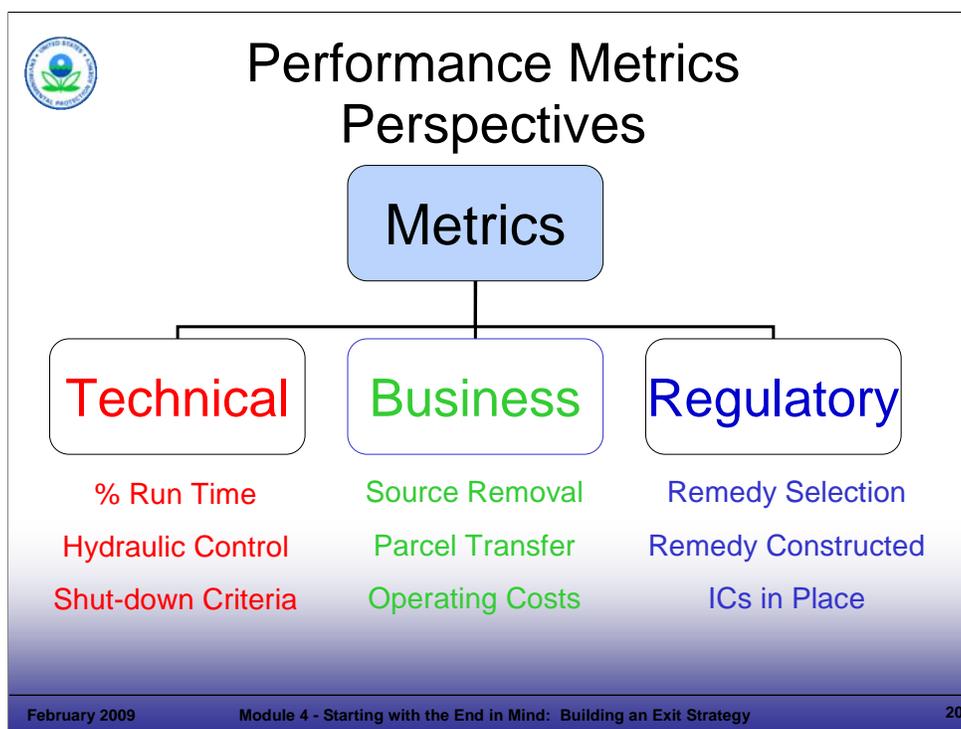
- Present how performance metrics are used within an Exit Strategy, in the context of different RAOs.

Key Points

- Performance metrics should be objective and specific. They generally fall into three categories: (1) operational metrics for engineered systems (extraction rates, treatment system efficiencies, discharge requirements); (2) risk reduction metrics (plume stability or recession, product or soil removal, land-use controls); and (3) response completion metrics or site close-out criteria (meeting cleanup criteria).
- Metrics can also be used as triggers for contingencies described in decision logic flowcharts. For example, if an operational performance metric of 99% removal efficiency for an air stripper is not achieved during three consecutive monthly sampling events, this could serve as a trigger for the requirement to add a carbon polishing unit.
- In the case of phased remediation (e.g., removal followed by bioaugmentation), interim metrics (milestones) may trigger the next phase of action. Similarly, there may be a step-wise optimization (scale down) of remedial actions and monitoring requirements as risks are reduced (e.g., as a plume shrinks or concentrations of the contaminants of concern decline). The Exit Strategy should identify these metrics and provide a decision logic that specifies what conditions must be met before proceeding.
- Facilities on a fast track for cleanup may have more intensive metrics to support changing land uses.
- Longer-term cleanups generally require less frequent sampling (over a greater length of time). If the CSM shows that contamination is stable, the facility is intended for continued use as an operating facility, and there are no threats to human health or the environment, the Exit Strategy may allow decades for site cleanup, in which case annual or less frequent sampling may be environmentally sound. O&M will be an important component of long-term cleanups to address factors such as aging equipment. In addition, appropriate ICs and monitoring will ensure that exposure assumptions based on continued use remain appropriate.
- 2020 milestones (such as Remedy Construction) can be included in an exit strategy as performance metrics.

References

- ITRC. 2006. Exit Strategy – Seeing the Forest Beyond the Trees. Second in a Series of Remediation Process Optimization Advanced Topics. ITRC Remediation Process Optimization Team. March.



Notes:

Purpose of Slide

- Illustrate various perspectives on performance metrics.

Key Points

- This slide illustrates technical, business, and regulatory perspectives on performance metrics.
- Technical metrics can include performance metrics that are used to measure progress towards milestones or endpoints and should be objective and specific. They generally fall into three categories: (1) operational metrics for engineered systems (extraction rates, treatment system efficiencies, discharge requirements); (2) risk reduction metrics (plume stability or recession, product or soil removal, land-use controls); and (3) response completion metrics or site close-out criteria (meeting cleanup criteria). Metrics can also be used as triggers for contingencies described in decision logic flowcharts. For example, if an operational performance metric of 99% removal efficiency for an air stripper is not achieved during three consecutive monthly sampling events, this could serve as a trigger for the requirement to add a carbon polishing unit.
- Business milestones may relate to source removal, property sales, or reducing annual or life cycle costs. Facilities on a fast track for cleanup may have more intensive metrics to support changing land uses.
- Regulatory milestones, such as the 2020 goals (e.g., Remedy Construction) can be included in an Exit Strategy as performance metrics.

References

- None.



EXAMPLE

Metrics / Milestones:
Meet residential soil criteria, stabilize groundwater

Remedy components:
excavate soil, air sparge, restrictive covenant

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Notes:

Purpose of Slide

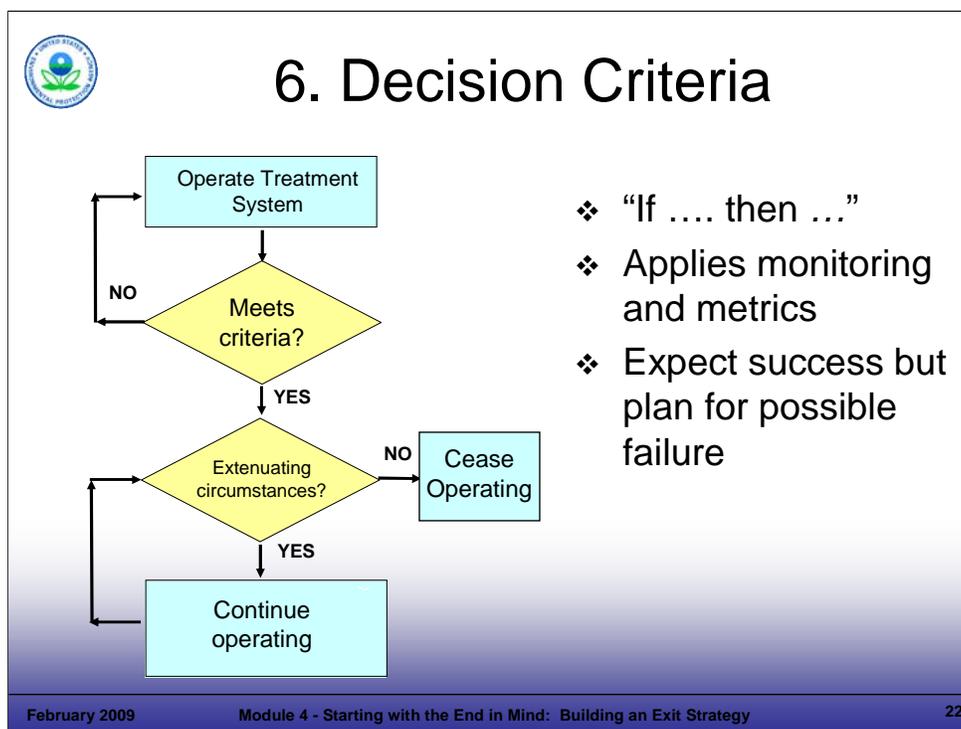
- Provide a case study example illustrating implementation of an Exit Strategy to meet RAOs at a site undergoing redevelopment.

Key Points

- This is a former Department of Defense contractor manufacturing facility with soil and groundwater contamination. The facility cleanup is being addressed under a voluntary agreement with the State. The RAOs are to (1) remove contaminated soil before and during site demolition to prepare for redevelopment by the site purchaser, (2) contain the groundwater plume through engineering controls by 2008, and (3) establish ICs to prevent exposure to contaminated groundwater. Redevelopment began in 2007; remediation activities are conducted by the seller and coordinated with the buyer's redevelopment schedule.
- The unit being addressed is a SWMU at a manufacturing facility, but the same approach to remediation could be taken if the site were a treatment, storage, or disposal facility (TSDF).
- The photograph in the upper left shows the removal of contaminated soil using a vacuum truck inside a building that is still partially occupied. The extent of contaminated soil has not been defined, but will be when the building is demolished. The photograph on the right shows mulch blown in to fill the excavated space. Mulch was chosen for cost effectiveness (cheaper than fill to purchase and place, and cheaper to remove during future excavation) and because it is easy to identify what portion of the site has been excavated (additional samples and probably additional excavation of contaminated soil will be necessary).
- The remedial technology selected for groundwater containment was air sparging. A restrictive covenant will be established to restrict groundwater use.

References

- None.



Notes:

Purpose of Slide

- Explain why decision criteria should be established as part of an Exit Strategy. Establishing decision logic allows implementation of a pre-determined process with stakeholder buy-in to efficiently and cost-effectively evaluate performance monitoring data and make corrections, implement contingency actions, or scale-down operational or monitoring requirements, depending on progress toward meeting RAOs.

Key Points

- Performance-based exit strategies should expect success but plan for possible failures. It is best to have a predetermined process, with stakeholder buy-in, to deal with eventualities that can occur during the CA process.
- Flow diagrams can be used to graphically depict decision logic, such as the flow diagram shown on this slide. It was developed cooperatively by a facility and the State agency.
- For example, the facility samples for chemicals of concern, and must meet cleanup criteria for at least “X” rounds before turning off a recovery well. The “X” would be agreed upon and documented by the agency and the o/o, and would be protective of human health and the environment based on current and reasonably anticipated uses.
- If there are “X” clean rounds, and there are no extenuating circumstances, then the facility can terminate recovery operations. Since the agency and facility developed this decision logic flowchart cooperatively, the facility can turn off the recovery well immediately upon achieving cleanup levels – a separate agency approval is not necessary.

References

- ITRC. 2006. Exit Strategy – Seeing the Forest Beyond the Trees. ITRC Remediation Process Optimization Team. March.



Decision Criteria Examples

- ❖ If/then action statements
 - If “X” consecutive monitoring well samples are clean, abandon the monitoring well
 - If air emissions drop below criteria, eliminate off-gas treatment
 - If plume distribution is wider than expected, add air sparge points

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Notes:

Purpose of Slide

- Provide examples of decision criteria and endpoints.

Key Points

- Simple “if (a specific condition occurs) ... then (a certain response action is taken) ...” uses the monitoring data and performance metrics to make decisions and keep the process moving. This slide provide examples of decision criteria that address changing conditions and associated contingencies.
 - A RAO may be to meet cleanup criteria; the first bullet provides a specific action (abandon the monitoring well) associated with a specific definition of when the criteria are met (“X” clean events).
 - The second bullet anticipates performance and a decision point - air emissions will drop below criteria. The associated action is to eliminate off-gas treatment.
 - On the other hand, additional treatment may be necessary when a plume is larger or deeper than expected.
- Establishing these criteria in the Exit Strategy streamlines actions and will lead to faster, cheaper cleanups.

References

- ITRC. 2006. Exit Strategy – Seeing the Forest Beyond the Trees. ITRC Remediation Process Optimization Team. March.
- U.S. Department of Energy. 2000. Developing Exit Strategies for Environmental Restoration Projects. DOE/EH-413-0013. March.



❖ Source removal – milestone

❖ Meet background levels – milestone or endpoint?

❖ Does Consent Order remain in force?

❖ Do residential criteria have to be met?

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Notes:

Purpose of Slide

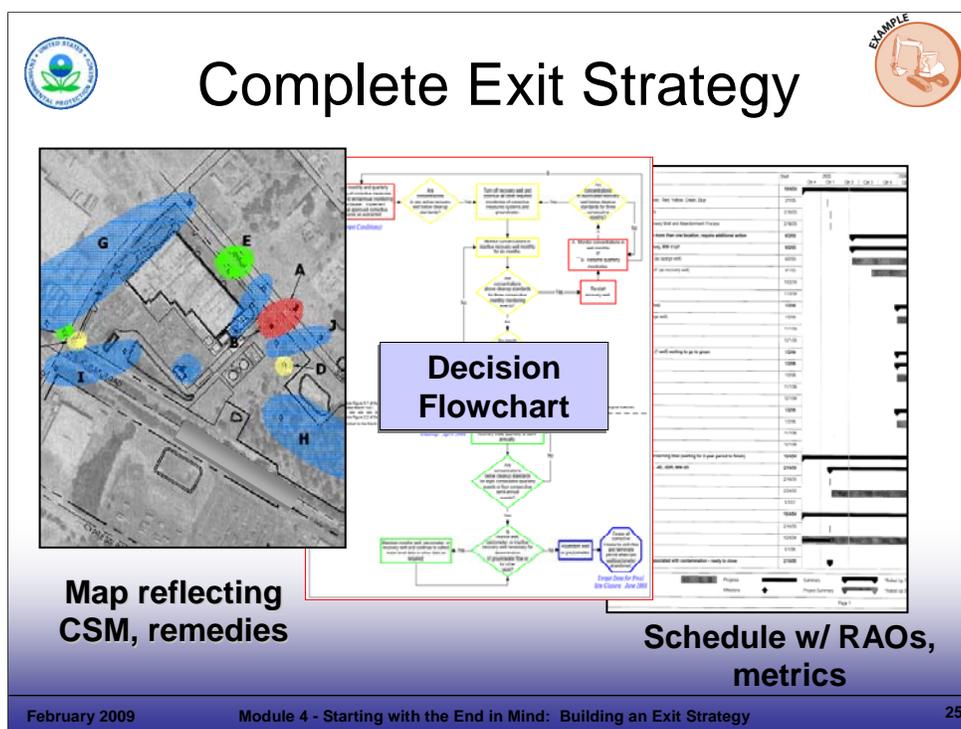
- Provide a case study example of issues that can make development of an Exit Strategy difficult.

Key Points

- At this site, trichloroethylene (TCE) has been released from a SWMU. Upgradient, there was a tetrachloroethylene (PCE) release from a Superfund site, which is degrading to TCE and the two plumes are now commingling.
- Developing an Exit Strategy for this site is difficult because establishment of the cleanup criteria is complicated for the following reasons:
 - The groundwater cleanup standard in this state is residential groundwater criteria at the RCRA CA facility.
 - The facility considers meeting background concentrations as the appropriate technical endpoint (so as not to create an “island of purity”). However, the regulatory agency considers residential criteria as the endpoint and meeting background concentrations as an interim milestone.
 - A schedule was established for meeting background concentrations and that schedule was met.
 - No schedule or cost estimate can be established for meeting residential criteria because that is dependent on the upgradient source.
 - The result is that the facility is on the Consent Order “hook” indefinitely, until the upgradient source is remediated.

References

- None.



Notes:

Purpose of Slide

- Provide an example of an efficient, focused Exit Strategy that has been distilled to a few key figures and charts.

Key Points

- This Exit Strategy has 3 components:
 - A **CSM** shows different categories of groundwater contamination (blue represents areas that have been clean for 2 years of monitoring; green represents areas that have been clean for less than 2 years; yellow represents an isolated pocket of contamination; and red represents areas with more widespread contamination). This is the CSM element of the Exit Strategy.
 - A **flowchart** shows remediation contingencies and the logic ("if/then") used to make decisions. The flow chart describes the circumstances under which the facility can discontinue sampling of groundwater monitoring wells, discontinue pumping of recovery wells, discontinue sampling of recovery wells, and abandon either type of well. The flowchart represents a performance-based approach that is self-implementing.
 - A **schedule** shows the anticipated activities over time (air sparge, pump and treat, monitoring, reporting, permitting) and the schedule required to meet the remedial action objectives. This schedule includes meeting health-based groundwater criteria in 5 years (at a cost of under \$1 million), and includes regulatory milestones (construction complete), based on a cooperative approach by the regulators and the facility.

References

- None.



Summary

- ❖ A performance-based Exit Strategy is best.
- ❖ The Exit Strategy can change with evolving site conditions and improved technical understanding.
- ❖ An Exit Strategy supports sound environmental management and the efficient use of resources.
- ❖ The Exit Strategy is a useful tool for meeting the 2020 CA goals.

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Module 4 - Starting with the End in Mind: Building an Exit Strategy

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Notes:

Purpose of Slide

- Summarize the main points of this module.

Key Points

- A performance-based Exit Strategy provides a practical framework to support RCRA CA; remember, keep the end in mind.
- The Exit Strategy can change with evolving site conditions and improved technical understanding.
- The Exit Strategy supports sound environmental management and an efficient use of resources.
- The Exit Strategy can integrate and help focus progress towards 2020 CA goals.

References

- None.

Module 05
Achieving Success: Practical Solutions to
Corrective Action Challenges



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



February 2009 Module 5 – Achieving Success: Practical Solutions to CA Challenges 1

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

February 2009 Module 5 – Achieving Success: Practical Solutions to CA Challenges 2

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

February 2009 Module 5 – Achieving Success: Practical Solutions to CA Challenges 3

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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Module 5 – Achieving Success: Practical Solutions to CA Challenges

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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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Module 5 – Achieving Success: Practical Solutions to CA Challenges

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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

February 2009 **Module 5 – Achieving Success: Practical Solutions to CA Challenges** **7**

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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Module 5 – Achieving Success: Practical Solutions to CA Challenges

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Notes:

Purpose of Slide

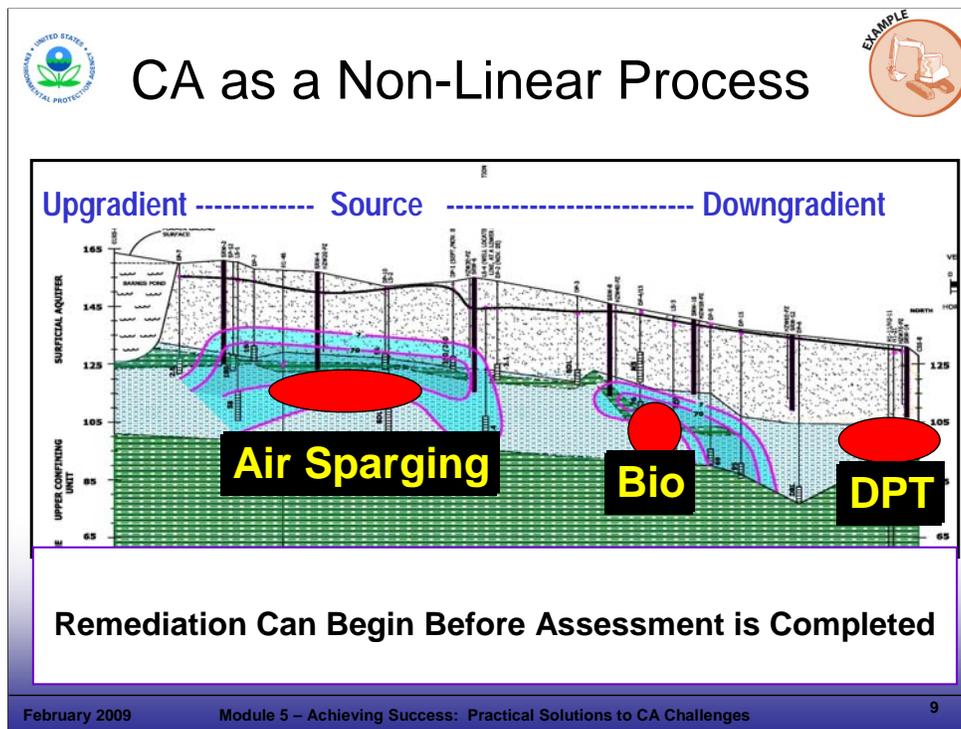
- Emphasize that CA is an iterative process.

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

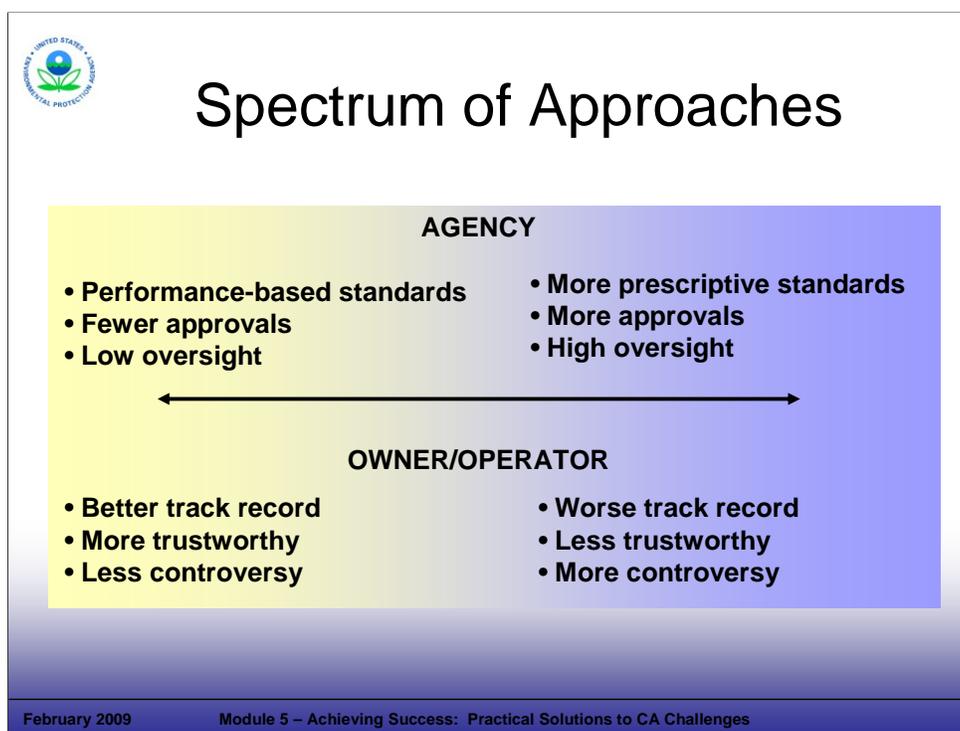
- Reiterate that EPA encourages practical considerations in the “process” because implementation challenges are rarely predictable. Emphasize CA program elements that support practical solutions.

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

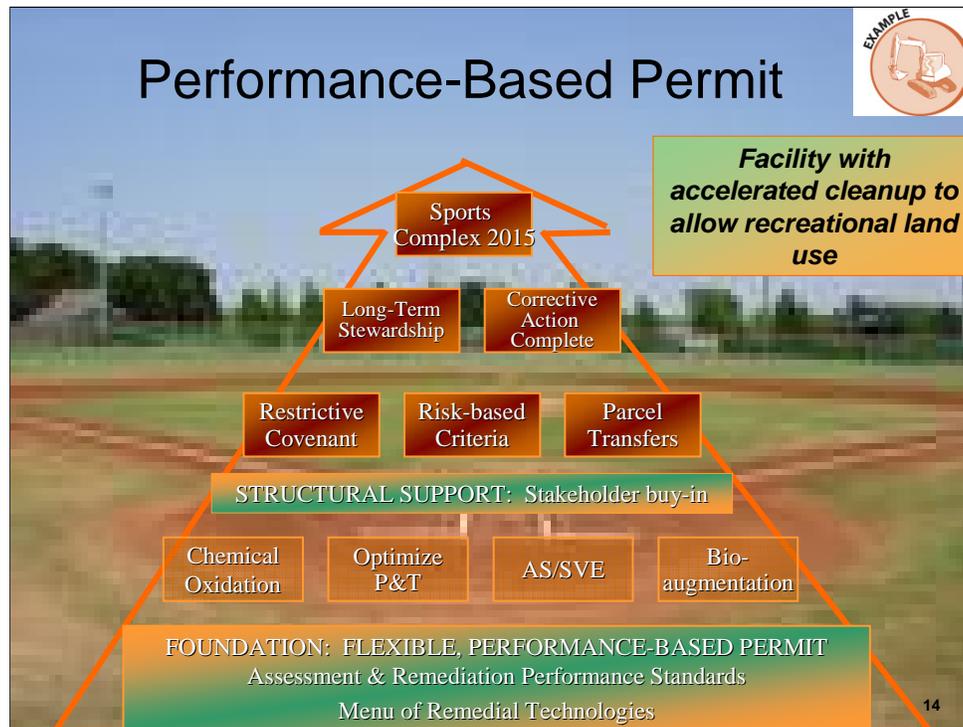
- Provide an example of a successful Facility-lead Agreement.

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

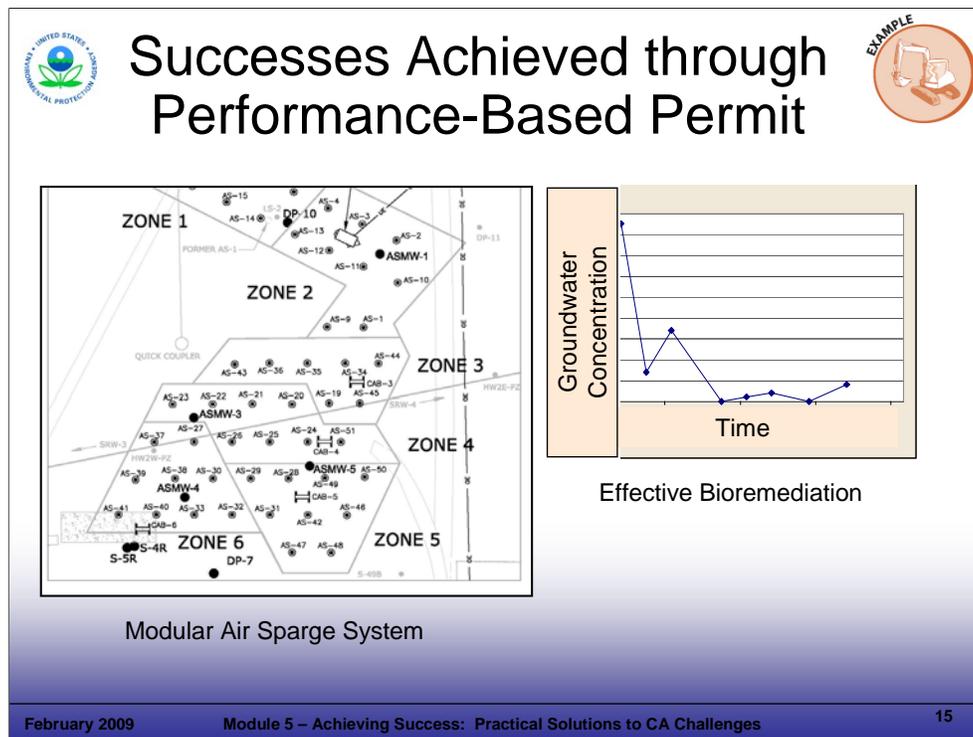
- Demonstrate how a performance-based permit can streamline the CA process. This example shows how a permit was used to support progress. While certain significant treatment system modifications may require permit modifications under 240 CFR 270.42, this course focuses on the flexibility that can be 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

(continued)

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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.

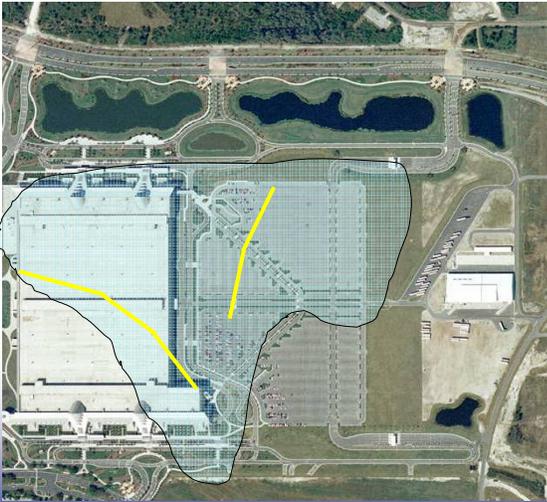
References

- 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

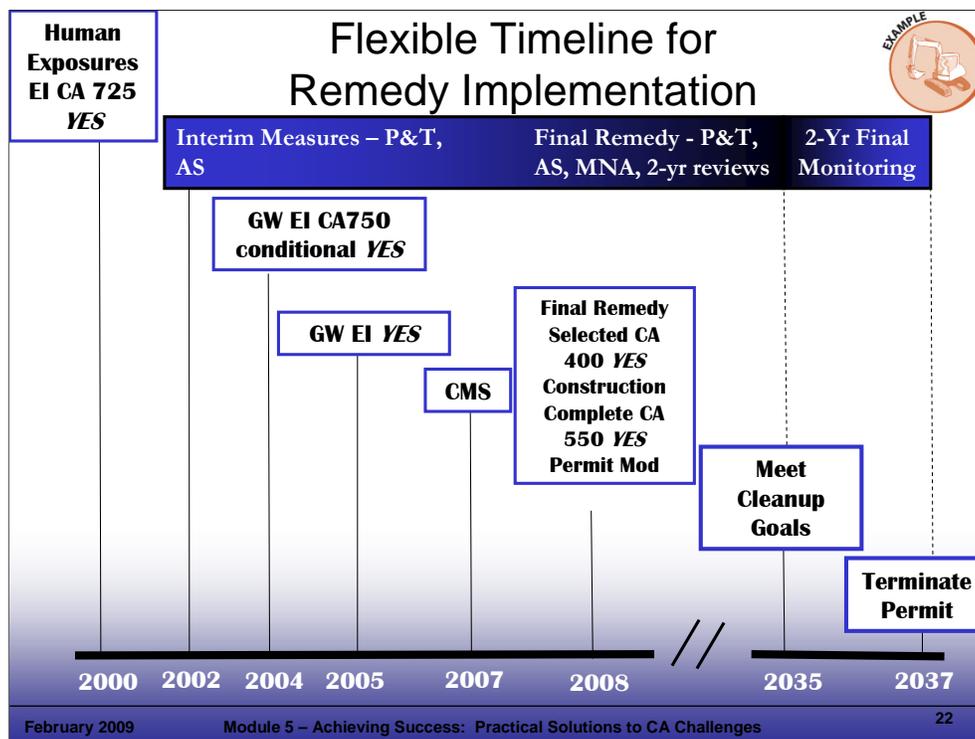
- Provide an example of a flexible, expedited implementation of a remedy - -combined with a long-term approach to completion.

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

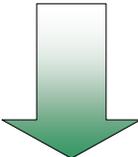
- None.



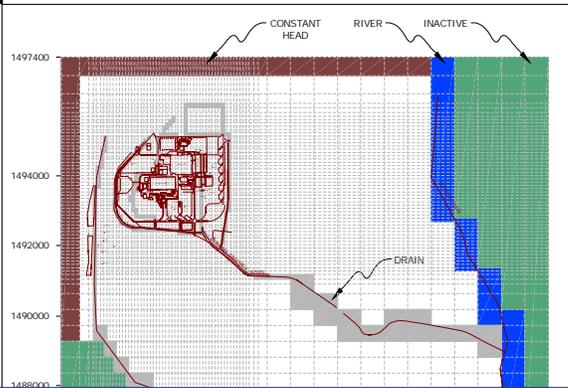
IM Approach to Remedy Implementation



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.

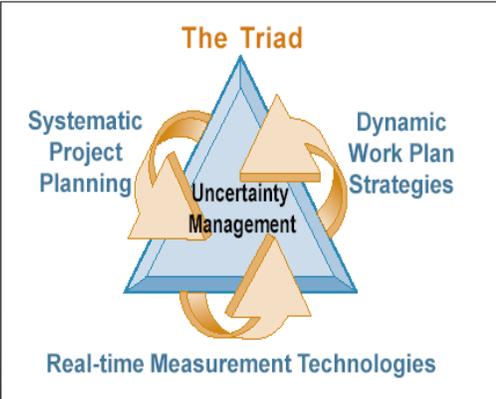
References

- 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

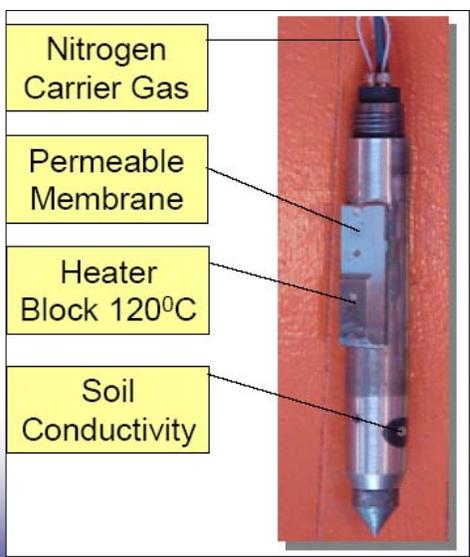
- A range of field sampling and analysis approaches support sound characterization of sites.
- Colorimetric test kits are self-contained analytical kits that use chemical reactions to produce color proportional to chemical concentration.
- Immunoassays methods use antibodies developed to bind with a 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

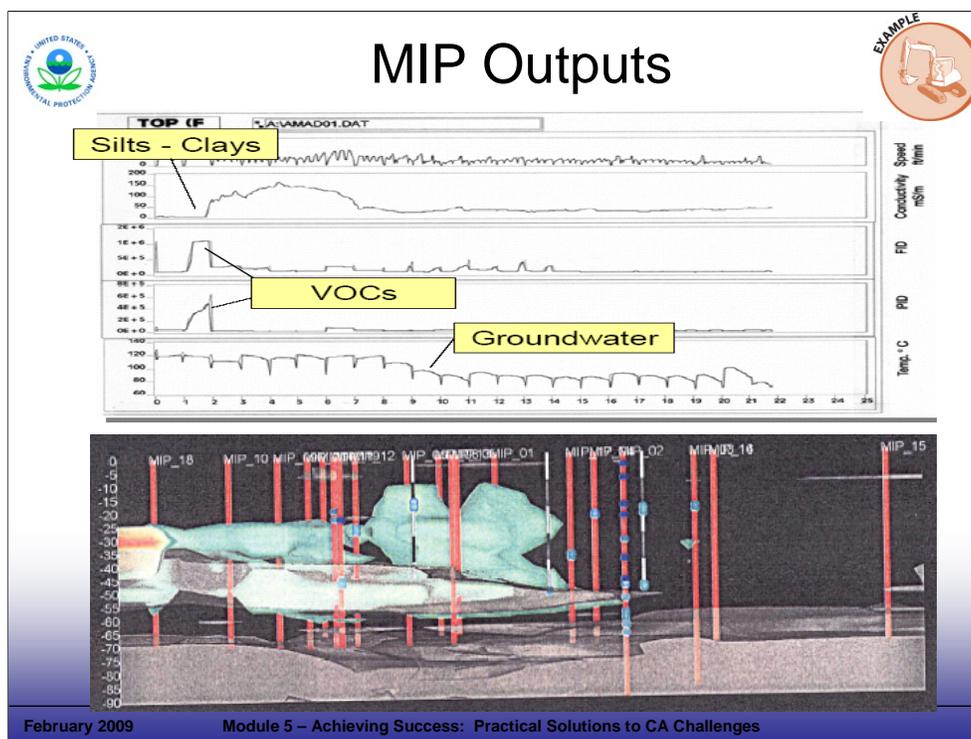
- Show and describe a MIP.

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)

February 2009 Module 5 – Achieving Success: Practical Solutions to CA Challenges

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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Module 5 – Achieving Success: Practical Solutions to CA Challenges

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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.

Module 06
Corrective Action and Facilitating Land
Revitalization



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



February 2009 Module 6 - CA and Facilitating Land Revitalization 1

Notes:Purpose of Slide

- This is the title slide for Module 6, Corrective Action (CA) and Facilitating Revitalization.

Key Points

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

References

- None.



Module 6

Corrective Action and Facilitating Land Revitalization

February 2009 Module 6 - CA and Facilitating Land Revitalization 2

Notes:

Purpose of Slide

- Review the content and purpose of this module.

Key Points

- As stated earlier in this course, Land Revitalization is a priority focus area for EPA.
- This module overviews some of the goals, activities, approaches, resources, tools, and measures available for Land Revitalization.
- The specific goals of this module include the following:
 - Convey EPA's goal that Resource Conservation and Recovery Act (RCRA) corrective action (CA) sites be cleaned up to accommodate safe reuse.
 - Provide information on approaches that may facilitate RCRA site reuse.
 - Present real world examples through a video of success stories.
- The title of this module reflects a two-way street. CA may facilitate land revitalization; in addition, revitalization may help to drive CA.

References

- None.



Module Overview

- ❖ Land Revitalization – an Agency Priority
- ❖ Resource Conservation and Recovery Act (RCRA) Goals and Initiatives for Land Revitalization
- ❖ Policies, Guidance, Resources, and Approaches
- ❖ RCRA Corrective Action (CA) Land Revitalization Measures
- ❖ RCRA CA Land Revitalization Examples



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Module 6 - CA and Facilitating Land Revitalization

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Notes:

Purpose of Slide

- Overview the content of the module.

Key Points

- EPA began to emphasize land revitalization in the 1990s, with the Brownfields Program. In 1997, the RCRA Brownfields and Prevention Initiative was launched. Now land revitalization is an Agency priority and is being implemented by all of EPA's cleanup programs and on the state and local level.
- We will start by reviewing EPA's Land Revitalization Priorities and the RCRA Land Revitalization Goals. We will consider how revitalization and CA progress goals are complementary. As a starting point, we will share some information on the status of current and planned uses at RCRA facilities. This provides a foundation of understanding for moving forward. We will also identify some of the potential obstacles to land revitalization.
- We will then review resources and approaches to support Land Revitalization, including those that provide incentives for, or support to, efforts to reuse and redevelop RCRA CA sites. This will include consideration of some key approaches and concepts that support revitalization at RCRA CA sites. A number of things must come together for a RCRA CA site to be revitalized; however, there are a few critical aspects for success, including: early consideration of end uses, leveraging reuse interests, communication, partnering, sharing of information on funding resources, using sustainable approaches, and ecological revitalization. While revitalization is a current emphasis, revitalization at RCRA sites is not new and is routine in RCRA program; hundreds of sites have been addressed in this manner.
- After reviewing these concepts and approaches, we will identify and review how progress in land revitalization will be measured. A cross-program group has developed guidance on land revitalization measures and specific guidance and measures have been developed for the RCRA CA program.
- We will share examples of successful Land Revitalization efforts to illustrate how existing tools, resources, and guidance can be applied in creative ways to spur cleanup and land revitalization. We also will show a video developed by EPA to share land revitalization success stories that were achieved at three RCRA CA facilities.

References

- None.



EPA Land Revitalization Initiative

- ❖ **Administrator's Action Plan**
"Restore contaminated properties...to environmental and economic vitality."
- ❖ **OSWER Action Plan**
"Encourage appropriate reuse of Brownfields, Underground Storage Tank fields, Superfund sites, RCRA facilities, Base Realignment and Closure (BRAC) sites, and other federal properties."
- ❖ **EPA's 2006-2011 Strategic Plan, Goal 3**
"EPA's cleanup programs have set a national goal for returning formerly contaminated sites to long-term, sustainable, and productive use."

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Module 6 - CA and Facilitating Land Revitalization

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Notes:

Purpose of Slide

- Review Agency plans and goals aligning with land revitalization.

Key Points

- Cleaning up contaminated properties and returning them to safe and productive use is an Agency priority.
- Recognizing the importance and necessity of restoring contaminated properties to environmental and economical vitality, EPA Administrator Stephen L. Johnson highlights land revitalization as a priority in his Action Plan.
- In its 2006-2011 Strategic Plan, EPA has established Goal 3: Land Preservation and Restoration to "preserve and restore the land by using innovative waste management practices and cleaning up contaminated properties to reduce risks posed by releases of harmful substances."
- EPA is actively encouraging all cleanup programs to ensure properties are remediated in a way that supports reasonably anticipated uses. Within the Office of Solid Waste and Emergency Response (OSWER), all cleanup programs and offices are working on Land Revitalization: the Office of Brownfields and Land Revitalization, the Superfund Program, Underground Storage Tanks, Federal Facilities Restoration and Reuse Office (FFRRO), and the RCRA CA Program.
- EPA recognizes that cleanup and revitalization are mutually supportive goals. Often revitalization/reuse interests can drive a cleanup. Therefore, land revitalization is a critical part of achieving the 2020 Vision for CA.

References

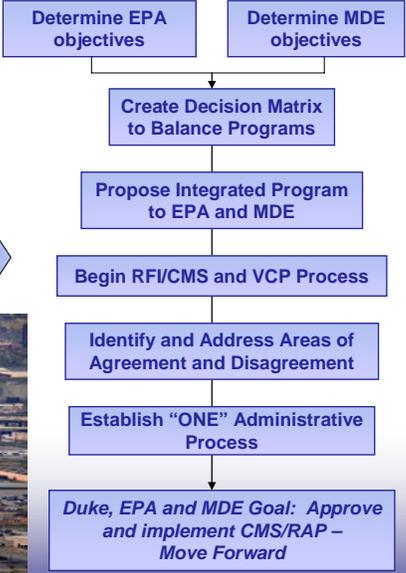
- EPA. EPA Administrator Action Plan. Accessed On-line at: <http://www.epa.gov/adminweb/administrator/actionplan.pdf>
- EPA. 2006. EPA Strategic Plan, 2006-1001. Goal 3. Accessed On-line at: <http://www.epa.gov/ocfo/plan.htm>.
- EPA. Undated. EPA OSWER Action Plan. Accessed On-line at: <http://www.epa.gov/swerrims/actionplan/index.htm>.

EXAMPLE

GM Duke

- ❖ Former Assembly Plant in Baltimore, MD
- ❖ Closure announced in 2005, requiring:
 - Termination of hazardous waste storage permit (MDE)
 - Meeting CA obligations (EPA)
- ❖ Duke Realty awarded development (\$140 million investment commitment)
- ❖ CA under facility lead agreement (EPA)
- ❖ EPA and MDE requirements integrated





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graph TD
    A[Determine EPA objectives] --> C[Create Decision Matrix to Balance Programs]
    B[Determine MDE objectives] --> C
    C --> D[Propose Integrated Program to EPA and MDE]
    D --> E[Begin RFI/CMS and VCP Process]
    E --> F[Identify and Address Areas of Agreement and Disagreement]
    F --> G[Establish "ONE" Administrative Process]
    G --> H[Duke, EPA and MDE Goal: Approve and implement CMS/RAP - Move Forward]
  
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February 2009 Module 6 - CA and Facilitating Land Revitalization 5

Notes:

Purpose of Slide

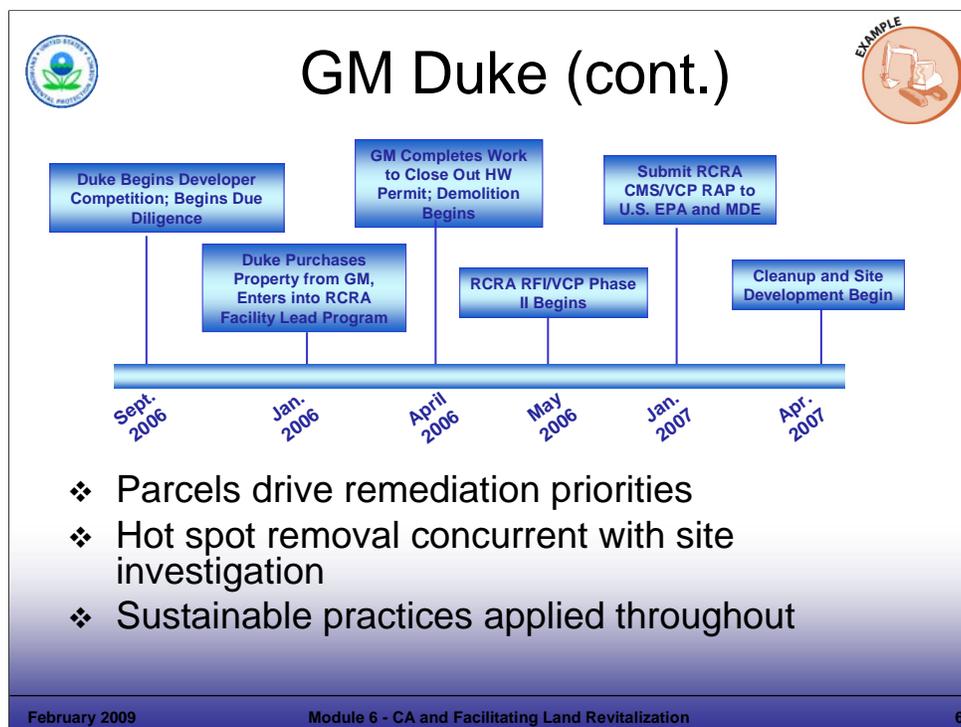
- Present an example of successful revitalization at a RCRA-regulated facility.

Key Points

- This photograph shows the GM Assembly Plant which operated in Baltimore for 68 years, with closure plans announced in 2005. The facility occupied 182 acres in SE Baltimore, with over 3.5 million square feet under roof. Before use as an assembly plant, sections of the property were used as a fort, and other industrial uses.
- The facility had both a hazardous waste storage permit issued by the Maryland Department of Environment (MDE) and had CA obligations that would be overseen by EPA Region 3 (as MD was not authorized for CA).
- To facilitate redevelopment, GM requested proposals from 20 developers including redevelopment and environmental planning requirements. Duke Realty (Duke) and its consultants won the project, which included a commitment to invest over \$140 million to achieve closure and support redevelopment.
- GM led closure of the hazardous waste permit. GM initiated a Facility Lead Agreement with Region 3, which Duke then took over. The EPA, MDE, GM, and Duke worked collaboratively to achieve an approach that integrated CA and State Voluntary Cleanup Program (VCP) requirements, supporting the dual goals of meeting RCRA CA obligations and ensuring state remediation requirements were addressed. The property was divided into four planned use areas, with appropriate protective measures identified for each area. Parcels were prioritized for remediation to support redevelopment (with less contaminated parcels addressed first to allow their redevelopment).
- Public participation efforts were significant as several homes border the facility; the community has been supportive of redevelopment and Duke has taken extra steps to minimize area disruptions such as truck traffic and dust. In some cases, the redevelopment also is affording area homes a better view of the harbor.
- Sustainable approaches were integrated into the revitalization process (see next slide).

References

- EPA. EPA Region 03 Revitalization Web Site. Accessed Online at: <http://www.epa.gov/region03/revitalization/newsletter/winter07/newsletter.pdf>.
- EPA. 2008. Presentation by Bob Greaves: Opening the Flood Gates. Presented at 2008 Brownfields Conference, Detroit, MI. May.
- MDE. 2007. MDE Web Site Article. GM Plant Site Revitalized. March. Accessed On-line at: <http://www.mde.state.md.us/ResearchCenter/Publications/General/eMDE/vol2no11/GMredevelopment.asp>.



Notes:

Purpose of Slide

- Continue an example of successful revitalization at a RCRA-regulated facility.

Key Points

- This slide shows the rapid timeline achieved by the parties supporting the remediation and redevelopment. Duke and its contractors worked closely with MDE and EPA, as well as with appropriate stakeholders, to develop plans and achieve concurrence.
- Through careful planning, regulatory analysis, and appropriate input – one set of standards and requirements that met both EPA CA requirements and MDE VCP standards was achieved. Implementing this planning up-front ensured fewer problems would be identified during the process in terms of remediation standards and requirements.
- Method to streamline the process included prioritizing parcels for remediation to support redevelopment plans and implementing hot spot removal concurrent with ongoing site investigation in other areas.
- Sustainable approaches were integrated into the revitalization process, with results including deconstruction of 3.5 million square feet of buildings, with 96% of the building material recycled. Recycling of other materials included 98,000 tons.
- Benefits to the community of the new business park included: (1) 3,500 new jobs; (2) \$140 million of new investment; (3) \$61 million in property taxes; and (4) cleanup and reuse of 182 acres of land for industrial and commercial purposes (including a warehouse and distribution center and 240,000 square feet of office space).

References

- EPA. EPA Region 03 Revitalization Web Site. Accessed Online at: <http://www.epa.gov/region03/revitalization/newsletter/winter07/newsletter.pdf>.
- EPA. 2008. Presentation by Bob Greaves: Opening the Flood Gates. Presented at 2008 Brownfields Conference, Detroit, MI. May.
- MDE. 2007. MDE Web Site Article. GM Plant Site Revitalized. March. Accessed On-line at: <http://www.mde.state.md.us/ResearchCenter/Publications/General/eMDE/vol2no11/GMredevelopment.asp>.



RCRA Land Revitalization Goals

- ❖ Cleanup close to 3,746 RCRA CA sites by 2020 (RCRA CA 2020 Universe)
- ❖ Leverage reuse interests and resources to achieve RCRA CA cleanup goals
- ❖ Measure progress towards the safe reuse of sites
- ❖ Move facilities from idle properties to productive assets for the community

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Module 6 - CA and Facilitating Land Revitalization

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Notes:

Purpose of Slide

- Present and explain RCRA Land Revitalization Goals; these support progress towards the 2020 Vision for CA.

Key Points

- As discussed in Module 2, the RCRA 2020 Vision for CA presents a vision that by 2020, RCRA CA sites are largely addressed in a manner that is safe for current and reasonably anticipated future uses. Because remedy decisions incorporate current and future use considerations, cleanup decisions tie to revitalization interests and goals; therefore, revitalization interests can help drive progress towards the 2020 Vision.
- Because revitalization interests can bring resources and momentum towards cleanup, reuse interests and resources should be leveraged to help achieve the RCRA 2020 Vision.
- Moving forward, cleanup progress will be reported using both the number of "sites" and "acres" of land that have been addressed and are safe for current and anticipated future uses (acres of land is a new measurement that complements the former focus on "facilities" or "sites"). We will discuss specific RCRA CA Land Revitalization Indicators and Performance Measures later in this module.
- A related goal is to ensure that RCRA properties are not left idle due to concerns about contamination; instead, these idle or underutilized sites should be addressed so that they can be revitalized to become positive resources for the community.

References

- EPA. Corrective Action Website. RCRA 2020 CA Goals and Program Results. Accessed On-line at: <http://www.epa.gov/correctiveaction/facility.htm>.
- EPA. 2007. Guidance for Documenting and Reporting RCRA Subtitle C Corrective Action Land Revitalization Indicators and Performance Measures. February 21.



RCRA Sites Present Opportunities for Revitalization

- ❖ Location
- ❖ Size
- ❖ Available utility and transportation infrastructure
- ❖ Existing environmental data
- ❖ Many facilities will continue operating, with some portions going to new uses

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Module 6 - CA and Facilitating Land Revitalization

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Notes:

Purpose of Slide

- Discuss why RCRA CA sites can provide a good fit for revitalization.

Key Points

- Location – RCRA CA sites often are located in areas that are urban. Other facilities are located in more rural areas. As the focus on reuse of property increases, these sites may be ideally located for particular uses.
- Size – Many RCRA CA sites are large properties and developers can often do more with larger sites. For example, larger sites provide room for major developments (housing or commercial complexes) and also provide an opportunity for parceling to support a variety of end uses.
- Utilities and Transportation – Because RCRA facilities generally already have utility and transportation infrastructure – reuse can build on the existing infrastructure at these facilities.
- Environmental Data – Because many RCRA facilities have been evaluated for CA, or for prioritization and evaluation of environmental indicators (EIs) status, environmental data often already exist for these facilities. This data can provide a strong starting point for evaluating potential future uses and cleanup needs.
- Operating Facilities – Over half of our RCRA sites plan to continue operating and therefore, will not be changed to a new use. However, at some of these larger sites, some parcels may be freed up (leased or sold) for new uses. Operating facilities can work to address cleanup obligations and achieve the “construction complete” CA milestone or the new Land Revitalization “Ready for Anticipated Use – RAU,” which we will address later in this module. Module 12 provides more information on the construction complete milestone.
- Looking at potential reuse can be good for the economy and also can conserve green space. Fewer acres of previously used land are required for redevelopment when compared to development on new land. A George Washington University Study cited in a Region 3 Land Use and Reuse Assessment Report found that “for every acre of Brownfields property redeveloped, a minimum of 4.5 acres would have been required had the same project been located in a greenfield area.”

References

- EPA. 2005. National CA Conference in Denver, CO. Session on “Capitalizing on Revitalization as a Catalyst for Cleanup.” Diana Duva, CT DEP – Slide on “RCRA and Land Revitalization – Why RCRA?” Discussion moderated by Sara Rasmussen, EPA Office of Resource Conservation and Recovery. Powerpoint. May 4.
- EPA. 2006. Hazardous Waste Cleanup Sites Land Use and Reuse Assessment. EPA Region 3. May. Accessed On-Line at: <http://www.epa.gov/region03/revitalization/reuse.htm>.



RCRA Land Revitalization Activities

- ❖ Increase knowledge and expertise for Land Revitalization
- ❖ Implement creative approaches and tools
- ❖ Partner/outreach/technology transfer with the RCRA community, stakeholders
- ❖ Partner with OSWER's other cleanup programs
- ❖ Support RCRA Reuse and Brownfields Prevention Workgroup activities
- ❖ Implement RCRA Land Revitalization Indicators and Performance Measures

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Module 6 - CA and Facilitating Land Revitalization

9

Notes:

Purpose of Slide: Provide specific examples of RCRA CA activities related to Land Revitalization.

Key Points

- RCRA's Draft Revitalization Strategy includes a clear goal to increase knowledge and expertise to support Land Revitalization. This will be achieved by a number of activities, including:
 - Outreach and Partnering Efforts - For example, in 2006, EPA Region 1 hosted the national RCRA CA conference in Providence, RI. The theme of this conference was revitalization.
 - Creative Approaches and Tools – A range of approaches and tools are being developed and shared to support revitalization efforts. For example, these include: (1) websites, (2) direct technical assistance, and (3) documentation of successful results (case studies, the video, course examples).
 - RCRA Brownfields Prevention Workgroup - This group was formed in the late 1990s to identify issues, develop tools, and support cross-region communication and technology transfer. This active workgroup has representatives from all 10 Regions and a number of states. The workgroup supports the RCRA program's activities to develop and pilot test approaches, share examples, and spread information to the RCRA community about revitalization tools. Other outreach efforts include the RCRA Brownfields Website, which includes: program descriptions, official documents, and links for a variety of topics related to RCRA Brownfields topics. It also identifies some of the initiatives, resources, and recent RCRA guidance and reforms that may be applicable at potential RCRA Brownfields facilities.
 - The RCRA program is participating in EPA's cross-program land revitalization effort and will measure land reuse as one parameter of success as it moves forward. EPA has been establishing common performance measures and we will discuss these efforts later in this module.
 - RCRA Land Revitalization Indicators and Performance Measures were issued as part of this effort for the CA Program (February 2007). These measures will help to track both the number of sites and acres that are ready for anticipated uses.

References

- EPA. RCRA Brownfields Prevention Initiative Website. Accessed On-line on at: <http://www.epa.gov/rcrabrownfields/index.html>.
- EPA. 2006. Measuring Revitalization of Contaminated Properties in America's Communities: Past Accomplishments and Future Opportunities. Interim Final. EPA OSWER Land Revitalization Staff Office. EPA-500-R-06-002. September.
- EPA. 2006. Interim Guidance on OSWER Cross-Program Revitalization Measures. October 20.
- EPA. 2007. Guidance for Documenting and Reporting RCRA Subtitle C CA Land Revitalization Indicators and Performance Measures. February 21.



What We Know About Use Status of RCRA Sites

- ❖ Several Regions and states are documenting the use status of RCRA sites
 - Regions 3, 5, and 9
 - Others Regions launching activities
 - States such as Florida are also documenting uses
- ❖ A few conclusions
 - Well over half of RCRA CA facilities still in “continued use”
 - Large number of RCRA CA facilities will discontinue operations and go to reuse

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Notes:

Purpose of Slide

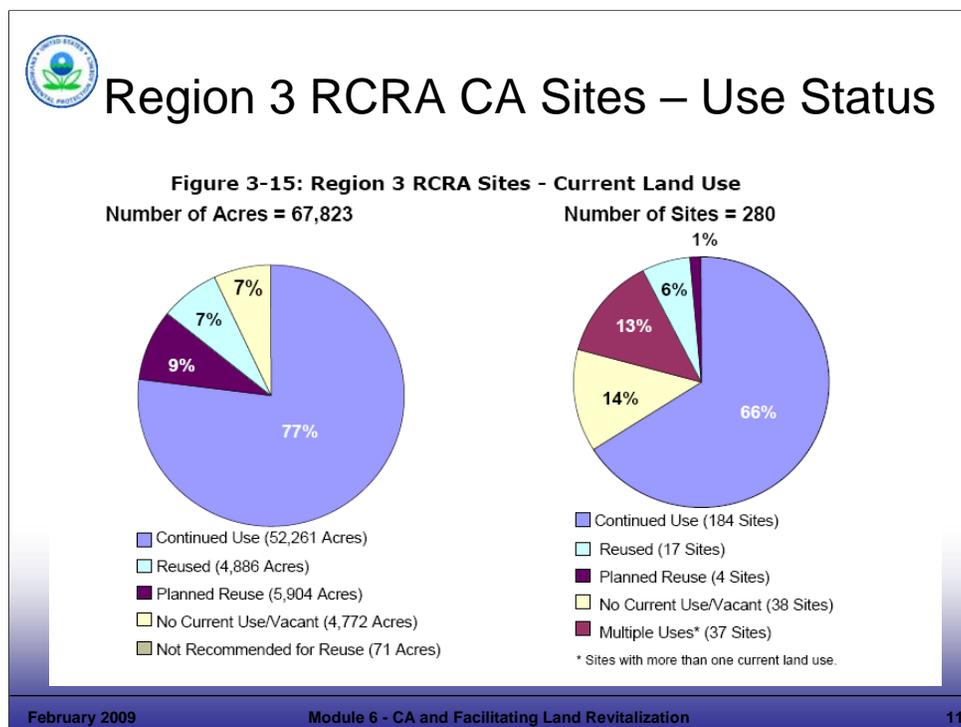
- Introduce efforts to catalogue current and reasonably anticipated uses of RCRA CA and other types of contaminated or underutilized properties.

Key Points

- Various EPA Regions have collected information regarding the use of RCRA Sites in their regions. We will review an example of these efforts in the next two slides. The example is taken from EPA Region 3, which has issued a report documenting its findings. Region 3 researched current and planned land use across all of its cleanup programs, including RCRA CA.
- Research to date shows that well over half of RCRA CA sites are still in continued use; the remainder will discontinue operation and go into reuse in some other form.

References

- EPA. 2006. Hazardous Waste Cleanup Sites Land Use and Reuse Assessment. EPA Region 3. May. Accessed On-Line at: <http://www.epa.gov/region03/revitalization/reuse.htm>.
- EPA. 2006. National Corrective Action Conference, Providence, RI. “Innovations in Measuring Revitalization Challenges and Successes.” Presented by Guy Tomassoni, OSWER Land Revitalization Office. June.



Notes:

Purpose of Slide

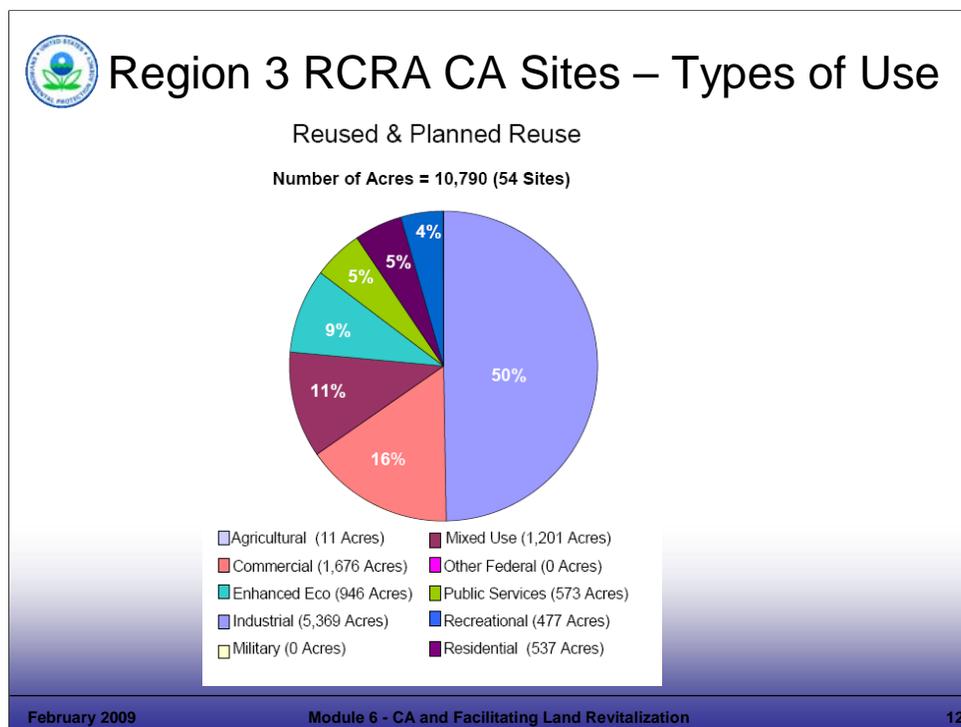
- Provide a perspective on how RCRA CA sites are currently used.

Key Points: EPA Region 3 conducted a Study of Land Use and Reuse at Superfund, Federal Facility, and RCRA CA sites as part of a regional pilot effort that looked at site use across cleanup programs (pages 3 and 14 of Region 3 Report). Deb Goldblum of EPA Region 3 is the primary contact for this work.

- Over 500 RCRA CA, Superfund National Priorities List (NPL), and Federal Facility sites with about 230,000 acres were evaluated (this is 10 times the total land mass of Manhattan Island in NY).
- The charts on this slide were developed for that study and show total ACRES and SITES (facilities) that fall within each category of use for RCRA CA Sites in the Region. This universe includes 280 RCRA CA High Priority sites, comprising 67,823 acres of site land. RCRA CA sites accounted for 29% of all acres of land within the Superfund NPL, Federal Facility, and RCRA CA Site Universe in this Region.
- Pie Chart on Left – This pie chart shows the number of ACRES of current land use by category for RCRA CA high priority sites, including: (1) Continued Use (52,261 acres/77%); (2) Planned Reuse (5,094 Acres/9%); (3) Reused (4,886 acres/7%); (4) No Current Use/Vacant (4,772 Acres/7%); and (5) Not Recommended for Reuse (71 Acres/Non-significant percent). All of the categories, except the last one, present active or potential Land Revitalization opportunities.
- Pie Chart on Right – This pie chart shows the number of SITES and current land use by category, including: (1) Continued Use (184 sites/66%); (2) Reused (17 Sites/6%); (3) Planned Reuse (4 Sites/1%); (5) No Current Use/Vacant (38 Sites/14%); and (6) Multiple Uses (37 Sites/13%). All of the categories encompass active or potential Land Revitalization opportunities. Multiple uses can occur at sites that have undergone parceling, which we will talk about later in this module.
- Note: The majority of RCRA site acreage in the U.S. is from Federal Facilities (9,600,000 acres federal facility, 600,500 acres non-federal facility). For more information on acreage and the RCRA universe, see the OSW FY07 RCRA Land Revitalization Measures Status Report.

References

- EPA. 2006. Hazardous Waste Cleanup Sites Land Use and Reuse Assessment. EPA Region 3. May. Accessed On-Line at: <http://www.epa.gov/region03/revitalization/reuse.htm>.
- EPA. 2006. National Corrective Action Conference, Providence, RI. "Innovations in Measuring Revitalization Challenges and Successes." Presented by Guy Tomassoni, OSWER Land Revitalization Office. June.
- EPA. 2007. Implementing RCRA Land Revitalization Measures. Presented by Sara Rasmussen, Corrective Actions Program Branch Office of Resource Conservation and Recovery, EPA. November 6 (Clu-In Session). Accessed On-Line at: <http://www.clu-in.org/conf/tio/rcralr/>



Notes:

Purpose of Slide

- To gain a perspective on how RCRA CA sites are being used after cleanup and to compare reuse of property to new development.

Key Points

- For the High Priority RCRA CA sites evaluated on the previous slide, EPA Region 3 selected a subset that were designated as Reused or Planned Reuse (not including Continued Use). The Region then identified the types of land uses that were occurring or planned for those sites. The pie chart on this slide provides information on specific types of use for the facilities studied.
- This slide shows the types of use for Reuse and Planned Reuse sites in EPA Region 3. The Reused and Planned Reuse sites subset included a total of 54 sites out of the 280 High Priority sites; which comprises 10,790 acres of land.
- EPA Region 3 estimated the ACRES for each site that falls into the following types of uses: (1) Agricultural (11 acres), (2) Commercial (1,676 acres), (3) Enhanced Ecological (946 acres), (4) Mixed Use (1,201 acres), (5) Industrial (5,369 acres), (6) Public Services (573 acres), (7) Military (0 acres), (8) Other Federal (0 acres), (9) Recreational (477 acres), and (10) Residential (537 acres). The percentages are shown on the pie chart.
- These types of studies are important because they provide a good picture of where we are and provide a foundation for where we are headed. This type of information informs programs of what types of uses RCRA sites are going into and what type of use might be reasonably expected.

References

- EPA. 2006. Hazardous Waste Cleanup Sites Land Use and Reuse Assessment. EPA Region 3. May. Accessed On-Line at: <http://www.epa.gov/region03/revitalization/reuse.htm>.



Potential Barriers to Revitalization

- ❖ Length of time for cleanup
- ❖ Cost of cleanup/financial obstacles
- ❖ Lack of certainty
- ❖ Concerns about liability

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Notes:

Purpose of Slide

- Set the stage for the next slides, which focus on resources, tools, approaches, and principles to achieving revitalization – making it happen.

Key Points

- The largest barriers to developers in reusing contaminated properties are tied to cost (which is sometimes manifested in time) and risk.
 - Length of Time for Cleanup – The risk of delay in a property getting ready for use. Time is money; developers often work with borrowed funding.
 - Cost of Cleanup – If developers cannot achieve a profit margin, they will pass on a property.
 - Lack of Certainty – Often, there may be real or perceived uncertainty regarding the environmental status of a property – this presents a risk of higher costs or future costs. Developers need to know the range of potential cleanup costs to make a business decision regarding redevelopment.
 - Concerns about Liability – Concerns about liability create uncertainty. The potential for additional cleanup presents a risk of future costs. Complete cleanups with minimal long term stewardship requirements reduce risk and potential future costs.
- EPA recognizes that actual and perceived barriers must be addressed. To support a better understanding of stakeholder perspectives on barriers, the Office of Brownfields and Land Revitalization hosted a forum in October 2007 for representatives of industry, EPA regions, states and cities to discuss specific examples of how such barriers have been successfully overcome.

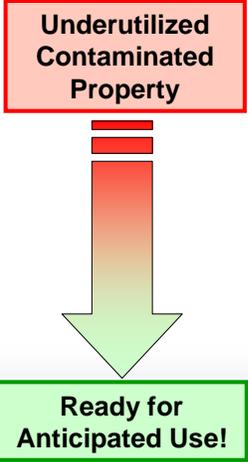
References

- None.



Overcoming Potential Obstacles to Revitalization

- ❖ Identify resources
- ❖ Leverage reuse interests
- ❖ Apply flexible and innovative approaches
- ❖ Identify anticipated future uses early
- ❖ Focus on the exit strategy
- ❖ Partner and communicate well
- ❖ Help overcome financial obstacles
- ❖ Integrate sustainable approaches
- ❖ Focus on long-term stewardship
- ❖ Measure and share successes



**Underutilized
Contaminated
Property**

**Ready for
Anticipated Use!**

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Notes:

Purpose of Slide

- Review obstacles to revitalization and guidance, resources, and approaches that support revitalization.

Key Points

- We mentioned some barriers to revitalization on the last slide.
- This section of Module 6 identifies resources and approaches to support revitalization.
- The speaker will mention and elaborate on some of the bullets above; for example, the importance of partnering and communication.
- Identify that some of these are touched on in this module as they relate to revitalization and also are addressed in other Modules (for example, the Exit Strategy is discussed in detail in Module 4). Others are presented on the following slides.
- The end goal is to move properties from underutilized to productive use that is appropriate and protective for anticipated future uses.

References

- None.



Identify Resources for Revitalization

- ❖ Financial
 - EPA Brownfields grants and loans
 - HUD and other federal grant and loans
 - State and local funds
- ❖ Technical
 - Brownfields and Land Revitalization Technology Support Center
 - CLU-IN Resources
 - SMARTe



<http://www.smarte.org/smarte/>



<http://www.brownfieldstsc.org>



<http://www.clu-in.org>

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Notes:

Purpose of Slide: Review some resources and approaches that support revitalization.

Key Points

- Grant Programs – EPA's Brownfields Grant program may be available for some RCRA CA facilities that might not otherwise be cleaned up (but can not be used to fund the obligations of o/o's for RCRA CA). Information on grants and the types of RCRA sites that might be eligible for grants can be found at <http://www.epa.gov/brownfields>. In addition, other federal agency grants support revitalization (e.g., Housing and Urban Development Brownfields Economic Development Initiative (BEDI) grants). Most states also offer Brownfields site assessment/cleanup grants; check with your state for more information. Also, the Brownfields Office recently posted a useful report on financing Brownfields. It can be found at: http://www.epa.gov/brownfields/partners/vf_fin_state.htm.
- The Brownfields and Land Revitalization Technology Support Center – This center provides information and support to sites that are undergoing investigation, remediation, and potential revitalization. The Website includes information about the use of innovative site investigation and cleanup technologies and strategies. Innovative technologies and strategies such as the Triad approach support redevelopment goals by lowering costs and decreasing project time frames.
- CLU-In – This web-based educational organization provides archives of several web-based seminars on revitalization topics, as well as web pages on ecological restoration and other aspects of land revitalization. CLU-IN is supported by EPA and is located at: <http://www.clu-in.org>.
- SMARTe – This is another on-line resource. EPA and the German Federal Ministry for Education and Research initiated a cooperative effort to share information and evaluate new solutions for the redevelopment of contaminated sites. This Website helps users identify, apply, and integrate tools and technologies to facilitate the revitalization of sites in the U.S. The Website will be updated as new tools, technologies, and approaches become available for revitalizing previously used lands. This Website also provides information on funding sources and shares community involvement tips.

References

- EPA. Brownfields and Land Revitalization Website. Accessed On-line, at: <http://www.epa.gov/brownfields/>.
- Department of Housing and Urban Development. Brownfields Economic Development Initiative Website. Accessed On-line, at: <http://www.hud.gov/offices/cpd/economicdevelopment/programs/bedi/index.cfm>.
- Brownfields and Land Revitalization Technology Support Center (BTSC). BTSC Website (Supported by EPA, Argonne National Laboratory, and the U.S. Army Corps of Engineers). Accessed On-line, at: <http://www.brownfieldstsc.org/>.
- EPA. 2007. SMARTe 2007 Web Site; On-line Revitalization Tool. Accessed On-line at: <http://www.smarte.org/smarte/home/index.xml>.



Leverage Reuse Interests

- ❖ Can bring resources towards cleanup
- ❖ Can result in accelerated cleanup
- ❖ Can help avoid properties being left idle due to RCRA concerns
- ❖ Requires cooperation with reuse interests to address their needs (when reasonable)
 - Identify developer needs and accommodate them (for example, schedule needs)
 - Provide site status documentation for use by lenders
 - Help identify and provide information on possible resources for the site

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Notes:

Purpose of Slide

- Stress that reuse interests should be leveraged through cooperative approaches to avoid delays or lack of progress.

Key Points

- Leveraging mutual interests or building on interest to redevelop a property can help expedite cleanup at some sites. Redevelopment interests for a site may provide resources and momentum for a site cleanup.
- Some sites that might remain idle due to RCRA CA concerns can be addressed if a reuse interest is identified, encouraged, and leveraged.
- Cooperation with stakeholders, when reasonable, can include:
 - Identifying developer needs and accommodating these where feasible (schedules, requests for documentation, etc.). Where feasible, a strong emphasis should be put on setting and adhering to schedules that work for the developer. Some Regions have found success in adhering to agreed-upon schedules that are important to developers.
 - As discussed previously, site documentation can be important to help developers understand the status and risk associated with a site; this documentation also can assist a developer in obtaining loans. Lenders will want to have a good understanding of site conditions and risks.
 - Some potential developers or interested parties may benefit from funding resources that are available (see slide on working at financially struggling sites).

References

- None.



Apply Flexible and Creative Approaches

- ❖ Use of alternate authorities (for example, state Voluntary cleanup programs)
- ❖ Facility-lead agreements
- ❖ Parceling

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Notes:

Purpose of Slide

- Discuss flexible and creative approaches that support reuse.

Key Points

- Use of Alternate Authorities – This was discussed in Module 3 and can include the application of state voluntary cleanup programs (VCPs) or other cleanup authorities. The Project Manager should consider available authorities and identify which may be best to support remediation and revitalization efforts at a particular site. States often may be best able to lead this consideration and determine the best program to use; input from other site parties (EPA, facility, etc.) also is important. In all cases, the authority used must achieve a cleanup equivalent to RCRA CA requirements; for states lacking RCRA CA authority, other options are likely available (for example, VCPs, Superfund programs, and Brownfields programs).
- Facility-Lead Agreements – This approach, which streamlines the process by developing an agreement on cleanup activities between the RCRA program and the regulated facility, is being used successfully in some situations.
- Parceling – Parceling is a viable option for some sites and can speed the site cleanup process; the next slide provides more information on parceling.

References

- EPA. 2004. "Getting it Done: RCRA Liability Tools." Includes topic of Parceling. Presented by Susan Bromm. Director of Office of Superfund Remediation and Enforcement (OSRE) at Brownfields Conference. December.
- EPA. 2002. Memorandum to RCRA Senior Policy Advisors from Robert Springer, "Clarifying My Views on RCRA Parceling." December 20.



Parceling

- ❖ Facility divided into parcels based on different end uses
 - Allows alternate cleanup criteria based on varying anticipated uses
 - Allows different timelines to be used
- ❖ Parcels can be transferred or leased using various approaches – outcomes
 - Must ensure protection of human health and the environment
 - Should allow cleanup and productive reuse to progress

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Notes:

Purpose of Slide: Review parceling in greater detail.

Key Points

- Parceling divides a site into portions to support cleanup to appropriate levels given each portion's anticipated end use. It also facilitates revitalization efforts by allowing some portions of a site to proceed quickly to reuse.
- Different portions of a site can be remediated to different degrees and on different timelines based on alternate future land uses.
- Parcels can be transferred or leased using a variety of approaches, as follows:
 - Clean parcels or parcels that do not require further cleanup, can be removed from an order or permit.
 - If a parcel requires additional cleanup activities parceling can be more difficult to achieve – approaches include: (1) the parcel can be defined as "off-site" contamination to the remaining property – with the original owner still required to conduct cleanup; and (2) the individuals involved can enter into agreements regarding who will cleanup remaining contamination. When someone other than the new owner will address remediation at the property, the new owner should provide legal access for the remediation activities. Whatever approach is used, CA obligations must be met.
 - Parceling is a viable option for some sites and can speed the site cleanup process. It allows redevelopment of some addressed or non-contaminated yet idle property sections – returning them to beneficial use for the community.
- Parceling at RCRA-permitted facilities can require a permit modification. That modification can state that the original owner is liable for cleanup of any newly discovered contamination. If expecting to undertake cleanup or maintenance activities, the regulator should require the old owner to also have an access agreement or otherwise address RCRA Section 3004 (v) requirements. Parceling at Interim Status facilities may involve reprioritization of cleanup goals to facilitate transfer; if there is a reuse interest for a parcel, remediation of that portion of the facility may be expedited to support reuse. Some legal issues could also require resolution.
- Information on the Agency's parceling efforts related to RCRA include: (1) Final Guidance on Completion of CA Activities at RCRA Facilities; (2) discussion on EPA's RCRA Reuse and Brownfields Prevention Website; and (3) examples posted on EPA's CA Website at <http://www.epa.gov/osw/hazard/correctiveaction/bfields.htm>.

References

- EPA. 2002. Memorandum to RCRA Senior Policy Advisors from Robert Springer, "Clarifying My Views on RCRA Parceling." December 20.
- Federal Register. 2003. Volume 68, Number 37. Final Guidance on Completion of Corrective Action Activities at RCRA Facilities. February 25.



Identify Anticipated Uses Early in the Process

- ❖ Helps to
 - Define expectations for cleanup
 - Identify various parts of a site that may have different future uses
- ❖ Partner with local stakeholders to ensure you are realistic in identifying future use - this is key!
- ❖ Future uses and the available types and potential effectiveness of ICs help to guide remedy selection decisions

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Notes:

Purpose of Slide

- Emphasize that looking at end uses early in the planning process can save time and resources; its also helps to identify potential problems so that they can be planned for and avoided.

Key Points

- Identify anticipated uses early in the planning process. This supports development of the Exit Strategy. Early planning can assist with, or address:
 - Defining expectations for cleanup.
 - Informing the remedy selection process, especially when parts of a site may have different future use scenarios (which can impact cleanup scenarios). Reuse assessments can evaluate available data early and guide further planning efforts.
- Identify and partner with local stakeholders. This is important because:
 - Community acceptance of site redevelopment should be factored into decisions.
 - Partnering can assist with early agreement on future uses and reduce future delays.
 - Partnering is critical and will be discussed further in this module.
- Future use considerations are important to selecting remedies. Cleanup strategies can be designed more efficiently when future use plans are available (for example, at a commercial development, a parking lot might be placed over an area of concern).
- This slide includes concepts we introduced in Module 4, Exit Strategy and will revisit throughout the course.

References

- None.



Document/Implement Exit Strategies

- ❖ Documentation of site status
 - Ready for Anticipated Use (RAU) Determination
 - Comfort letters, no further action assurance
- ❖ Other documentation to assist developers
 - Prospective Purchaser Agreements (State or Federal)
- ❖ CA Completion Determination
 - With controls (Institutional and/or Engineering Controls)
 - Without controls

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Notes:

Purpose of Slide: Review the government's role in supporting revitalization and in documenting that cleanup decisions also are protective of human health and the environment, in accordance with EPA policies and guidelines. Review available tools.

Key Points

- The Instructor should introduce Agency documentation related to RCRA CA Sites:
- Under RCRA CA, a national determination that is used to document that a site is safe for use is the new RCRA Land Revitalization Measure we will discuss later in this Module (RAU).
- In addition to the RAU measure, comfort letters and no further action assurances from Federal or State Agencies can document the status of cleanup at a site and assist in moving revitalization forward. Comfort letters help to appease concerns about potential liability under RCRA and CERCLA. When a state is the lead at a RCRA facility, the comfort letter normally comes from the state. The letters may convey varying degrees of comfort by communicating EPA or State perceptions of the environmental status of the property and intentions regarding future cleanup activities. The letters, when issued by EPA, may include Agency policy statements regarding the exercise of EPA's enforcement discretion as it relates to specific site circumstances or activities of a party. As of September 2000, EPA Regional staff had issued more than 500 comfort/status letters. No further action assurances document that the Agency has reviewed available information and concluded that based on current data, no further action is necessary at a site. This can help a redeveloper assess if a site is a good prospect for redevelopment.
- Other documentation may also support redevelopment, for example, Prospective Purchaser Agreements (PPA). A PPA is a covenant not to sue that is issued by the Federal government to the prospective purchaser for existing, pre-purchase contamination. States also issue PPAs under state laws. The PPA can require the purchaser to perform cleanup work relating to existing contamination at the site. Federal PPAs must be prepared with Department of Justice input and can take a significant amount of time and resources to complete, although EPA is trying to streamline the process.
- The RCRA CA Completion Guidance provides information on making CA Completion "with controls" or "without controls" determinations, as we will discuss in Module 12. Several Regions are making completion determinations both for entire facilities and for parcels of a facility.

References

- EPA. 2007. Guidance for Documenting and Reporting RCRA Subtitle C Corrective Action Land Revitalization Indicators and Performance Measures. February 21.
- EPA. 1986. Policy on Issuance of Comfort/Status Letters. November 8.
- EPA. 2000. EPA's PPAs and Comfort/Status Letters: How Effective Are They? Findings, Benefits, and Suggested Improvements Final Report. Office of Site Remediation Enforcement Publication # 330R00002. September 29.
- EPA. 1989. Guidance on Settlements with Prospective Purchasers of Contaminated Property. OSWER Directive No. 9835.9 and 54 F.R. 34235. August 18. Accessed On-line at: <http://www.epa.gov/brownfields/html-doc/purchase.htm>.
- Federal Register. 2003. Volume 68, Number 37. Final Guidance on Completion of Corrective Action Activities at RCRA Facilities. February 25. Accessed online at: http://www.epa.gov/correctiveaction/resource/guidance/gen_ca/compfedr.pdf.



Partnership and Good Communication

- ❖ Create a common vision of the revitalization project
- ❖ Successful partnering requires
 - Commitment, respect, and trust
 - Free exchange of information
 - Clearly defined goals and expectations of success
- ❖ Good communication includes:
 - Listening and responding – communicate with stakeholders to identify reasonable and realistic uses of the site
 - Clearly stating cleanup expectations up front

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Notes:

Purpose of Slide

- Emphasize the importance of communication in the land revitalization process. Stress that working in partnership with stakeholders is considered one of the most important ingredients to a successful Brownfields or RCRA CA Revitalization project.

Key Points

- Partnering and good communication create a common vision that can guide a revitalization effort. Agreeing on a vision and working together to achieve it can support progress. Partnering is important across all phases of the project and it can: (1) help streamline the process; (2) help avoid project upsets; and (3) improve the chances of revitalization and cleanup success.
- Communication is a key role that RCRA staff can support in terms of revitalization.
- RCRA program staff should communicate with site owners and stakeholders to identify reasonable and realistic future uses for the site. RCRA site cleanup staff should provide as much site information as possible to developers and stakeholders up front. This allows new parties to clearly understand the cleanup needs of the site and reduces uncertainty and risk.
- RCRA staff also should listen and respond to developer information needs, as appropriate. Information may be requested regarding funding resources, integration of cleanup with a state VCP, how to obtain comfort letters, etc.
- Finally, EPA or State personnel should clearly state cleanup expectations. To prevent any misunderstandings, RCRA staff should be straight forward about the cleanup expectations for the site. The developers and site owner should have these requirements clearly laid out for them so that they can make decisions and move forward.
- There are two EPA programs that can provide assistance to communities in understanding the complexities of CA sites. Technical Outreach Services for Communities (TOSC) uses university educational and technical resources to help community groups understand the technical issues involving the hazardous waste sites in their midst (<http://www.toscprom.org/>). The Community Action for a Renewed Environment (CARE) is a community-based, community-driven, multimedia demonstration program. It provides grants to help communities understand and reduce the risk of exposure to toxic chemicals (<http://www.epa.gov/CARE>).

References

- None.



Work with Financially Struggling Sites



- ❖ Understand financial situation at site
- ❖ Share information regarding funding sources, particularly for struggling sites and communities
 - EPA Brownfields Grants and other federal funds
 - State Brownfields, cleanup and redevelopment financing
 - Local funding – for example, economic development agencies
 - Recent EPA report on financing for Brownfields sites: (http://www.epa.gov/brownfields/partners/bf_fin_state.htm)
- ❖ Creative partnering



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Notes:

Purpose of Slide

- RCRA owner/operators (o/o's) are required to demonstrate financial assurance to address CA obligations. However, EPA acknowledge that financial hurdles must be overcome at some sites and this slide reviews how EPA and State personnel can assist by sharing information on resources. Financial assurance requirements for o/o's are discussed in Module 3.

Key Points

- Understand the financial situation of the site; in some cases, the potential developer needs to obtain funding.
- As discussed previously, some communities and sites may be eligible for Federal funding including: (1) EPA Brownfields grants and other Federal grants/funds; (2) State Brownfields, cleanup, and redevelopment financial support; and (3) local funding. The recently released report on Brownfield Funding should be a useful resource (referenced earlier). The handout for this module includes a list of tax incentive opportunities compiled by representatives of OBCR.
- Help the owner look for partnering opportunities. A great example of this is the Century Brass site in New Milford, CT. This 72 acre site was formerly occupied by a copper and brass alloy tubing manufacturer. Past practices resulted in hazardous metal hydroxide sludge being disposed in two unlined surface impoundments, which required clean closure. PCBs also were identified and threatened human health and the river.
- The City took over this RCRA CA site through a foreclosure in 1999. The property then moved toward redevelopment with assistance from the CT DEP, EPA Brownfields, and EPA TSCA Programs. In 2001, New Milford was provided with a \$1 million loan for cleanup. In 2002, the City was awarded a \$150,000 grant to continue Brownfield redevelopment and cleanup.
- Costs to remediate the site were greater than initially estimated (as of July 2004, \$2.6 million had been spent and additional contamination was identified and required another \$500,000 to address). However, the site is now cleaned up and listed for sale on the town's web site. This site is the only available industrially zoned property in town, is served by sewer and water, and is near to a national gas pipeline, rail line, and major highway. This makes it a promising property for future use. In March 2008, the town received an offer of \$4.5 million for the site, with plans to use it for a venture that will produce an alternative fuel.

References

- Litchfield County Times Web site. 2008. Article by Nancy Barnes. Firm Is Seeking New Milford Site To Make Ethanol. March 13.
- EPA. 2007. List of Tax Incentive Web sites. Provided by David Lloyd of OBCR. August 8, 2007.
- EPA. 2002. Press Release. EPA Awards Brownfields Redevelopment Money to Two CT Communities. May 20.
- EPA. 2001. Press Release. EPA Gives CT Towns Seven Grants Worth \$3.4 Million. April 20.
- New York Times. 1986. In Westchester and CT, 3 Large Old Brass Mill Sites Up for Sale. March 9.
- American Metal Market. 2004. CT Town Faces Rising Costs to Clean Site of Old Brass Mill. July 8.



Sustainable Approaches in the Land Revitalization Process

Sustainable Revitalization is a holistic approach to the cleanup and revitalization of a property. It considers a broad array of environmental factors and community impacts during all phases (demolition, waste remediation, design and construction, reuse), in order to maximize the environmental, social, and economic benefits associated with a project. Adopting green approaches is a key aspect of sustainable revitalization.

Deconstruction, Demolition, and Removal	Cleanup, Remediation, and Waste Mgmt.	Design and Construction for Reuse	Sustainable Use and Long-Term Stewardship
<ul style="list-style-type: none"> • Reuse/recycle deconstruction and demolition materials • Reuse materials on site whenever possible • Consider future site use and reuse existing infrastructure • Use clean diesel and low sulfur fuels in equipment and noise controls for power generation • Retain native vegetation and soils, wherever possible 	<ul style="list-style-type: none"> • Power machinery and equipment using clean fuels • Use renewable energy sources, such as solar, wind, and methane to power remediation activities • Improve energy efficiency of chosen remediation strategies, as appropriate • Consider remediation approaches that reduce resource use and impact on air, water, adjacent lands, and public health • Incorporate remediation activities that sequester carbon, where applicable, such as planting native grasses and using soil amendments 	<ul style="list-style-type: none"> • Use Energy Star, LEED, and GreenScapes principles in both new and existing buildings • Reduce environmental impact by reusing existing structures and recycling industrial materials • Use natural systems to manage stormwater, like green roofs, landscaped swales, and wetlands • Incorporate Smart Growth principles that promote more balanced land uses, walkable neighborhoods, and open space • Create ecological enhancements to promote biodiversity and provide wildlife habitat 	<ul style="list-style-type: none"> • Reduce use of toxic materials in manufacturing, maintenance, and use of buildings and land • Minimize waste generation, manage waste properly, and recycle materials used/generated • Maintain engineering and institutional controls on site • Reduce water use by incorporating water efficient systems and use native vegetation to limit irrigation • Promote energy efficiency and use of renewable energy • Take appropriate steps to prevent (re)contamination



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Notes:

Purpose of Slide

- Provide examples of sustainable approaches and resources.

Key Points

- This graphic demonstrates that there are opportunities to promote sustainability throughout the land revitalization process. The key to implementing any sustainable approach is to begin planning early in the process.
- Deconstruction, Demolition, and Removal – In this phase, you can reuse and recycle several components of buildings, such as bricks, concrete, and wood. Often, building and infrastructure components may be of value (e.g., steel that can be recycled).
- Cleanup, Remediation, and Waste Management – While cleaning up a site, consider remediation approaches that would reduce resource use and impacts on the environment. For example, you could power a pump & treat system with renewable energy or use clean fuels to power machinery and equipment on the site.
- Design and Construction for Reuse – Reuse available infrastructure, reuse existing buildings, and develop ecological enhancements. NOTE: Ecological revitalization is discussed further in later slides.
- Sustainable Use and Long-Term Stewardship – Finally, you can encourage and effect sustainable use and long-term stewardship. For example, you can work with stakeholders to minimize waste generation, manage waste properly, and recycle materials onsite.

References

- EPA. EPA Sustainability Website. Accessed On-line at: <http://www.epa.gov/sustainability/>.
- EPA. EPA ER3 Website. Accessed On-line at: <http://www.epa.gov/compliance/cleanup/revitalize/er3/>.



Sustainable Approaches in the Land Revitalization Process

- ❖ Reuse/recycling of demolition and deconstruction wastes
- ❖ Green landscaping
- ❖ Green building
- ❖ Smart growth concepts
- ❖ Ecological revitalization
- ❖ Environmentally Responsible Redevelopment and Reuse (ER3)

<http://www.epa.gov/compliance/cleanup/revitalization/er3/>



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Notes:

Purpose of Slide: Provide examples of sustainable approaches and resources:

Key Points

- Reuse/Recycling of Demolition and Deconstruction Wastes – Various components of buildings are valuable and can be reused. For example, bricks are often reused for residential or other purposes. For older buildings, architectural features and trim may be valuable. Some revitalization projects have been able to sell used machinery and equipment on the internet for parts, avoiding disposal costs. Always make sure that any reuse/recycling is done in a safe and environmentally sound manner. Information on recycling demolition wastes and other materials can be found at: <http://www.epa.gov/epaoswer/non-hw/debris-new/index.htm>.
- Green Landscaping – This includes the consideration of features that may require less chemicals and water to thrive. For example, native species and the local climate should be considered. EPA has an active Greenscapes program for companies: <http://www.epa.gov/greenscapes>. Also there is a new Website on sustainable sites – ideas for sustainable approaches can be found there: <http://www.sustainablesites.org/>
- Green Building – This area is becoming recognized as a long-term way to save money when operating facilities, whether industrial or commercial. Rising energy costs have spurred interest in this area. Green design can save energy through the use of energy efficient layouts, equipment, and alternate energy sources. Water reuse is another practice that is popular, particularly in arid areas. There are a number of resources on green building design. EPA provides information at: <http://www.epa.gov/greenbuilding>.
- Smart Growth – Smart growth is development that serves the economy, the community, and the environment. It shifts the development debate from the traditional “growth/no growth” question to evaluating “how and where new development can be accommodated.” Smart growth focuses on economic growth that is conducted more efficiently (for example, in a manner that supports energy savings, reduced pollution, etc.) than traditional development. Revitalization of RCRA CA facilities can constitute smart growth because these sites are often located in developed areas that will not require the development of new roads and infrastructure, etc. Information regarding EPA’s Smart Growth program is available at - <http://www.epa.gov/smartgrowth/>.
- Ecological Revitalization is discussed on the next slide.
- Environmentally Responsible Redevelopment and Reuse (ER3) – The Office of Enforcement and Compliance Assurance (OECA) has developed the ER3 effort, which is designed to use enforcement and other Agency-wide incentives to promote sustainable redevelopment of contaminated sites. For example, ER3 can provide enforcement assurances (such as comfort letters, no further action letters, PPAs, streamlined orders, etc.) in exchange for a site owner/developer implementing “green” or sustainable measures (such as green building, smart growth, etc.). For more information on ER3 - <http://www.epa.gov/compliance/cleanup/revitalization/er3/>.

References

- Web sites listed above.



Ecological Revitalization

- ❖ Integrates ecological enhancement and reuse when possible
- ❖ Does not have to jeopardize remediation goals and objectives
- ❖ Uses partnerships and resources (for example, Wildlife Habitat Council and Interstate Technology and Regulatory Council, Clu-in)
- ❖ Tools are available to help

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Notes:

Purpose of Slide

- Discuss ecological reuse practices in relation to revitalization of RCRA CA sites.

Key Points

- There are a number of ecological enhancements that can be incorporated into development designs that benefit the environment. For example, providing rain gardens and vegetative buffer zones can reduce run-off and also control contamination of nearby surface waters.
- For some sites or portions of a site, returning the property to a vital habitat may be the primary "new use."
- There are a number of resources available to aid in restoring land to provide useful local habitat (for instance, through the use of native plants to help ensure a native habitat).
- In 2006, the Interstate Technology and Regulatory Council (ITRC) finalized a guidance on "Planning and Promoting Ecological Land Reuse of Remediated Sites." This was developed in collaboration with a number of organizations, including the Wildlife Habitat Council and EPA. The ITRC has provided internet training on this guidance, which has been archived and can be viewed at <http://www.clu-in.org/live/archive.xml>. Clu-in also has created a "resource" page for ecological restoration, which will serve as a useful tool.
- The Wildlife Habitat Council has held workshops in EPA Regions 2, 3, 4, 5, 6, and 10 on ecological reuse. Information about these workshops can be found at: <http://www.wildlifehc.org/events/restoringgreenspace.cfm>. A range of similar tools are available to assist your efforts.

References

- EPA. 2006. Presented at National CA Conference in Providence, RI: Planning and Promoting of Ecological Re-Use of Remediated Sites. ITRC Technical/Regulatory Guideline Planning and Promoting of Ecological Re-Use of Remediated Sites. June 21.
- ITRC. Web Site. Accessed On-line at: <http://www.itrcweb.org/>.
 - "Making the Case for Ecological Enhancements" (January 2004).
 - "Planning and Promoting Ecological Re-Use of Remediated Sites" (July 2006).

EXAMPLE

Kenosha Harbor Park, WI





Site in 1990 and as redeveloped

- ❖ Former AMC Plant
- ❖ Voluntary cleanup under WI regulations
- ❖ City led financial and development aspects
- ❖ Urban Land Institute supported smart growth planning

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Notes:

Purpose of Slide: Illustrate land revitalization of a former industrial site, integrating smart growth principles.

Key Points:

- In Wisconsin, an approach to revitalization is to allow all cleanups to follow one set of regulations (NR 700 – State Comprehensive Cleanup Regulations). Wisconsin also has a Memorandum of Agreement with EPA, regarding cleanup of properties under various authorities. The goal is to be protective of human health and the environment, with flexible remedial options to achieve that endpoint. The one cleanup program approach combines: protection of all state groundwater, a risk-based approach to soil contamination, ICs to limit exposure, and one program to allow for quicker and less expensive cleanups.
- The Kenosha Harbor Lakefront Redevelopment is a former Chrysler/AMC Plant. The site includes over 40 acres on Lake Michigan, impacted by historical manufacturing since the 1900s (AMC, Simmons Mattress). The property was vacant from 1986 on and impacted by petroleum and chlorinated carbon; the site also includes historic fill. Environmental issues included 17 underground storage tanks, impacted loading docks, waste, and product storage areas, foundry sand and dredge fill areas, rail lines and an incinerator. Cleanup was implemented under a voluntary cleanup program.
- The City led the way on market analysis and planning, securing financing, liability protections, and identification of developers.
- The Urban Land Institute assisted sustainable redevelopment, including the integration of Smart Growth concepts. Goals included revitalization of the area, buildings on existing infrastructure, and encouraging a mix of public and commercial uses. Smart Growth concepts include: housing with a park and open space and easy access to the area. The site links to the area by bike trail, streets, a street car line, and boat. The bike trail is part of a larger system connecting the south and north sections of the city with a regional trail system linking to Chicago, Milwaukee, and beyond. The street car stops allow riders to access the area, Kenosha's downtown, and connect with commuter train lines to Chicago.

References:

- Wisconsin Department of Natural Resources (WDNR). (Michael Prager). Year not Cited. National Governor's Association Meeting: Coastal Brownfields – Wisconsin's Brownfields Initiative. Presented September 10-12.
- EPA (Sara Rasmussen). 2008. Green Approaches in the Land Revitalization Process. Presentation to Association of State and Territorial Waste Management Officials. July 31.
- WDNR. 2006. Letter from Scott Hassett of WDNR to Mary Gade, Regional Administrator (Region 5), Attaching Memorandum of Agreement for Wisconsin's One Cleanup Program. December 6.



Long-Term Stewardship

- ❖ Institutional Controls (ICs)
 - EPA guidance
 - State uniform environmental covenants act (UECA)
 - Criteria of RAU
- ❖ ICs discussed further in later modules

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Notes:

Purpose of Slide: Present general information on long-term stewardship and institutional controls (ICs).

Key Points

- Remedies must be implemented in a manner that is protective in the long term.
- EPA defines ICs as non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and protect the integrity of the remedy. Such controls provide information and/or restrictions that help modify or guide human behavior at properties where hazardous waste contamination prevents unlimited use and unrestricted exposure.
- ICs can provide vital safeguards for property that has not been remediated to levels safe for unrestricted use.
- ICs may be used by themselves or in conjunction with engineering controls to ensure that exposure to remaining contamination is prevented in the future.
- Twenty states and territories have adopted a Uniform Environmental Covenants Act (UECA); UECA is a model law that helps to provide clear rules for the States and federal agencies to create, enforce, and modify a valid real estate document – an “environmental covenant” - to restrict the use of contaminated real estate.
- The EPA Land Revitalization Measure, Ready for Anticipated Use (RAU), includes as part of its criteria, that ICs that were identified as necessary in the remedy selection documents must be in place to achieve a positive RAU determination.
- To assist with IC issues, each EPA Region has designated a Regional IC Legal Coordinator (see first reference below). EPA also has a Long-Term Stewardship task force.

References

- EPA. List of EPA Region IC Legal Coordinators. Available to EPA employees at: <http://intranet.epa.gov/oeca/osre/workgroup/ic.html>.
- EPA. Superfund Program Website with IC Information. Accessed On-line at: <http://www.epa.gov/superfund/policy/ic/index.htm>.
- EPA. 2007. Ensuring Reliable and Effective ICs at RCRA facilities. June 14. Accessed On-line at: <http://www.epa.gov/reg3wcmd/ca/pdf/EnsuringReliableIC.pdf>
- EPA. 2000. Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups. (EPA 540-F-00-005, OSWER 9355.0-74FS-P). September 29.
- EPA. 2005. Long Term Stewardship Task Force Report. Ensuring Environmental Site Cleanups Remain Protective Over Time: Challenges and Opportunities Facing EPA's Cleanup Programs. EPA 500-R-05-001. September.
- Environmental Law Commission Web Site. Accessed On-line at: <http://www.environmentalcovenants.org>.



RCRA Land Revitalization Indicators and Performance Measures

- ❖ Two cross-program measures that focus on documenting:
 - Protective for People under Current Conditions (PFP)
 - Land Ready for Anticipated Uses (RAU)
- ❖ Tool to support implementation
 - RCRA Guidance issued in February 2007
 - Two forms



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Notes:

Purpose of Slide: Overview the specific RCRA measures that will track progress in protecting human health and land ready for anticipated uses.

Key Points

- Building on cross-program efforts, the RCRA program issued a guidance to assist in tracking RCRA CA land revitalization progress in February 2007; this guidance operates together with the October 2006 Guidance on OSWER Cross-Program Revitalization Measures.
- RCRA CA Indicators included in the guidance include: (1) universe indicator, (2) status of use indicator (optional), and (3) type of use indicator (optional). For 2008, the universe includes the 2008 baseline (1,968 facilities). For 2009 and beyond, the universe will include the 2020 CA Universe.
- Measure 1: Protective for People under Current Conditions (PFP): This measure is based on the Human Exposure Controlled Environmental Indicator (HE EI) (CA 725). All or portions of a facility may be reported as PFP (for example, facilities that have achieved CA 725 facility-wide, would have all acres counted as meeting PFP). Guidance is also provided to assess and record partial facility achievement of PFP.
- Measure 2: Ready for Anticipated Use (RAU): This measure is based on the criteria for meeting cleanup goals that are protective for safe reuse of the land and having ICs in place to ensure that the land is not used in an unsafe manner. The RCRA program has developed a methodology for collecting data and assessing which RCRA sites and acreages meet this measure. Initial reporting on this measure will begin in 2008. ICs and recent guidance on ICs are presented in later modules.
- The two measures – PFP and RAU – address both the number of sites and the number of acres.
- Instructors will be familiar with the guidance and EPA implementation considerations when delivering the course. Suggested materials for a handout include: (1) Type of Use/Status of Use Form, (2) RAU Form, and (3) Decision Tree – RCRA RAU Measure (page 11 of guidance).

References

- EPA. 2006. Measuring Revitalization of Contaminated Properties in America's Communities: Past Accomplishments and Future Opportunities. Interim Final. EPA OSWER Land Revitalization Staff Office. EPA-500-R-06-002. September.
- EPA. 2006. Interim Guidance on OSWER Cross-Program Revitalization Measures. October 20.
- EPA. 2007. Guidance for Documenting and Reporting RCRA Subtitle C Corrective Action Land Revitalization Indicators and Performance Measures. February 21.



Review of Useful Resources

EPA RCRA Reuse and Brownfields Prevention
http://www.epa.gov/swerosps/rcrabf/
EPA RCRA CA
http://www.epa.gov/correctiveaction/
EPA Land Revitalization
http://www.epa.gov/oswer/landrevitalization/index.htm
EPA Brownfields
http://www.epa.gov/brownfields.htm
EPA Sustainability
http://www.epa.gov/sustainability
CLU-IN
http://www.clu-in.org
EPA Long Term Stewardship
http://www.epa.gov/landrevitalization/ltstf_report/index.htm
Green Remediation
http://www.clu-in.org/greenremediation

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Notes:

Purpose of Slide

- Review some of the useful resources for revitalization.

Key Points

- Review some of the useful resources identified for revitalization information.

References

- None.



Summary

- ❖ Incorporate anticipated land reuse options as early as possible.
- ❖ Use available tools and resources to support land revitalization and cleanup.
- ❖ Keys to success include:
 - Communication
 - Partnering
 - Creativity

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Notes:

Purpose of Slide

- Review the take home messages from the module.

Key Points

- Many facilities may provide opportunities for revitalization; however, the regulator can only do so much.
- At some sites, opportunities will not be ideal for revitalization (for example, no reuse potential, no developer); focus your efforts on those sites with promise. Identify promising sites as early as possible.

References

- None.



The slide features a central graphic with two vertical film strips on either side of a central purple circle containing a white camera icon. To the left of the film strips is a yellow speaker icon. Above the speaker is the EPA logo. Below the graphic, the text 'Video: Our Land, Our Legacy' is displayed in a large, black, sans-serif font. At the bottom of the slide, a dark blue gradient bar contains the text 'February 2009', 'Module 6 - CA and Facilitating Land Revitalization', and '31'.

Notes:

Purpose of Slide

- Illustrate the successful implementation of RCRA Land Revitalization through a video.

Key Points

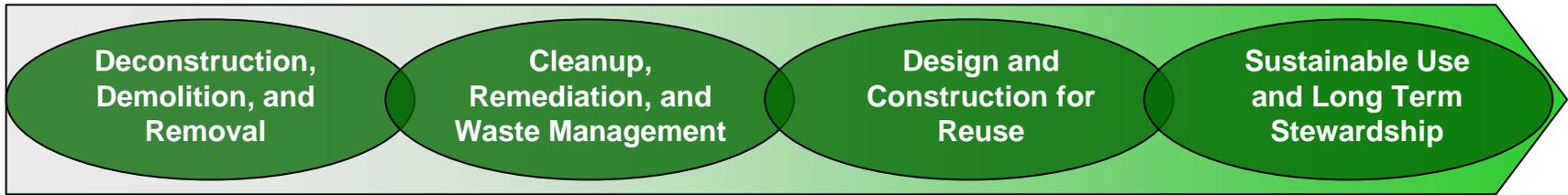
- Introduce the video, which provides three real-world examples that illustrate successful revitalization that also helps to drive environmental cleanup and progress towards the 2020 Vision for CA.

References

- EPA. 2007. Our Land, Our Legacy – The Resource Conservation and Recovery Act. EPA 530-C-07-003. January.

Green Approaches in the Land Revitalization Process

When planning for cleanup and reuse of a property, involve the public to ensure specific needs and all the impacts to the community are clearly understood and addressed. Opportunities to conserve resources, reduce impacts to the community, and reduce impacts on human health and the environment include, but are not limited to:



- Reuse/recycle deconstruction and demolition materials
- Reuse materials on site whenever possible
- Consider future site use and reuse existing infrastructure
- Use clean diesel and low sulfur fuels in equipment and noise controls for power generation
- Retain native vegetation and soils, wherever possible

- Power machinery and equipment using clean fuels
- Use renewable energy sources, such as solar, wind, and methane to power remediation activities
- Improve energy efficiency of chosen remediation strategies, as appropriate
- Consider remediation approaches that reduce resource use and impact on air, water, adjacent lands, and public health
- Incorporate remediation activities that sequester carbon, where applicable, such as planting native grasses and using soil amendments

- Use Energy Star, LEED, and GreenScapes principles in both new and existing buildings
- Reduce environmental impact by reusing existing structures and recycling industrial materials
- Use natural systems to manage stormwater, like green roofs, landscaped swales, and wetlands
- Incorporate Smart Growth principles, such as incorporating mixed land uses, walkable neighborhoods, and open space
- Create ecological enhancements to promote biodiversity and provide wildlife habitat

- Reduce use of toxic materials in manufacturing, maintenance, and use of buildings and land
- Minimize waste generation, manage waste properly, and recycle materials used/generated
- Monitor engineering and institutional controls on site
- Reduce water use by incorporating water efficient systems and use native vegetation to limit irrigation
- Promote energy efficiency and use of renewable energy
- Take appropriate steps to prevent (re)contamination

Strategic Objectives Support

EPA ADMINISTRATOR'S ACTION PLAN

- ...[F]oster technological innovations to support the clean development of domestic energy resources (oil, gas, nuclear, coal, wind, and solar)
- Restore contaminated properties, including brownfields, to environmental and economic vitality
- Promote stewardship through increased resource conservation, including waste minimization and recycling
- Expand the use of biofuels and promote diesel emissions reductions through retrofit and other technologies

OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE (OSWER) ACTION PLAN

- Encourage the appropriate reuse and revitalization of brownfields, USTfields, Superfund sites, RCRA facilities, BRAC sites, and other federal properties
- Promote the reduction, reuse, and recycling of both municipal and industrial wastes

MODULE 6 HANDOUT
TAX INCENTIVES AND REVITALIZATION:
WEB SITE REFERENCES



Historic Rehabilitation Tax Credits

http://www.nationaltrust.org/rehab_tax_credits/ and
<http://www.nationaltrust.org/funding/> -- Tax incentives and funding pages from the National Trust for Historic Preservation
www.ntcicfunds.com -- for information about equity investments in projects that combine historic rehab tax credits with New Markets tax credits and other credit enhancements

Low Income Housing Tax Credits

<http://www.nahro.org/home/resource/credit.html> -- information on how the tax credit works from the National Assn of Housing and Redevelopment Officials

New Markets Tax Credits

www.cdfifund.gov -- official information on New Markets Tax Credits, from Dept of Treasury office overseeing the credits
http://www.lisc.org/section/goals/economic/new_markets -- basic information on New Markets Tax Credits, from the New Markets Support Company, an affiliate of the Local Initiatives Support Corp, a key non-profit development organization

Energy efficiency tax incentives (from Energy Policy Act of 2005) revitalization)

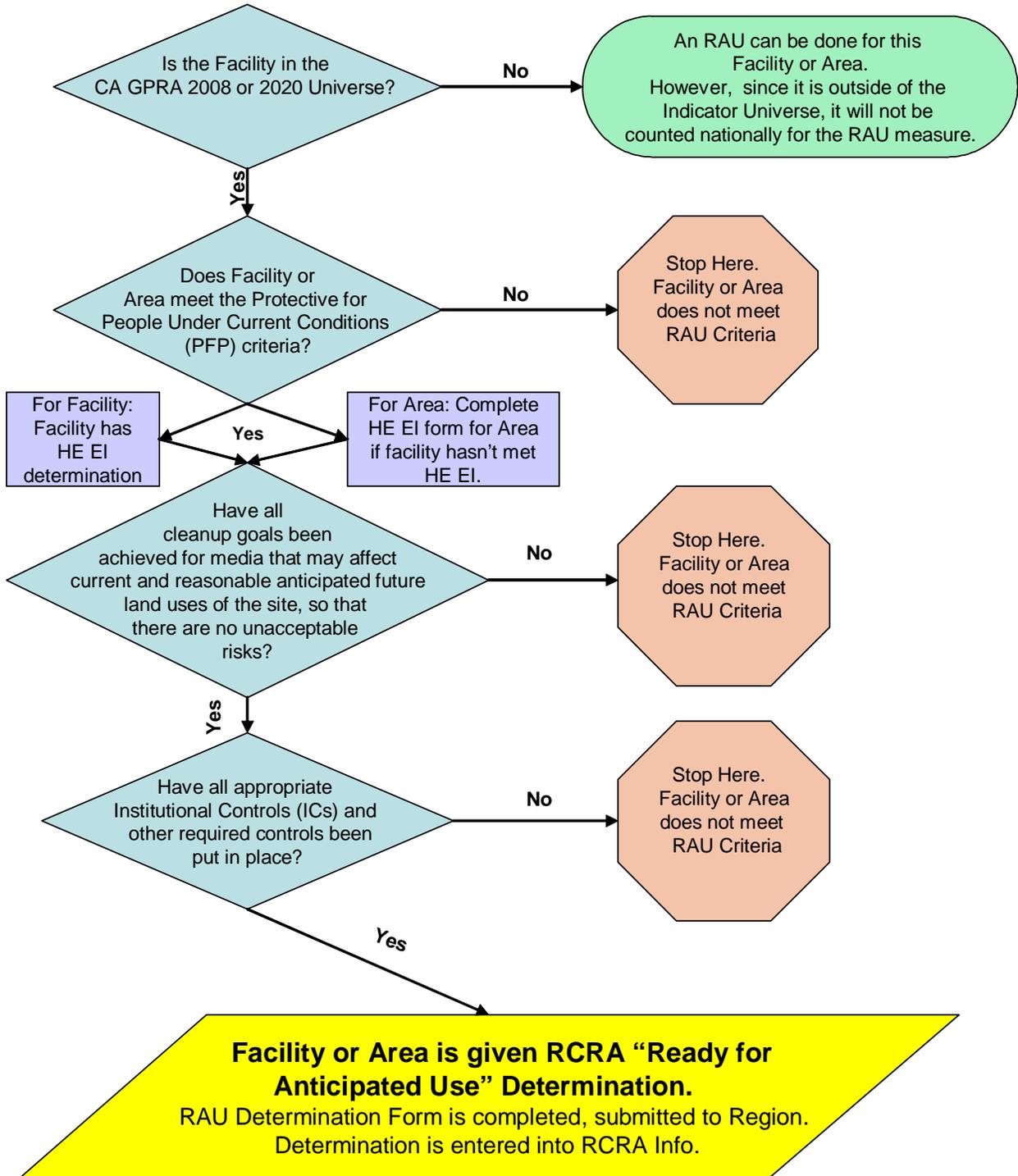
<http://www.energy.gov/taxbreaks.htm> -- information on the various Energy Policy Act of 2005 tax incentives, from DOE, applicable to new construction or commercial renovation

Brownfield Expensing Tax Incentive

www.epa.gov/brownfields/bftaxinc.htm -- basic information on the brownfields tax incentive and how it works

Web sites tested and updated January 19, 2009.

Decision Tree - RCRA “Ready for Anticipated Use” Measure



RCRA READY FOR ANTICIPATED USE (RAU) DOCUMENTATION FORM



United States
ENVIRONMENTAL PROTECTION AGENCY
Washington, DC 20460

PART A – GENERAL FACILITY INFORMATION

1. Facility Name		2. EPA ID	
3. Street Address			
4. City	5. State	6. Zip Code	
7. Project Manager		8. Organization	

PART B – READY FOR ANTICIPATED USE DETERMINATION

9. This RAU Determination is for:

Facility-wide Designation, or

Area Designation - Defined in RCRA INFO as _____
Number of Acres in Area _____

10. Protective for People under Current Conditions Requirements

A Current Human Exposure Under Control Environmental Indicator determination has been made.
Date of Determination _____

11. Cleanup Goals for Media That Affect Land Use Have Been Achieved

No cleanup goals are necessary for media that may affect current and reasonable anticipated future **land** uses.

All final cleanup goals in the remedy selection document or other decision document(s), that may affect current and reasonably anticipated future **land** uses have been achieved. (See RCRA Land Revitalization guidance for more specific information.), or

Event code achieved or document (s) supporting this determination:

Clean up Activities Terminated (RCRAInfo CA999) or Construction Complete (CA550), or

Document and date (e.g., comfort letter, no further action letter, interim measures report, RFI report) indicating that clean up goals have been achieved or that no clean up is necessary for media relevant to current and reasonably anticipated **land** uses. Construction Complete

12. Needed Institutional Controls are Implemented

- All acres covered by this RAU form meet the requirement for unrestricted use for all media and no institutional controls are necessary, or
- Site has a achieved a cleanup complete (CA999) or cleanup complete with controls determination, or
- All institutional controls or other administrative controls (e.g. orders, permit, written agreement) required in the remedy decision document or other decision document(s) have been put in place.

List contaminated media and use restrictions:

Identify Institutional Controls implemented at the facility (each of these should be entered into RCRAInfo, CA772 event code):

PART C – SIGNATURE

NOTE: The outcome of this Property Reuse Evaluation does not have any legally binding effect and does not expressly or implicitly create, expand, or limit any legal rights, obligations, responsibilities, expectations, or benefits of any party. EPA assumes no responsibility for reuse activities and/or any potential harm that might result from reuse activities. EPA retains any and all rights and authorities it has, including but not limited to legal, equitable, or administrative rights. EPA specifically retains any and all rights and authorities it has to conduct, direct, oversee, and/or require environmental response actions in connection with the facility, including but not limited to instances when new or additional information has been discovered regarding the contamination or conditions at the facility that indicates that the response and/or the conditions at the facility are no longer protective of human health or the environment.

13. Project Manager	14. Signature	15. Date
16. Supervisor	17. Signature	18. Date

PART D – REMOVAL OF ACRES FROM READY FOR ANTICIPATED USE DETERMINATION

19. Retraction of RAU Determination

- RAU Determination retracted for entire facility, or
- RAU Determination retracted for area. Area Name _____, # _____ of acres

Reason: _____

20. Project Manager	21. Signature	22. Date
23. Supervisor	24. Signature	25. Date

RCRA Land Revitalization Indicators: Type of Use, Status of Use

		United States ENVIRONMENTAL PROTECTION AGENCY Washington, DC 20460	
1. Date:			
2. Facility Name		3. EPA ID	
4. Project Manager		5. Organization	
List the number of acres for that fit each category			
<u>Reused:</u> Total acres _____	<u>Planned Reuse:</u> Total acres _____	<u>Unused:</u> Total acres _____	<u>Continued Use:</u> Total acres _____
<u>Types of Use</u> ___ <i>Commercial & Public Service</i> ___ Commercial. ___ Public Service ___ <i>Green Space</i> ___ Agricultural Use ___ Recreational ___ Ecological ___ <i>Industrial</i> ___ Industrial Use. ___ <i>Military and Other Federal</i> ___ Military Use ___ Other Federal Use ___ <i>Mixed</i> ___ Mixed Use ___ <i>Residential</i> ___ Residential Use	<u>Types of Use</u> ___ <i>Commercial & Public Service</i> ___ Commercial. ___ Public Service ___ <i>Green Space</i> ___ Agricultural Use ___ Recreational ___ Ecological ___ <i>Industrial</i> ___ Industrial Use. ___ <i>Military and Other Federal</i> ___ Military Use ___ Other Federal Use ___ <i>Mixed</i> ___ Mixed Use ___ <i>Residential</i> ___ Residential Use	<u>Types of Use</u> ___ <i>Commercial & Public Service</i> ___ Commercial. ___ Public Service ___ <i>Green Space</i> ___ Agricultural Use ___ Recreational ___ Ecological ___ <i>Industrial</i> ___ Industrial Use. ___ <i>Military and Other Federal</i> ___ Military Use ___ Other Federal Use ___ <i>Mixed</i> ___ Mixed Use ___ <i>Residential</i> ___ Residential Use	<u>Types of Use</u> ___ <i>Commercial & Public Service</i> ___ Commercial. ___ Public Service ___ <i>Green Space</i> ___ Agricultural Use ___ Recreational ___ Ecological ___ <i>Industrial</i> ___ Industrial Use. ___ <i>Military and Other Federal</i> ___ Military Use ___ Other Federal Use ___ <i>Mixed</i> ___ Mixed Use ___ <i>Residential</i> ___ Residential Use

Unit Conversions: 1 square foot = 0.000023 acre; 1 square meter = 0.0002471 acre

Current Land Use

Continued Use - A site or portion of a site which is currently being used in the same general manner as it was when the site became contaminated. For example, continued use would be an appropriate description for a property where industrial operations resulted in the contamination and the property is still used as an operating industrial facility. The RCRA Program will count all acres of an active RCRA industrial facility as Continued Use, except for parcels specifically designated as Reused or Planned Reuse.

Reused - A site or portion of a site where a new use, or uses, is occurring such that there has been a change in the type of use (e.g. industrial to commercial) or the property was vacant and now supports a specific use. This means that the developed site, or portion of the site, is "open" or actually being used by customers, visitors, employees, residents, etc.

Planned Reuse - A site or portion of a site where a plan for new use is in place. This could include conceptual plans, a contract with a developer, secured financing, approval by the local government, or the initiation of site redevelopment.

Unused - A site or portion of a site that is currently vacant or not being used in any identifiable manner. This could be because site investigation and cleanup are on-going, operations ceased or owner is in bankruptcy, or cleanup is complete but the site remains vacant.

Types of Use

Commercial and Public Service

- Commercial Use – Commercial use refers to use for retail shops, grocery stores, offices, restaurants and other businesses.
- Public Service Use – Public service use refers use by a local or state government agency or a non-profit group to serve citizens' needs. This can include transportation services such as rail lines and bus depots, libraries and schools, government offices, public infrastructure such as roads, bridges, utilities or other services for the general public.

Green Space

- Agricultural Use – Agricultural uses refers to use for agricultural purposes, such as farmland for growing crops and pasture for livestock. It also can encompass other activities, such as orchards, agricultural research and development, and irrigating existing farmland.
- Recreational Use – Recreational use refers to use for recreational activities, such as sports facilities, golf courses, ball fields, open space for hiking and picnicking, and other opportunities for indoor or outdoor leisure activities.
- Ecological Use – Ecological use refers to areas where proactive measures, including a conservation easement, have been implemented to create, restore, protect or enhance a habitat for terrestrial and/or aquatic plants and animals, such as wildlife sanctuaries, nature preserves, meadows, and wetlands.

Industrial

- Industrial Use – Industrial use refers to traditional light and heavy industrial uses, such as processing and manufacturing products from raw materials, as well as fabrication, assembly, treatment, and packaging of finished products. Examples of industrial uses include factories, power plants, warehouses, waste disposal sites, landfill operations, and salvage yards.

Military and Other Federal

- Military Use – Military use refers to use for training, operations, research and development, weapons testing, range activities, logistical support, and/or provision of services to support military or national security purposes.
- Other Federal Use – Other federal use refers to use to support the Federal government in federal agency operations, training, research, and/or provision of services for purposes other than national security or military.

Mixed

- Mixed Use – Mixed use refers to areas at which uses cannot be differentiated on the basis of acres. For example, a condominium with retail shops on the ground floor and residential use on the upper floors would fall into this category. When using Mixed Use, the individual types of uses should be identified, if possible.

Residential

- Residential Use – Residential use refers to use for residential purposes, including single-family homes, town homes, apartment complexes and condominiums, and child/elder care facilities.

Module 07
Selecting and Approving a Protective Remedy



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



HSW

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Notes:

Purpose of Slide

- This is the introductory slide to Module 7, Selecting and Approving a Protective Remedy.

Key Points

- None.

References

- None.



Module 7

Selecting and Approving a Protective Remedy

Part 1 - Policy Considerations
Part 2 - Field Considerations

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Notes:

Purpose of Slide

- This module familiarizes the class with how remedies are chosen and documented. The module is broken into two sections: policy considerations and field considerations.

Key Points

- Examples of policy considerations are cleanup criteria, EPA's threshold and balancing criteria, selecting institutional controls (ICs), and documenting remedy decisions (CA 400).
- Field considerations include hydrogeology and contaminant distribution at the facility. Field considerations also include facility operations that limit access for characterization or cleanup.
- Both policy and field considerations play significant roles in making a remedy decision.

References

- None.



Policy Considerations

- ❖ Remedy Decision Defined and Remedy Objectives
- ❖ Selecting the Remedy
 - Anticipated land and groundwater use
 - Final cleanup goals (and threshold and balancing criteria)
 - Engineering solutions
 - Institutional controls
- ❖ Documenting the Remedy Decision

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Module 7 – Selecting and Approving a Protective Remedy

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Notes:

Purpose of Slide

- Provide an overview of policy considerations related to selecting a remedy that is protective of human health and the environment (HH&E).

Key Points

- EPA has defined Remedy Decision as a milestone toward EPA's 2020 Vision for corrective action (CA). This module will focus on how to achieve this milestone.
- This module will discuss factors that impact remedy selection, including:
 - Anticipated land and groundwater use - One of the most important aspects of remedy selection is anticipated land and groundwater use, which will influence cleanup objectives, including: timing, cleanup criteria, and points of compliance. Land use will also affect design considerations and construction options – for example, aesthetics may not be as important to operating facilities as facilities planned for redevelopment.
 - Final Cleanup Goals - EPA has established performance standards that are useful for evaluating and selecting remedies. These standards are known as threshold criteria and balancing criteria. Threshold criteria are used to determine if a remedy is acceptable (that is, protective of HH&E); balancing criteria assist in selecting from a range of acceptable remedies.
 - Engineering solutions - We will begin to consider technology options, including raising awareness regarding remedies that are well-established in the field (for example, presumptive remedies) and touching on some special considerations for particular site types (for example, sites impacted by non-aqueous phase liquids [NAPLs]).
 - Institutional Controls (ICs) - The selected remedy will often be a combination of engineering controls (ECs) and ICs. Therefore, ICs also will be reviewed.
- We will end this portion of the module by discussing the process of documenting the remedy decision.

References

- EPA. 2000. Final Remedy Selection for Results-Based RCRA Corrective Action (Fact Sheet #3).



Remedy Decision Defined

- ❖ Remedy Decision met when State or EPA approves remedy designed to meet corrective action (CA) long-terms goals
- ❖ Facility recommends remedies or remedy performance standards
- ❖ State or EPA approves and documents the remedy and associated performance standards
- ❖ Final remedy may be No Further Action
- ❖ Site-wide versus partial or phase remedy decisions

A formal Corrective Measures Study document is not necessary to select a final remedy.

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Notes:

Purpose of Slide

- Provide the key elements of Remedy Decision, as specified in EPA's definition of the measure. Remedy Decision is a milestone toward the 2020 Vision.

Key Points

- The Remedy Decision milestone is met when the State or EPA approves a remedy designed to meet RCRA CA long-term goals of protection of HH&E. The RCRA Info Code is CA 400.
- As we discussed previously, the owner/operator (o/o) studies and identifies the recommended remedy.
- The regulatory authority reviews and approves the recommended remedy. Later in this module, we will discuss how EPA or the state can document the remedy decision.
- A Remedy Decision also applies when no further CA is required because stabilization measure(s) have already been implemented or because site characterization has demonstrated the attainment of long-term RCRA CA goals. In some cases, especially at lower concern facilities, successful remedies may have been achieved through means such as stabilization measures and long-term CA goals met before they receive formal regulatory attention. In these cases, the regulatory agency need only affirm the remedies and address any needed long-term controls through appropriate processes.
- When a site-wide remedy decision has been made, Remedy Decision must be linked to the entire facility. Partial or phased remedies or other remedy decisions pertaining only to specific areas of the facility are to be linked only to the specific areas of implementation (not the "Entire Facility").

References

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



Remedy Objectives

- ❖ Protect human health and the environment (HH&E) and maintain that protection over time
- ❖ Address all environmental media
- ❖ No unacceptable risk based on current and reasonably anticipated future land and groundwater uses
- ❖ Include Engineering Controls (ECs) and Institutional Controls (ICs) to ensure long-term protection

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Module 7 – Selecting and Approving a Protective Remedy

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Notes:

Purpose of Slide: Review remedy objectives and the factors that impact remedy decisions.

Key Points

- CA remedies must be protective of HH&E and maintain protection over time.
- Remedy decisions must address contamination in all environmental media – groundwater, surface water, soil, sediment, and air – and be designed to meet the cleanup objectives.
- RCRA requires that cleanup be achieved to levels that are protective of HH&E, and EPA interprets that to mean that cleanup objectives should address risk based on current and reasonably anticipated land and groundwater uses. As stated in the Groundwater Handbook:
 - EPA recommends that groundwater cleanup levels be based on the maximum beneficial use to ensure that groundwater is cleaned up to levels that protect HH&E both now and in the future. (p. 5.1)*
 - The maximum beneficial use, determined by EPA or State regulators, is the current or reasonably expected use that warrants the most stringent groundwater cleanup levels. (p. 5.3)*
- A few examples include:
 - From a federal perspective, cleanup criteria at manufacturing facilities where groundwater is not a current or reasonably anticipated future source of drinking water do not need to be set at maximum contaminant levels (MCLs), but rather at levels based on potential exposure.
 - Similarly, groundwater cleanup criteria at facilities that are being revitalized under a Brownfields agreement for urban residential use, for instance, may not be set at MCLs (from a federal perspective) if groundwater is not a current or reasonably anticipated source of drinking water.
- In each of these cases, ICs and ECs are expected to provide long-term protection. For instance:
 - The state may require the manufacturing facility to have a restrictive covenant, which would prohibit groundwater use.
 - The urban residential area may have a requirement for each home to be constructed with a vapor intrusion barrier, and with restrictions relating to well drilling for home irrigation.
- Cleanup criteria should be set at MCLs when there is a reasonable expectation that groundwater will be used as a drinking water source, or if the contaminated groundwater is hydraulically connected to an aquifer used for drinking water. From the Groundwater Handbook:
 - For groundwater that is currently used or designated as a current or reasonably expected source of drinking water, EPA recommends that regulators identify cleanup levels based on a residential drinking water exposure scenario. Even if no one is currently drinking the groundwater, the cleanup level should generally be based on drinking water use if the aquifer is considered by EPA or the State to be a reasonably expected future source of drinking water. (p. 5.4)*
- ICs and ECs should be established as necessary to ensure long-term protection across all media.

References

- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.
- 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. EPA 530-R-04-030. Update. April.



Anticipated Land Use



Planned Urban Residential



Light Industrial



Planned Commercial



Heavy Industrial

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Notes:

Purpose of Slide

- Current and reasonably anticipated land use and a groundwater use designation by EPA or the State will help to define the cleanup criteria necessary for the remedy. Companies should select remedies based on the current and reasonably anticipated use of the site; the regulator should approve the remedies based on that use. Anticipated use planning ties back to the 2nd and 4th principles we discussed in Module 2 (2nd – environmental cleanup to risk-based levels is the goal and 4th – tailor sustainable solutions considering risk management and revitalization).

Key Points

- Establishing the current and reasonably anticipated land and groundwater uses is the first step in risk-based CA. It is necessary to establish the land and groundwater uses to determine actual and potential receptors, which in turn form the basis for establishing risk-based cleanup criteria.
- It is important to realize that land use and groundwater use should be evaluated separately: for example, a currently operating manufacturing facility may be anticipated to remain industrial, but may overlie an aquifer currently used as a drinking water supply.
- Facilities must select remedies that are protective of HH&E. MCLs may be cleanup criteria for protecting drinking water sources. EPA's position is that decisions on cleanup criteria should relate to current and reasonably anticipated land and groundwater uses. EPA does not expect that MCLs or other drinking water criteria will necessarily be the applicable cleanup criteria in areas that are not reasonably expected to be sources of drinking water. As stated in the Groundwater Handbook:

Groundwater cleanup levels for human health should typically be developed by using existing cleanup standards (e.g., drinking water standards) when they are available and when using them is protective of current and reasonably expected exposures. If a cleanup standard is not available for a constituent, a facility should first assess all actual and potential exposures to the contaminant(s). Then, a groundwater cleanup level should be developed based on the magnitude of exposure (i.e., dose), and the toxicity of the contaminant resulting in an estimate of risk. Groundwater cleanup levels are then calculated to fall within generally acceptable levels of risk....Higher cleanup levels may be appropriate, for a given facility, for example, when: ... the groundwater designation is not a current or reasonably expected source of drinking water, and contaminants in groundwater would not result in unacceptable impacts to hydraulically connected surface water bodies. (pp. 5.1-5.3)

- State regulators have the responsibility of regulating groundwater use in their state, and states may have a position relating to groundwater protection or cleanup that is more stringent than the federal guidance. For instance, a state may designate all groundwater as a current or potential drinking water source, even in industrial areas where groundwater is not currently or likely ever to be used as a water supply. In this case, state regulators may find longer-term remediation solutions, such as monitored natural attenuation coupled with ICs, to be acceptable. While it may take years or decades to achieve drinking water standards, HH&E would be protected during the cleanup period while the facility remains industrial.
- There are special considerations for establishing cleanup criteria for facilities where NAPLs are present; we will cover such situations in subsequent slides.

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. EPA 530-R-04-030. Update. April.

**Notes:**Purpose of Slide

- Reiterate that reasonably anticipated use aligns with the approach discussed in Module 4, Starting with the End in Mind.

Key Points

- Once the reasonably anticipated use is established, specific cleanup goals can be identified.
- The cleanup goals are the "what," "where," and "when" of final remedies.
- We will explain these "what," "where," and "when" goals further in the following slides.

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. EPA 530-R-04-030. Update. April.



the What?

Establishing Cleanup Goals

- ❖ Standards for all environmental media
- ❖ Based on reasonably anticipated land and groundwater uses
 - Human exposure scenarios, including vapor intrusion
 - Ecological scenarios
 - Groundwater/surface water interaction
- ❖ Normally state decisions

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Notes:

Purpose of Slide

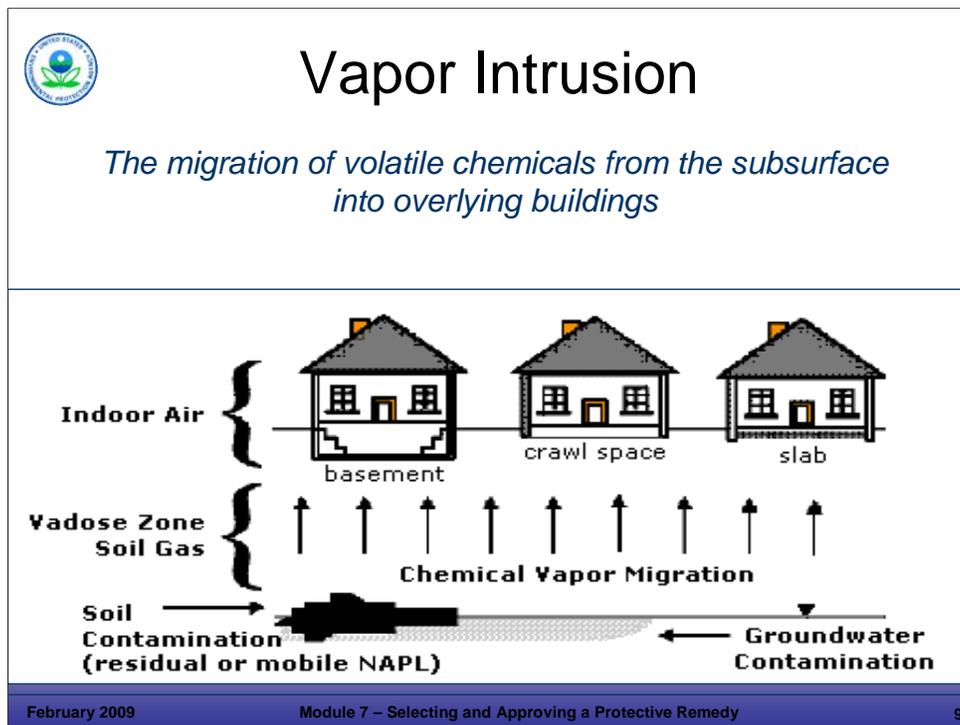
- Discuss establishing cleanup goals in all environmental media – air, groundwater, surface water, sediment, soil, and air.

Key Points

- Cleanup criteria typically represent *what* specific numerical cleanup criteria a facility needs to meet. These criteria are established for all contaminated media based on reasonably expected land uses, State or EPA groundwater use designations, and/or cross media transfer (e.g., soil to groundwater).
- Cleanup criteria for soil and groundwater are typically based on human exposure scenarios such as direct contact, ingestion, and inhalation (vapor intrusion) whereas sediment and surface water criteria are more often established based on ecological considerations.
- Cleanup criteria should typically be developed by using existing cleanup standards or guidelines (for example, drinking water standards or surface water criteria for protection of aquatic organisms) when they are available and when using them is protective of current and reasonably expected exposures.
- If a cleanup standard or guideline is not available to establish an applicable cleanup criterion for a site contaminant, the facility may conduct a risk assessment to develop a cleanup level based on the magnitude of exposure and the toxicity of the contaminant.
- State regulations and guidance are important in establishing cleanup levels. If a State is not authorized for CA, EPA will make these decisions.
- Cleanup criteria should be consistent with the identified groundwater use designation, reasonably expected worker or public exposure, and ecological considerations at the facility. The facility should always verify that the groundwater use designation is correct and that the cleanup criteria are protective of surface water and sediments.
- Cleanup criteria at NAPL sites do not always need to be numerical. Rather, the criteria may be to (1) remove sufficient NAPL to contain it, and (2) control movement of the dissolved plume and/or treat the dissolved plume to numerical standards.

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. EPA 530-R-04-030. Update. April.



Notes:

Purpose of Slide

- In the previous slide, we identified vapor intrusion (VI) as a human exposure pathway that should be considered in establishing cleanup goals. This slide and the next provide an introduction to VI concepts.

Key Points

- EPA defines VI as the migration of volatile chemicals from the subsurface into overlying buildings.
- EPA environmental indicators (EIs) require evaluation of the indoor air pathway for the human exposures under control EI. If a site has volatile chemicals, remedy selection must also evaluate VI.
- Historical observations indicate that VI into structures is a potential exposure pathway.
- Estimating human exposures by the VI pathway is complex and the subject of ongoing research and reevaluation.

References

- EPA. 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). OSWER. EPA 530-D-02-004. August. Accessed On-Line at: <http://www.epa.gov/osw/hazard/correctiveaction/eis/vapor/complete.pdf>.
- EPA. 2004. Design Solutions for Vapor Intrusion and Indoor Air Quality. EPA 500F-04-004. March. Accessed On-line at: http://www.epa.gov/brownfields/facts/vapor_intrusion.pdf.
- EPA. 2004. User's Guide For Evaluating Subsurface Vapor Intrusion Into Buildings. August. Accessed On-line at: http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm.
- ITRC. 2003. Background Document: Vapor Intrusion Issues at Brownfield Sites. ITRC Brownfields Team. December. Accessed On-line at: <http://www.itrcweb.org/Documents/BRNFLD-1.pdf>.



Vapor Intrusion Questions

- ❖ Source of contaminated vapors?
- ↓
- ❖ Potential receptors present?
- ↓
- ❖ Connection between vapors and receptors?
- ↓
- ❖ Complete pathway?
- ↓
- ❖ Potential significant risk?

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Notes:

Purpose of Slide

- This slide lists some questions regarding VI.

Key Points

- Are there data suggesting soil vapors could be contaminated (for example, shallow VOC-contaminated plume)?
- Are potential receptors present (that is, do occupied buildings exist over VOC contaminated groundwater or soil)?
- Is there a potential connection between receptors and the soil vapor? That is, could residents, workers, or school children be exposed to soil vapors?
- Is the pathway between soil vapor and human receptors complete?
- If complete, does the indoor air pathway present a potential significant risk?

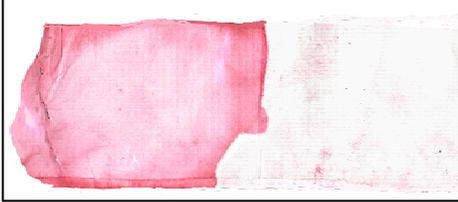
References

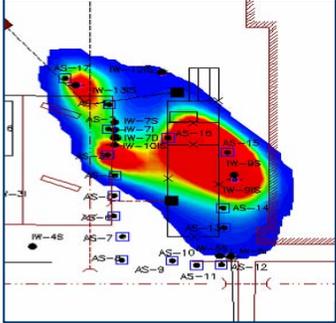
- EPA. 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). OSWER. EPA 530-D-02-004. November. Accessed On-line at: <http://www.epa.gov/correctiveaction/eis/vapor.htm>



Special Case for Establishing Cleanup Goals: NAPL Remediation

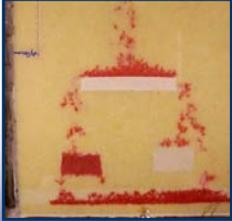
Flute™ liner showing TCE





Concentrations indicative of DNAPL

(continued)



Lab demo of PCE DNAPL

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Notes:

Purpose of Slide

- Discuss special considerations associated with establishing cleanup goals for facilities where NAPLs are present. They may be in the form of dense nonaqueous phase liquids (DNAPLs, “sinkers”) or light nonaqueous phase liquids (LNAPLs, “floaters”).

Key Points

- Nonaqueous phase liquids (NAPLs), especially DNAPLs in the subsurface are extremely difficult to locate and delineate, and present real challenges to remediate completely, other than through excavation.
- Given the technical challenges associated with NAPL remediation, a successful remediation strategy may focus primarily on containment, stabilization of NAPL source areas, coupled with remediation of the dissolved portion of the plume to meet cleanup criteria.

References

- EPA. 2004. DNAPL Remediation: Selected Projects Approaching Regulatory Closure. EPA 542-R-04-016. December.
- 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. EPA 530-R-04-030. Update. April.
- Interstate Technology Regulatory Council. 2003. Technology Overview. An introduction to Characterizing Sites Contaminated with DNAPLs. September.
- ITRC. 2000. Technology Overview. DNAPLS: Review of Emerging Characterization and Remediation Technologies. June.



Special Case: NAPL Remediation

- ❖ Non-numeric cleanup criteria
 - Stabilization
 - Containment
- ❖ Engineering solutions to reduce source
- ❖ Institutional controls to protect HH&E
- ❖ Dissolved phase criteria

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Notes:

Purpose of Slide

- Continue discussion on special considerations for NAPL cleanup criteria (given that reliable remediation technologies are not yet available).

Key Points

- In most cases, NAPL remedies should focus primarily on the use of ECs to stabilize and contain the contamination, active remedies to treat the dissolved plume, and ICs to fully protect HH&E. A Remedy Decision (CA 400) can be achieved for a facility where NAPL is present and no numerical cleanup criteria are established for the NAPL. In this case, the key to an effective Remedy Decision is assuring long-term protection of HH&E with appropriate ECs and ICs.
- Stabilization means that neither the NAPL nor the dissolved portion of the plume is migrating.
- At RCRA CA sites, an approvable remedy can be designed that prevents exposure by cutting off exposure pathways through ECs or ICs. Numerical criteria may be appropriate for the dissolved phase plume originating from the NAPL, and it may be appropriate to establish a point of compliance for the dissolved phase plume.
- Technical impracticability (TI) would apply if the established cleanup criteria could not be met, and under RCRA CA, an achievable cleanup goal for protection of HH&E (i.e., stabilization or risk management) can be set.
- In states that designate all groundwater as drinking water, it may be necessary to make a TI determination for NAPL sites.

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. EPA 530-R-04-030. Update. April.
- Interstate Technology Regulatory Council. 2003. Technology Overview. An introduction to Characterizing Sites Contaminated with DNAPLs. September.
- ITRC. 2000. Technology Overview. DNAPLs: Review of Emerging Characterization and Remediation Technologies. June.



the Where?

Defining the Remediation Area

- ❖ Remedy Decision applies to entire facility
- ❖ Options for applying numerical standards
 - Soil
 - Based on current and reasonably anticipated future land use
 - May vary (for example, residential off site, industrial on site)
 - Groundwater
 - At and beyond the unit boundary (when waste left in place)
 - Throughout the plume (when no waste left in place)
 - At and beyond a defined groundwater management zone
- ❖ Parceling property

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Notes:

Purpose of Slide

- Discuss that the Remedy Decision (CA 400) applies to the entire facility, but there may be different cleanup goals established for different portions of the facility. This concept is particularly important for facilities that are subdivided for sale or for reuse of parcels.

Key Points

- The remedy decision applies to the entire facility, but where cleanup criteria apply may vary. For instance, at an operating chemical plant, contaminated soil may be allowed to meet industrial exposure scenario values within the plant and residential values at and beyond the facility boundary. Groundwater standards may apply at the unit boundary (such as the edge of a landfill), throughout a groundwater plume, or within a defined groundwater management zone.
- There are many RCRA facilities across the country that are being subdivided for reuse under different ownership and land uses.
- Once parcels have achieved numerical cleanup criteria, they may no longer be subject to CA (depending on the requirement in facility permits or orders).
- Parcels that have appropriate ECs and/or ICs in place for the anticipated land use may or may not remain subject to the permit or other regulatory mechanism. The parcel will remain a part of the CA "facility" until a permit or order modification is made.
- In some cases, different cleanup criteria would be established for a given parcel than for other portions of the property, depending on the intended land use for the parcel.

References

- None.



Parceling

- ❖ **Benefits**
 - May jump-start cleanups
 - Makes valuable real estate available
 - Provides benefits to the community before final cleanup
- ❖ **Considerations**
 - Safe future anticipated uses of the property
 - ICs when wastes left in place
 - Financial considerations

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Notes:

Purpose of Slide

- In the previous slide, property parceling was mentioned as a factor in defining the remediation area. This and the following slide will provide more details on property parceling concepts.

Key Points

- RCRA facility parceling is selling or leasing a piece of a RCRA facility, normally with the intent for revitalization or productive/positive use.
- Parceling is a useful tool, because it makes valuable real estate resources available for revitalization, providing benefits to the community sooner, rather than after, final cleanup at the entire facility. Parceling can help to move cleanups more quickly.
- Considerations for parceling include:
 - The cleanup remedy should allow for safe future anticipated uses of the property.
 - If waste is left in place, ICs will be appropriate to ensure safe use of the property.
 - Financial considerations should include: (1) preventing bankruptcy and future Superfund sites, (2) ensuring a party is responsible for CA and financial assurance for the rest of the facility, and (3) the mechanics of implementation.

Reference

- EPA. Presentation on Parceling (David Hockey, EPA Office of Resource Conservation and Recovery).



Overarching Parceling Framework

- ❖ CA obligations
 - Authorized states
 - Regional EPA offices in non-authorized states
 - Case-by-case approach
- ❖ Permit requirements
 - States make modifications when necessary
 - Consider performance-based permit

Example: Using the minor modifications requirements...may redefine facility boundaries whenever a parcel of the facility is sold...so long as the parcel does not include a solid waste management unit (SWMU).

- ❖ Expedited parcel cleanup = revitalization

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Notes:

Purpose of Slide

- Further explain how parceling can and should be implemented to expedite cleanup and revitalization.

Key Points

- Most states are authorized for CA. State programs have authority to make decisions, including approaches to parceling facilities. Likewise, Regions may make these decisions for non-authorized states.
- The permitting authority (EPA or state) has responsibility for any modifications that may be required to address regulatory requirements for CA on parcels. To avoid permit delays, language can be incorporated into permits to address parceling. In the example language shown, the facility can parcel any portion of its property with a class 1 permit modification, as long as no further action is achieved. The class 1 permit modification is the simplest form of permit modification.
- Expedited cleanup of parcels allows for the parcel to be revitalized/used sooner and should be encouraged when there is a reuse.

References

- EPA. Presentation on Parceling (David Hockey, EPA Office of Resource Conservation and Recovery).



Overarching Parceling Considerations

- ❖ Brief window of opportunity for developers
 - Phased cleanup, by parcel
 - Voluntary/other State programs useful
 - Expeditious agency reviews / cleanup decisions
- ❖ Parceling allowed regardless of cleanup status
 - Most cleanups occur before sale
 - Enforceable mechanism is required when cleanup not completed before sale

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Notes:

Purpose of Slide

- Further explain how parceling can and should be implemented to expedite cleanup and revitalization

Key Points

- The window for developers is often brief, and phasing cleanup activities may help to facilitate parcel transfer. Some portions of the property may be completed long before others.
- Voluntary cleanup programs or other State programs can be useful and have been used in getting parcels addressed in a timely fashion.
- Regulators should be expeditious in conducting reviews and cleanup decisions when reuse interests are involved.
- Facilities can be parceled regardless of cleanup status, but CA obligations must be addressed.
- Most parcels that have been sold have had cleanup addressed prior to sale or lease.
- In some cases, a property sale may happen before the cleanup, with cleanup to be implemented by the original or new owner. Where this happens, enforceable mechanisms are required to ensure cleanup of the parcel and the remainder of the facility.

References

- EPA. Presentation on Parceling (David Hockey, EPA Office of Resource Conservation and Recovery).




Parceling Example

❖ Union Pacific Railroad Maintenance Yards, Omaha Riverfront

Redeveloping the Riverfront

Omaha has joined the growing national trend of rebuilding along riverfront areas to revitalize old industrial spaces as well as control urban sprawl. These once heavily industrialized areas are being developed for numerous uses, including parks, recreation areas, office space, and convention facilities.

Riverfront areas were commonly industrialized due to the need for access to water at manufacturing and processing facilities, as well as for transportation of raw materials and goods.

RAPMA sites. All are located adjacent to or near the Missouri River along the city's eastern edge.

Gallup Campus and National Park Service Area Headquarters

The area known as the Omaha Riverfront Redevelopment site is composed of several former industrial, commercial, and landfill properties. The City of Omaha has acquired properties where the Gallup Organization plans to build its headquarters and education campus facility. The National Park Service will also build a new service headquarters.

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Notes:

Purpose of Slide

- Provide an example where parceling has been implemented to expedite cleanup and revitalization.

Key Points

- Background – The Union Pacific Railroad (UPRR) Maintenance Yards is a 210 acre facility that was formerly used as a maintenance yard. It is located on the Omaha Riverfront and has been addressed as part of a larger “Riverfront Revitalization” effort.
- Regulatory Status – In 1994, the facility entered the Nebraska Voluntary Cleanup Program. Under Interim Status, a RCRA Section 3008(h) Administrative Order on Consent between EPA and UPRR was issued in 2002.
- Cleanup – A parcel of about 100 acres was cleaned up to non-residential risk-based standards. Lead contaminated soil was consolidated into an onsite soil repository. Other contaminated soil was taken off site.
- Reuse – When remediation was complete, this parcel was sold to City of Omaha; it now houses the Qwest Center, a \$290 million Arena and Convention Center.
- ICs – Covenants on the property restrict the type of use, prohibiting use as a daycare, preschool, playground, etc. Covenants prohibit treatment, storage, and disposal activities. Excavation of soil must comply with the Excavation Management Plan on Record. Drilling of wells is prohibited (except monitoring and dewatering wells). A City ordinance prohibits installation of drinking water wells without approval of the City health department.
- Other Parcels – UPRR sold another parcel, which will be the site of two hotels. EPA used Nebraska’s Uniform Environmental Covenants Act to provide suitable restrictions on this parcel. Other parcels will be used for commercial uses.

References

- EPA. Region 7 Web Site. 2006. Fact Sheet Proposed Cleanup Plan for Union Pacific Railroad, Omaha, NE. http://www.epa.gov/region07/factsheets/2006/fs_proposed_cleanup_public_comment_union_pacific_rr_omaha_ne0406.htm.
- EPA. Region 7. 2000. Fact Sheet: Corrective Action Summary for Union Pacific Railroad. March.



... and the When? Setting the Cleanup Timeframe

- ❖ Based on facility goals
 - Property sale/environmental restoration
 - Close-out of regulatory mechanism
 - Continued property use
- ❖ Timing affects technology selection
- ❖ Establishing milestones

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Notes:

Purpose of Slide

- Cleanup timeframes generally represent *when* specific numerical standards need to be met. Or in the case of NAPL, when stabilization or containment criteria have been met.

Key Points

- Regulators should work with facilities to establish reasonable timeframes for meeting cleanup criteria. Timeframes to meet cleanup goals may differ for different parts of a facility or in different media.
- Cleanup timeframes should be reasonable, linked to specific goals, and based on facility-specific conditions.
- A cleanup timeframe is an estimate of the schedule for meeting groundwater or other media cleanup criteria at a specified location. The timeframe may include the schedule for developing and constructing a remedy to achieve the cleanup goals.
- Some facilities may be on a fast-track for cleanup, which would generally be considered a few years. Facilities on a fast-track are often those undergoing revitalization efforts that include changing land uses or facilities that are focused on reducing permit requirements and eliminating environmental liabilities.
- Facilities on a fast track will tend to select more aggressive remedies such as excavation or bioremediation, whereas facilities with fewer time constraints will be more inclined to choose passive remedies such as monitored natural attenuation (MNA).
- Industrial facilities selecting MNA, where no new future land uses are anticipated, could consider a timeframe that spans decades. Some facilities have even adopted timeframes of centuries; one example is the Casper, WY facility we saw in the video for Module 6. That facility anticipates meeting groundwater cleanup criteria in 400 years. In the meantime, ECs and ICs have been implemented at the facility and are protective of HH&E. This facility has been redeveloped and is currently being used as a golf course and business park.
- Regulators may approve a Remedy Decision (CA 400) that will take many years to achieve numerical cleanup levels, as long as the remedy is protective of HH&E for its current and reasonably anticipated uses.
- In working with facilities, the regulator should establish a timeframe for intermediate goals such as achieving environmental indicators and other RCRA CA Measures (such as Human Exposures under Control and Groundwater Migration under Control by 2008 and Remedy Selected and Remedy Constructed by 2020).
- There are many uncertainties associated with estimating a cleanup timeframe, but it is prudent to do so, because the cleanup timeframe affects the Exit Strategy.

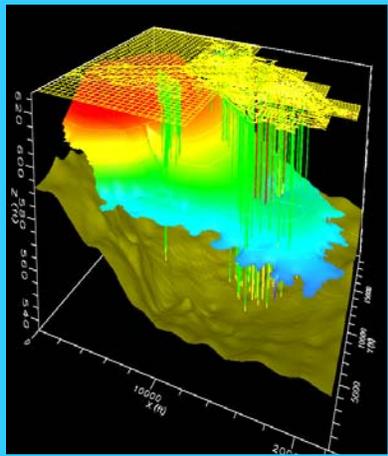
References

- None.



Remedy Selection





- ❖ What: Meet risk-based groundwater criteria
- ❖ Where: Throughout the plume
- ❖ When: 2012
- ❖ ECs and ICs required

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Notes:

Purpose of Slide

- Provide a case study demonstrating the selection of a remedy.

Key Points

- At this site, volatile organic compounds (VOCs) are present in 100s of parts per billion in the shallow aquifers (30 and 60 feet deep), with the highest concentrations generally near the original source area. VOCs have migrated to greater depths with distance from the source. Very low concentrations (but slightly above the MCLs) are present in lower aquifers.
- A number of remediation goals are associated with the site remedial approach. One goal is to meet risk-based criteria in groundwater throughout the plume (recall from an earlier module, that this represents a technical goal for the remedy). In Florida, no further action with ICs may be acceptable when non-numeric criteria are met, such as: ECs are in place to prevent off-site migration and there is no impact or potential impact to surface water.
- Layered onto that technical goal, the property owner wants to transfer the land without requirements for continuing active remediation (this represents a business goal).
- The facility owner has a goal of meeting the above criteria by the year 2012.
- A corresponding regulatory goal would be to establish "CA complete with controls," for the facility, which we will address in more detail in Module 12 (CA Complete). In this case, the controls would be ICs to prohibit the use of groundwater until MCLs are achieved. Based on fate and transport modeling, groundwater will meet MCLs throughout the plume in 2025.

References

- None.



Evaluation Criteria: Selecting the Right Remedy

- ❖ Threshold criteria
- ❖ Balancing criteria



Expectations for Final Remedies at RCRA Corrective Action Facilities (Fact Sheet #2)
Final Remedy Selection for Results-based RCRA Corrective Action (Fact Sheet #3)

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Notes:

Purpose of Slide

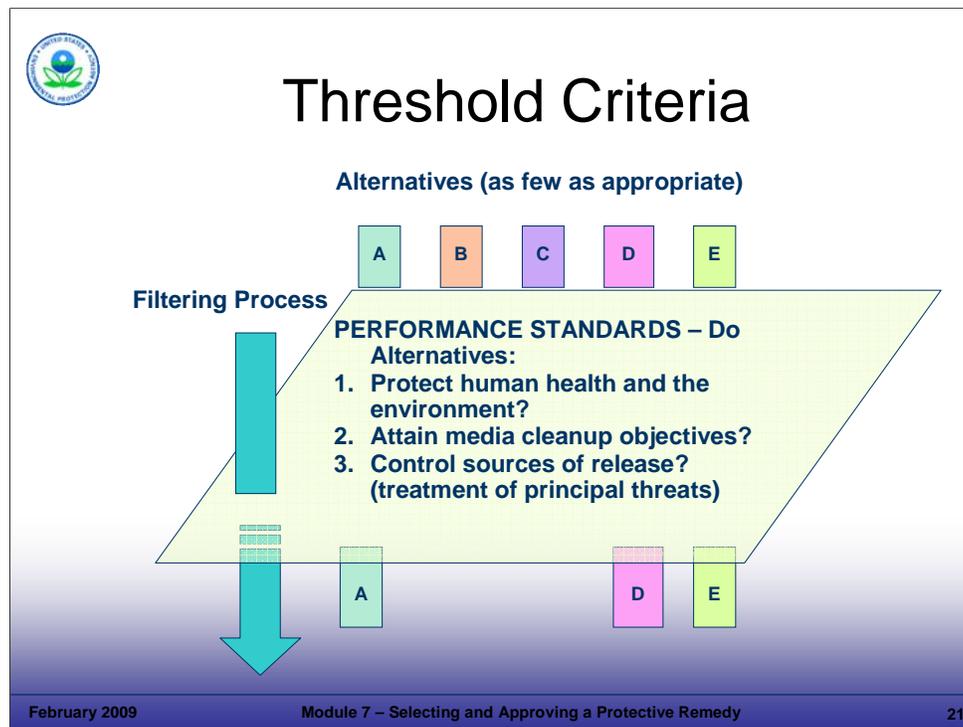
- Discuss EPA's guidance for the selection of final remedies.

Key Points

- EPA has established useful guidance for selecting remedies, particularly for complicated sites. The guidance provides threshold and balancing criteria for evaluating multiple technologies. Facilities must meet threshold criteria in evaluating technologies. Facilities may also use balancing criteria to evaluate the effectiveness of remedies, but there is no EPA requirement to do so; the balancing criteria are considered guidance. First, potential remedies are evaluated using threshold criteria, which are general performance standards that serve as filters or screens. If a remedy under consideration does not meet these performance standards, it is screened out and does not move on for further evaluation.
- Potential remedies that pass the threshold criteria screen are then evaluated against EPA's balancing criteria, which serve as the "scale" to balance different remedy selection considerations (for example, effectiveness and cost). Remedies do not have to "meet" balancing criteria but are simply measured against them. For example, if a property is undergoing redevelopment, the short-term effectiveness and implementability of a remedy may weigh more heavily in the remediation decisions than long-term effectiveness or cost. This evaluation affects the remedy decision.
- When a single remedy alternative is being considered, these criteria serve as a basis to determine that the remedy will be adequate.
- For multiple alternatives, the criteria allow identification of a recommended or "best" remedial approach.
- It is not necessary to evaluate multiple remedies for a site; a single, proven remedy can be selected and approved.

References

- EPA. 2000. Expectations For Final Remedies At RCRA Corrective Action Facilities, RCRA Corrective Action Workshop On Results-Based Project Management (Fact Sheet #2). March. <http://www.epa.gov/epaoswer/hazwaste/ca/workshop/fremedy/expect.pdf>.
- EPA. 2000. Final Remedy Selection for Results-Based RCRA Corrective Action (Fact Sheet #3). March. Accessed On-line at: <http://www.epa.gov/epaoswer/hazwaste/ca/workshop/fremedy/select.pdf>.



Notes:

Purpose of Slide: Present and review EPA's threshold criteria for remedies.

Key Points

- There are three threshold criteria, which can serve as general performance standards. The facility, regulators, and public agree to the standard and the facility has the flexibility to decide how to meet the standard.
- Protecting HH&E is the mandate of the RCRA statute and regulations. Also, remedies must meet the second and third criteria as a means of achieving the overall mandate to protect HH&E.
- Protecting HH&E is a function of current and reasonably anticipated uses and receptors. For instance, if air stripping is being evaluated against this criterion, the projected air emissions from the stripper to the ambient air must be protective of surrounding populations.
- Protecting the environment involves, among other things, considering the ecological setting around a facility when evaluating and selecting a final remedy. For instance, if groundwater pump and treat is being evaluated, it may be eliminated as a remedy if lowering the water table through groundwater extraction would negatively impact a fragile wetland area.
- The criterion of "attaining media cleanup objectives" reflects three concepts that we discussed earlier: (1) "what" cleanup criteria have to be met, such as numerical cleanup criteria or stabilization and containment measures; (2) "where" cleanup criteria need to be met, such as a unit boundary or throughout the plume; and (3) "when" cleanup criteria need to be met. Each of these concepts is influenced by the anticipated use of the property.
- The criterion of "controlling sources of releases" focuses on reducing or eliminating further releases of hazardous wastes or constituents that may pose a threat to HH&E. In satisfying this criterion, EPA expects facilities to use treatment for wastes and contaminated media that are principal threats and ECs for wastes and contaminated media that can be reliably contained, pose relatively low long-term threats, or for which treatment is impracticable.

References

- EPA. 2000. Final Remedy Selection for Results-Based RCRA Corrective Action (Fact Sheet #3). March.
- 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. EPA 530-R-04-030. Update. April.



Balancing Criteria

- ❖ Long-term effectiveness
- ❖ Toxicity, mobility, or volume reduction
- ❖ Short-term effectiveness
- ❖ Implementability
- ❖ Cost
- ❖ Community acceptance
- ❖ State acceptance

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Notes:

Purpose of Slide: Describe EPA's balancing criteria for final remedy selection. These criteria are provided as guidance, particularly for complicated sites.

Key Points

- Balancing criteria are used to evaluate remedies that have passed the threshold screening criteria. Balancing criteria use the 7 factors shown on this slide. The facility is not required to evaluate multiple remedies, if the selected engineering solution has proven effective in similar situations.
- Decision-makers should evaluate final remedies based on their anticipated long-term effectiveness and reliability in protecting HH&E. Long-term effectiveness should consider reasonably anticipated future uses.
- Reducing the toxicity, mobility, or volume of hazardous waste and contaminated media helps achieve the broader objectives of long-term reliability and permanence in reducing the risks posed by hazardous wastes and constituents.
- Short-term effectiveness addresses the amount of time it will take for remedy design, construction, and implementation. This criterion may be important to address risks to the community, workers, and the environment. It also may be most important criterion to a facility undergoing revitalization.
- Decision-makers should evaluate remedies based on the implementability, or technical feasibility, of constructing, operating, and monitoring the remedy. This would include the administrative feasibility of obtaining needed permits and approvals and the availability of services and materials.
- Facilities can propose lower cost remedies as long as they are effective. Some facilities may prefer to keep short-term capital expenditures to a minimum, while other facilities focus on life cycle costs. Net present value estimates of remediation costs can be considered, including operation and maintenance costs. Tools that can be used to evaluate potential remedial costs include EPA's CostPro Software and the U.S. Air Force Remedial Action Cost Engineering and Requirements System (RACER).
- Evaluation of community acceptance is important and should address, among other things, community concerns regarding reuse of the property. Individuals or local groups may have input.
- Finally, the State's acceptance is important, particularly when EPA selects the remedy.

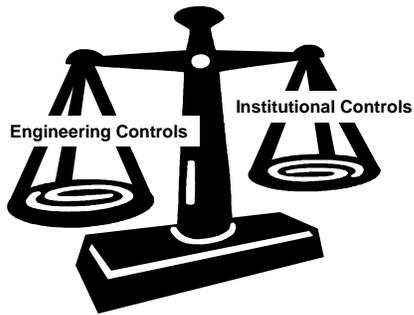
References

- EPA. Final Remedy Selection Module. EPA Region 7 Delivery of the EPA Headquarters RCRA Corrective Action Workshop. Delivered by Guy Tomassoni.
- EPA. 2000. Final Remedy Selection for Results-Based RCRA Corrective Action (Fact Sheet #3).



Institutional Controls

- ❖ Legal or administrative instruments
- ❖ Minimize potential for exposure
- ❖ Limit land or resource use
- ❖ Examples:
 - Government controls
 - Enforcement tools





ICs: A Guide to Implementing, Monitoring, and Enforcing ICs at Superfund, Brownfields, Federal Facility, Underground Storage Tank and RCRA CA Cleanups. Draft. 2003. <http://www.epa.gov/superfund/policy/ic/guide/index.htm>

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Notes:

Purpose of Slide: Discuss the purposes for, and types of, ICs.

Key Points

- Many remedy decisions include the incorporation of ECs and ICs. ECs are discussed in more detail in Module 9.
- In the past, facilities and agencies have focused first on selecting and developing good engineering designs, followed by a decision regarding the applicability of ICs to ensure long-term protectiveness.
- Today's remedy decision process involves evaluating, integrating, and balancing engineering solutions and ICs from the beginning of the process -- to establish a holistic approach to facility remediation.
- EPA defines ICs as "non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and protect the integrity of the remedy." For example, a remedy may use an engineered cap to cover contaminated soils and an IC (for example, an excavation permit) to restrict excavation through the cap.
- A remedy generally should include ICs if contamination will remain in place at the facility above residential risk-based levels. ICs should minimize the potential for exposure to contamination by limiting land or resource use.
- Various types of ICs can be used including:
 - **Government Controls:** These controls impose land or resource use restrictions using the authority of an existing government. Examples include: (1) zoning, (2) laws regarding well drilling or water usage, and (3) legal authorities involving licensing or permitting processes.
 - **Proprietary ICs:** These include legal instruments placed in the chain of title that convey a property interest from the owner to a second party. Proprietary ICs impose restrictions on land and water use. Examples include: (1) restrictive easements and (2) covenants. These controls often include the right of access to inspect and monitor.
 - **Enforcement Tools:** Enforcement tools include orders, permits, and consent decrees, which may incorporate ICs. Prohibitions on certain land uses or activities can be made a condition of the permit.
 - **Informational Devices:** A notice of land use restrictions (sometimes referred to as a deed notice) may be placed in the land records or statewide registries by the owner. Such notices are usually not enforceable, but have informational value. The term "Deed Restriction" is not a property law term or concept. To avoid confusion, site managers should avoid the term and instead be specific about the types of ICs under consideration.

References

- EPA. 1999. Final Remedy Selection Module. Kansas City Version of EPA HQ Corrective Action Workshop. Delivered by Guy Tomassoni.
- EPA. 2000. ICs: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls. Fact Sheet. OSWER 9355.0-74FS-P. EPA 540-F-00-005. OSWER 9355.0-74FS-P. September.
- EPA. 2003. ICs: A Guide to Implementing, Monitoring, and Enforcing ICs at Superfund, Brownfields, Federal Facility, UST and RCRA CA Cleanups. Draft. February.
- EPA. 1996. Advanced Notice of Proposed Rulemaking. 61 FR 19432. Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities. May 1.
- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.



Guiding Principles for ICs

- ❖ Necessary when remedy does not provide for unlimited use and unrestricted exposure (UU/UE)
- ❖ Early planning required
- ❖ Ensure enforceable mechanisms
- ❖ Layering of ICs

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Notes:

Purpose of Slide: Present guiding principles associated with the evaluation and selection of ICs.

Key Points

- If remedial options will not allow for unlimited use and unrestricted exposure, the facility should generally identify appropriate ICs to ensure that inappropriate uses or unacceptable exposures from residual contamination do not occur. In addition, ECs may need ICs to protect them.
- The assessment of potential ICs requires early planning – evaluation should begin as early as possible during the remedy selection process and carry on through remedy implementation. Short- and long-term considerations apply.
 - Near term ECs or ICs may be needed to limit exposure.
 - In addition, evaluation of long-term ICs should continue through remedy selection and implementation.
 - ICs may be either short- or long-term; applied to a portion of a site or the entire site; and can be part of interim or final actions.
- Evaluation and selection of ICs for a remedy will vary. Sometimes the o/o will recommend them, sometime the o/o will analyze and establish them, sometimes ICs will be prescribed by law, or worked out by interested parties.
- All parties should have the understanding, authority, and financial capacity to fulfill their responsibilities relating to identifying, evaluating, implementing, and monitoring ICs.
- Establishing and implementing ICs through enforceable mechanisms is important to ensure long-term effectiveness. ICs need to be effective and reliable for as long as they are needed, including whenever the property is transferred, to protect HH&E.
- Implementing more than one IC at a particular facility increases reliability. This approach is known as layering.

References

- EPA. Final Remedy Selection Module. Kansas City Version of EPA HQ Corrective Action Workshop. Delivered by Guy Tomassoni.
- EPA. 2000. ICs: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls. Fact Sheet. OSWER 9355.0-74FS-P. EPA 540-F-00-005. OSWER 9355.0-74FS-P. September.
- EPA. 2003. ICs: A Guide to Implementing, Monitoring, and Enforcing ICs at Superfund, Brownfields, Federal Facility, UST and RCRA CA Cleanups. Draft. February.
- Federal Register (FR). 1996. Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities; Advance Notice of Proposed Rulemaking (ANPR). 61 FR 19432. May 1.
- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.



Evaluating ICs

- ❖ Identify objectives
- ❖ Determine that enforceable mechanisms are available
- ❖ Determine long-term effectiveness
- ❖ Evaluate costs

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Notes:

Purpose of Slide

- Regulators and facilities determine the selection and implementation of effective and reliable ICs, which are used to prevent human exposure to unacceptable levels of contamination. This slide presents important steps that the facility should consider in selecting ICs at RCRA facilities.

Key Points

- The IC evaluation should begin by identifying the IC objectives (for example, preventing dermal contact with contaminated soils, the ingestion of contaminated groundwater, or damage to an engineered cap).
- The availability of a particular governmental, enforcement, or proprietary IC (for example, zoning or restrictive covenant) may depend on the state and local jurisdiction where the facility is located. Therefore, the facility should determine whether there are viable IC tools and enforceable mechanisms available under state and local law.
- The facility should plan for and delineate the roles and responsibilities of the parties involved in implementing, monitoring, and enforcing the selected controls so that they remain effective over the long term.
 - These parties should have the financial and organizational capabilities and interest to reliably accomplish their tasks.
 - Care should be taken to determine that the ICs will survive property transfer and/or permit termination.
- The facility should consider short- and long-term costs associated with ICs and include these costs in financial assurance, as necessary.

References

- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.



Other Considerations in Remedy Selection

- ❖ Green Remediation
 - Maximize net environmental benefit of remediation
- ❖ Long-term Stewardship
 - Manage on-site waste and contaminated environmental media to protect HH&E
- ❖ Sustainability
 - Meeting the needs of the present w/o compromising the ability of future generations to meet their own needs

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Notes:

Purpose of Slide

- Introduce additional considerations relevant to remedy selection.

Key Points

- Green remediation considers the environmental impacts of remediation activities at every stage of the remedial process to maximize the net environmental benefit of a cleanup. Considerations include: energy requirements, efficiency of on-site activities, and reduction of impacts on surrounding areas. Many pump and treat systems currently in place were designed and installed when energy was less expensive and designers did not consider the full impacts of using non-renewable energy. Alternative energy sources are now available for powering remediation systems and reducing the emission of greenhouse gases.
- Long-term stewardship typically centers on physical and legal controls to prevent inappropriate exposure to contamination that is left in place at a site. We will describe how to maintain ECs through efficient and effective operation and maintenance in Module 11 and how to select, implement, and maintain ICs to minimize the potential for human exposure to contamination by limiting land or resource use later in this module.
- As discussed in Module 6, sustainability means meeting the needs of the present without compromising the ability of future generations to meet their own needs, in terms of environmental cleanup. This means considering remedies that minimize or eliminate energy consumption, maximize the reuse of land and recycling of materials, preserve natural resources, and minimize or eliminate ancillary environmental impacts such as carbon dioxide (CO₂) emissions.

References

- EPA Website. Sustainability. Accessed On-line at: <http://www.epa.gov/sustainability>.
- Goldblum, Deborah (EPA). 2007. Integrating Sustainability into EPA's Cleanup Programs Region 3 RCRA/DuPont Pilot. June 27.
- Dellens, Amanda. 2007. Green Remediation and the Use of Renewable Energy Sources for Remediation Projects. National Network for Environmental Management Studies Fellow Case Western Reserve University (developed for EPA). August. Accessed On-line at: <http://clu-in.org/download/studentpapers/Green-Remediation-Renewables-A-Dellens.pdf>.



Documenting the Remedy Decision

- ❖ Facility documentation – letter report, CMS, or other
- ❖ Timely regulator review
- ❖ Regulatory documentation – Statement of Basis or equivalent
- ❖ Public participation – comments in response to public notice
- ❖ Final regulatory decision (CA 400 measure)

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Notes:

Purpose of Slide

- Explain the process of documenting a Remedy Decision.

Key Points

- The regulated facility is responsible for developing a proposed remedy, and then submitting the proposed remedy to the regulatory agency with documentation in the form of a letter report, CMS, or other applicable document.
- The regulators should review remedies submitted by the facility expeditiously.
- Once the remedy is preliminarily approved by the regulator, the decision is announced through issuance of a decision document such as a Statement of Basis, which can be prepared by the regulatory agency or facility for public review and comment. A Statement of Basis may not be required in all cases, depending on the regulatory mechanism and state requirements. This is also the stage in the CA process where many facilities are required to demonstrate financial assurance.
- Following a public comment period, the regulatory agency makes a final decision, which is published along with a response to public comments.
- A “Remedy Decision and Response to Comments” or other appropriate decision document is used to formalize the agency’s remedy decision (CA 400).

References

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



Field Considerations

- ❖ Health and Safety
- ❖ Nature of the Site

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Notes:

Purpose of Slide

- Overview the second part of this module, which presents field considerations related to selecting a remedy.

Key Points

- We have talked about some of the policy considerations that impact remedy selection.
- Field considerations are also important to remedy selection.
- During the remainder of this module, we will discuss factors that impact the remedy decision, such as:
 - Health and safety considerations; and
 - Nature of the site (location, status of the facility, accessibility issues, site conditions and contamination, waste management, and other site goals (for example, green remediation goals)).
- All of these factors should be considered as the remedy for a particular site is selected.

References

- None.



Health and Safety

- ❖ Off-site Issues
 - Community Impacts
 - Proximity of Neighbors
- ❖ On-site Issues
 - Worker Exposure
 - Employee Exposure

(continued)

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Notes:

Purpose of Slide

- Discuss health and safety considerations.

Key Points

- Health and safety impacts to the community must be considered.
- Frequently, sites are in close proximity to residential neighborhoods that may be impacted and the technology selected must consider its potential impact. In the case of excavation of highly contaminated soils, vapor suppression foam may be appropriate to minimize impacts. Modified excavation techniques may be appropriate where only very small areas may be open at any time. Pretreatment of an area (for example, dewatering and vapor extraction) also may be suitable before excavation.
- Air quality may not pose a health risk to neighbors but may create a problem with odors. Sometimes, engineers use air dispersion modeling to design a system based upon an acceptable odor threshold.
- Sites that have organic contaminants creating air emissions well below health-based risk levels and perhaps not even analytically detectable can still have an odor and a taste to downwind receptors.
- On site worker exposure also must be considered as part of technology selection. Intrusive activities may require breathing protection for site workers. The use of personal protective equipment can impact workers and these impacts can be aggravated by weather conditions (that is, think of Level B supplied air on a hot summer day). To reduce worker risk, the technology approach or timing may be modified to ensure worker safety.
- At large installations, employees may be located close to an area where intrusive remediation activities may allow emissions to impact them. The nature of duties may not allow the area to be evacuated or their work relocated.

References

- EPA. 1994. RCRA Corrective Action Plan. May.



Health and Safety

❖ Associated with the remedy:

- Dust Control
- Emissions
- Dermal Contact

❖ Associated with site operations:

- Physical hazards, traffic
- Electrical and other utilities

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Notes:

Purpose of Slide

- Discuss some specific impacts related to health and safety considerations.

Key Points

- Dust control during site remediation efforts may be a major issue. Contaminated dust must be controlled, but even non-contaminated dust can be a health problem for both site workers and neighbors. Traffic-generated dust can create problems to site neighbors, especially residential neighbors.
- Process emissions are also important. It is wise to use a basic screening model for air dispersion, such as Toxics Screen (TSCREEN), to assess the potential impact a remediation process will have on the area. If TSCREEN indicates a problem, a more detailed modeling approach using software, such as the Industrial Source Complex Short Term Model (ISCST3), can be used. This level of effort should be implemented for any remediation technology with a process that can emit contaminants.
- Fugitive emissions can be difficult to control and monitor. Site operators should inspect their systems for fugitive emissions and maintain equipment to reduce or eliminate them.
- Direct skin or dermal contact is also a factor. Remediation activities should take this into account so that contact is avoided.
- There are many health and safety issues associated with operating sites, including traffic and other physical hazards.
- Above-ground electrical lines and buried utilities can be safety concerns.
- Remedies should always be consistent with a facility's health and safety plans.

References

- NASA. 2007. Website on TSCREEN. Accessed On-line at: <http://gcmd.nasa.gov/records/TSCREEN-Model.html>.
- EPA. Industrial Source Complex Short Term Area Model (ISCST). Website. Accessed On-line at: http://www.epa.gov/scram001/dispersion_alt.htm.



Safety at Operating Facilities



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Notes:

Purpose of Slide

- Demonstrate how some areas of an operating facility are too dangerous to implement an active remedy. In addition, some areas of an operating facility need to be avoided so as not to interrupt facility operations and to avoid above-ground and underground obstructions.

Key Points

- These photographs show the congestion and complexity of operating facilities. Notice that some areas are roped off to limit access.
- At this operating plant (a refinery), drilling monitor wells or collecting soil samples would be too dangerous while the facility is operating. Numerous underground and above-ground obstruction exist and most have high pressure and high temperatures. In addition, the plant operations would be interrupted to collect samples or construct a remedy.
- An operating facility may achieve the performance measure of Ready for Anticipated Use by demonstrating that environmental conditions in operating areas are safe for their current and reasonably anticipated uses.
- Criteria that may be considered in selecting a remedy for an operating facility with limited access are:
 - Demonstrate that environmental conditions (for example, VI from product in the subsurface) are not contributing to worker exposures in excess of applicable standards;
 - Maintain control of contaminant plumes through the use of groundwater management zones or ECs;
 - Identify actions to ensure site conditions are protective of HH&E in the context of the use of the facility;
 - Record use restrictions in the deed;
 - Have plans for inspection and maintenance of ECs to make sure they are in place; and
 - Provide financial assurance for future investigation, long-term monitoring, or anticipated active remediation for current or reasonably anticipated uses.

References

- None.



Nature of the Site

- ❖ Location
- ❖ Status
- ❖ Accessibility
- ❖ Site conditions and contaminant distribution
- ❖ Waste management considerations

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Notes:

Purpose of Slide

- Discuss the nature of the site and how this can impact the remedy.

Key Points

- It is important that the nature of the site be considered during remedy selection.
- The location of the facility will impact how a remedy can be implemented; different considerations will be important in a densely residential area versus a rural area. In addition, the weather conditions will vary across the country from some areas where extreme heat or cold must be considered to areas where events such as hurricanes must be planned for.
- Operating status is also important:
 - Industrial facilities have unique issues because they do not want their operations interrupted. The remedies selected dictate the type of tasks that must be performed. Some tasks may be able to be performed during off-hours or during plant vacation or maintenance shutdowns. Non-operating facilities generally have more latitude and will probably not be affected by remedial activities, unless revitalization is underway.
 - Site security requirements can vary based on the type of facility and its operating status.
- Accessibility may be limited at some sites and this also can impact the remedy decision. The types of accessibility considerations that apply include: physical access, utilities, and right of way/ ownership considerations. We will look at each of these in the slides that follow.
- The type and distribution of contaminants and remediation waste generation and management issues also can impact remedy selection.
- The factors above can impact the selection of one remedy over another (this would fall under the balancing criteria of implementability) or it may impact aspects of a remedy such as the schedule or design. We will present some examples of how these factors can impact remedial choices and approaches.

References

- None.



Location – Area Use



Industrial



Suburban



Commercial



Urban



Ecologically sensitive

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Notes:

Purpose of Slide

- Illustrate the types of locations where RCRA CA facilities may be present and discuss how location can impact the remedy decision.

Key Points

- The type of location will affect the remedy selection.
- Industrial locations are usually the least problematic unless the remediation will interfere with ongoing operations or if accessibility is limited due to health and safety concerns. Intrusive activities and those that are noisy, dusty, or have a similar nuisance impact will be more acceptable at an industrial facility than at a location that is residential.
- Residential (urban and suburban) and commercial locations pose the greatest challenge. It will be difficult to gain public acceptance for loud, disruptive operations. Air emissions, odors, and dust are other, less obvious, issues that must be addressed at such locations.
- In cities, interference with traffic may pose an issue. Imagine installing a groundwater monitoring well in the sidewalk of a major downtown business district and having to close a major road to do it. Night time drilling is an option.
- Ecologically sensitive areas pose special considerations and difficulties. For instance, a remedy that involves pumping (for example, dewatering for excavation or pump and treat systems) might have to be eliminated from consideration at a site with wetlands due to the negative ecological impacts of lowering water levels. Similarly, thermal treatment or chemical oxidation may also have to be eliminated at some sites because they can alter the temperature and chemistry of groundwater.
- The participants may wish to share input regarding how site location (the nature of the site) has impacted remedy selection at RCRA CA or other sites that they have been involved with.

References

- None.



Location – Noise and Air Quality



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Notes:

Purpose of Slide

- Discuss how potential community impacts associated with noise and air quality can affect remedy selection.

Key Points

- A large excavation project or landfill cap could require heavy truck traffic for 12 hours a day for months. This situation would impact traffic safety and congestion, and may lead to selection of an alternative remedy.
- Noise can be a serious problem with process equipment. Blowers, compressors, and other rotating machinery can generate high pitched whines that carry long distances. These sounds would be especially noticeable at night. Other machinery can generate low frequency vibrations that are felt more than heard. These also can be objectionable. The photograph on the right is an air stripping tower installed on personal property to address contaminated groundwater that had migrated off-site.
- Earth moving and construction machinery can also generate these types of objectionable noises.

References

- None.



Location - Weather

- ❖ Extreme Cold / Heat
- ❖ Tropical Storms / Hurricanes
- ❖ Floods
- ❖ Rainy Season

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Notes:

Purpose of Slide

- Discuss weather impacts and conditions and how they can impact CA remedy selection and design.

Key Points

- Weather plays a role in remedy decisions as it affects both technology selection and implementation.
- Extreme cold conditions not only create a freezing problem for groundwater systems but adversely affect some materials of construction (metals and plastics).
- Hot (and humid) environments create challenges for site workers (implementation and construction) as well as technological problems. We frequently forget about humidity but it can wreak havoc on electronic instruments and control systems by providing an environment conducive to the propagation of mold and mildew growth.
- Tropical storms and hurricanes affect the entire Gulf and Atlantic coastal regions, the eastern half of the U.S. interior region, and islands in the Caribbean. Other types of storms, including thunderstorms and tornadoes can impact facilities in the continental interior.
- Floods can have significant impacts on a remedy and also on any staged materials or waste on a site.
- Rainy seasons are primarily an issue during the construction phase, but may aggravate long-term operations if not planned for in advance.

References

- None.

Location - Weather
140 MPH Design
CCF AST's Survived

Hurricanes

2004 – Frances
108 MPH Gusts

February 2009

Shuttle VAB Damaged

EXAMPLE

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Notes:

Purpose of Slide

- Discuss design considerations to address the potential weather events, such as storm conditions (video clip included).

Key Points

- In coastal regions of the country, primarily the Gulf Coast, hurricanes have to be accommodated during design and implementation.
- In coastal Florida, the design wind load conditions for structures is 140 miles per hour (MPH). Further inland, the wind load criteria may drop to 110 MPH. Systems and buildings should be designed to withstand the force of these winds.
- In the photograph above (upper right), the dual aboveground storage tank (AST) system at the CCF facility at NASA Kennedy Space Center (KSC) was designed for a 140 MPH wind loading in a free-standing structure with no added bracing of guy wires. This level of effort required detailed design of the reinforced fiberglass ASTs, including shop samples and structural testing.
- In the same area at NASA KSC, the VAB building was severely damaged by Hurricane Frances in 2004 (108 MPH gusts), while the treatment system sustained no damage.
- Tropical storms (below 75 MPH) are common and can also cause severe damage.
- Hurricanes and tropical storms can drop large amounts of rain (up to 24-inches of rain in 24 hours).
- These wind and rain conditions can interrupt construction work, remediation system operations, and field work -- and can cause site shutdown and abandonment. Heavy rains associated with hurricanes also can affect groundwater conditions.
- Hurricanes can affect the Atlantic Coast all the way to Long Island and Cape Cod and heavy rains from such storms occur in the Appalachian and Blue Ridge mountains and into Pennsylvania and New York and cause major flooding issues.
- The bottom line is that potential weather conditions and storm events should be considered during remedy selection and design.

References

- None.



Facility Status



Active Versus Inactive Facilities

Bioremediation system at an operating facility, visible to plant personnel

Bioremediation system at an inactive facility, with restricted access



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Notes:

Purpose of Slide

- Illustrate design and implementation considerations for active versus inactive facilities.

Key Points

- The photograph on the right is a bioremediation system installed in the parking lot of an active facility, near a sump where the original spill occurred. The system was designed to be as compact as possible (use few parking spaces); it is secure from a security and safety standpoint, and it is aesthetically acceptable.
- The photograph on the bottom shows a remediation system at an inactive facility with 24 hour security and no access to anyone other than remediation personnel. System design is more flexible from an aesthetic standpoint, since there is limited access to the site.

References

- None.

EXAMPLE

Facility Status

Avoiding Operational Interruptions





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Notes:

Purpose of Slide: Explain how remedies are selected to avoid interrupting facility operations and address operational accessibility issues that could be associated with an active facility.

Key Points

- At the NASA facility shown on the left, remediation activities were planned so that transport of the Shuttle Atlantis to Launch Complex 39 is not affected. Remedy components include:
 - Trenching for pipe installations and construction of a remediation system had minimal impact on NASA operations, but NASA operations did impact the schedule of remedial activities.
 - Remedies selected dictate the type of work tasks to be performed. Some tasks may be able to be performed during off-hours or during plant vacation or maintenance shutdowns.
 - In this case, groundwater recovery for plume control was coupled with air sparging and soil vapor extraction (AS/SVE). The AS/SVE system was installed to reduce contaminant levels in the upper 15 feet so that an organic layer contaminated with DNAPL TCE could be excavated without seriously impacting worker activities in adjoining operations. Complete excavation was not possible because of mission critical railroad tracks that could not be removed from service.
- In the example shown on the right, a large plume was located under an active Department of Energy (DOE) contractor's manufacturing facility. The remedial action objective is plume stabilization.
- Remediation systems on this active facility, were located so that selected remedies have minimal interference with facility operations.
- The nature of the contamination and the manufacturing nature of the site dictated the remedy selected. Horizontal wells were drilled under the facility to establish and maintain hydraulic control. Drilling had to occur within 24 hours once horizontal well installation began, hence the night time drilling photograph.
- Additional dual-phase vapor extraction (DPVE) wells and collection systems are located around the facility. Central treatment and processing for all recovered groundwater was located in a manner that minimizes interference with operations.
- Final cleanup criteria at this facility are MCLs (specified in a permit). Remedy Decision (CA 400) and Remedy Constructed (CA 550) performance measures have been achieved, although CA complete (cleanup criteria met) will probably not be achieved for decades.

References

- None.

EXAMPLE

Facility Status

Site Security



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Notes:

Purpose of Slide

- Review site security considerations.

Key Points

- Many sites require security to protect the public and prevent damage and vandalism.
- This site is located in an industrial area undergoing revitalization.
- This remediation system is protected by a 10-foot chain link fence with razor ribbon to prevent intruders from coming into the site. Security lighting may also be required. As the area is developed, aesthetics will become important and it may be necessary to surround the site with a privacy fence.
- It is important to periodically review potential exposures as land uses change.

References

- None.

EXAMPLE

Accessibility



Elevated piping for groundwater recovery



Compact, indoor controls



No accessibility issues for air sparge equipment

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Notes:

Purpose of Slide

- Discuss remediation design considerations as they relate to accessibility and facility operations.

Key Points

- The photographs in the upper left and middle show groundwater recovery lines that had to be elevated at an operating facility because there were so many buildings and other underground lines for which limited information was available (this facility is over 50 years old). The groundwater influent lines had to snake around the buildings from recovery wells to treatment systems. In some areas, such as parking lots, the pipes were buried.
- The photograph in the upper right shows a distribution system that was located and designed with considerable space limitations.
- The photograph at the bottom is meant for comparison – this air sparge system was installed where well points can protrude from the ground, pipe can be laid above-ground, and equipment can be placed virtually anywhere.
- Design and installation of systems at operating facilities is typically more complicated – it takes more time and is more costly.

References

- None.

 **Accessibility -
Right of Way / Ownership / Utilities** 



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Notes:

Purpose of Slide

- Discuss Right of Way/Ownership issues.

Key Points

- This photograph shows rotasonic drilling at an angle to reach potential DNAPL contamination. The contaminants are along a rail right of way and access was not possible from the right of way.
- A similar case may arise when the adjoining property owner will not allow access to investigate.
- Notice the power lines in this photograph. Both above-ground and underground utilities are considered during remedy design and implementation.

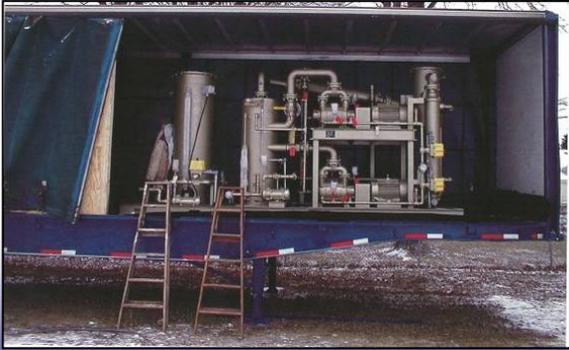
References

- None.

 Accessibility –
Facility
Operations



LPH recovery well



Multi-phase extraction trailer

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Notes:

Purpose of Slide

- Further discussion of remediation design considerations as they relate to accessibility and facility operations.

Key Points

- These photographs show ECs are protective of HH&E at operating facilities where there is limited access to portions of the facility.
- The multi-phase extraction trailer is at a chemical plant. The trailer is located outside the main part of the plant where it is safer and does not interfere with the operating facility.
- The light petroleum hydrocarbon (LPH) recovery well is placed outside the area of an operating facility where high pressure and high temperature equipment is present.

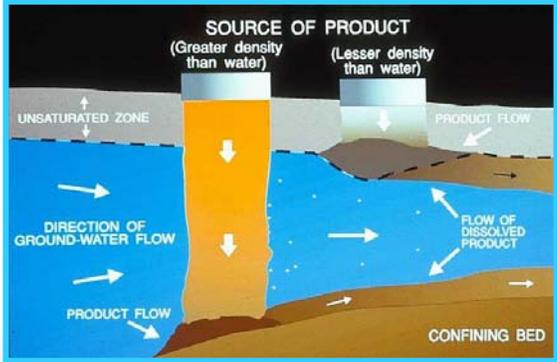
References

- None.



Site Conditions and Contaminant Distribution

- ❖ Hydrogeology
- ❖ Release characteristics
- ❖ Natural groundwater chemistry
- ❖ Natural environment



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Notes:

Purpose of Slide

- Discuss site conditions and contaminant distribution and their potential impacts on the remedy.

Key Points

- Site conditions and contaminant type and distribution are the characteristics that we generally focus on during the characterization and remedy selection phase.
- However, the other topics we are discussing in this module can be equally important because they can make the difference between a remedy being implementable and not.
- The types of contaminants, media, type of release, and age of release, will all affect the remedial approach.
- Type of contaminant –
 - What was released? VOCs? Semi-volatile organic compounds (SVOCs)? Metals?
 - NAPL (product) or dissolved phase (like rinse water)? Solid waste? Floaters or sinkers?
- Release characteristics –
 - How was the material released? Through a spill or a slow leak over numerous years?
 - A spill generally spreads out over a wide area and percolates downward.
 - A long, slow release generally tends to cover a smaller area, but may migrate deeper.
 - Age of release – When was the material released?
 - Time affects degradation (what are we dealing with now) and dispersion (how far have the contaminants spread).
 - Some byproducts can provide clues to what natural processes are occurring on site.
- Natural groundwater chemistry can affect treatment options. Slide 44 shows problems associated with high iron content.

References

- None.



Natural Groundwater Chemistry







Iron fouling



Calcium scale



Biofouling



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Notes:

Purpose of Slide

- Explain how the natural chemistry of the groundwater can affect treatment system design and cost. Anticipating issues is always preferred, but sometimes treatment problems do not show up until a system is running and modifications to design or maintenance become necessary.

Key Points

- This is an example of a site where a proven remedy – pump and treat groundwater contaminated with VOCs with air stripping technology – was implemented. Iron pretreatment was considered but eliminated in initial design due to high cost and some uncertainty of need, given the anticipated flow from multiple recovery wells with highly variable iron content combining as influent to the treatment system.
- The alternative to pretreatment was anticipating higher maintenance costs due to iron fouling at the air stripper. The operation and maintenance (O&M) plan and budget called for frequent cleaning and replacement of the packing material.
- However, iron oxidized at the collection pad due to aeration and affected system operation.
- The system was modified by replacing jet pumps. An air diaphragm pump was pilot tested at one of the treatment zones. It recovered groundwater at similar rates while lowering maintenance costs by reducing aeration and recirculation of the iron laden groundwater.
- Calcium scale can build up on air sparge packing material, and biofouling can also be a problem, depending on natural water chemistry.

References

- None.



Natural Environment



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Notes:

Purpose of Slide

- Review how natural site conditions can affect remedy selection.

Key Points

- Physical site conditions can be problematic for some remedies. In this photograph, a large front end loader is being used to extract a bull dozer mired in mud. This incident occurred while workers were trying to clear a path to install a monitoring well.
- The presence of wetlands can impact remedy selection. For instance, thermal treatment may damage natural habitats and therefore, may be eliminated as a remediation option when wetlands are present.

References

- None.



Pilot Studies



Bioaugmentation Unit





Air Sparge Unit

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Notes:

Purpose of Slide

- Discuss the concept of pilot studies to verify the feasibility/effectiveness of the selected technology(ies) to address site-specific conditions.

Key Points

- A pilot study is a focused, limited-scale test of a technology to determine its potential effectiveness under field conditions.
- Sometimes, a pilot study is preceded by a bench-scale test, which is a smaller lab-based test of the technology.
- Data from field observations are used to scale up the technology from the pilot-scale to the full-scale remedy.
- On some small sites, cleanup that is accomplished through a successful pilot study may actually turn out to be the final remedy.
- The unit shown on the left is a portable air sparge unit, originally used for a pilot study. At one site, this unit remediated groundwater to below MCLs in less than six months; it was used as a polishing step following pump and treat.
- The unit shown on the right is a bioaugmentation pilot trailer. Groundwater is extracted, amended with nutrients, and reinjected. Groundwater oxidation-reduction potential (ORP), pH, and temperature are read and logged electronically. The amended groundwater is then injected upgradient of the contaminant source area under gravity flow. After 12 months, contaminant mass in the source area was reduced by 97%, resulting in the elimination of a contaminated groundwater discharge to a stream and a change in remediation approach to monitoring only.
- In some cases, the pilot study will prove that a remedy is not effective and an alternative approach will be needed.

References

- None.



Waste Management

- ❖ Air Emissions
- ❖ Effluent Disposal
 - Where?
 - How?
- ❖ Remediation Waste Handling
 - storage
 - transport
 - testing

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Notes:

Purpose of Slide

- Discuss the importance of addressing waste management issues early in the remedy selection process – point out that waste management is discussed in greater detail in Module 9, Managing Remediation Waste.

Key Points

- Understanding the volume and nature of wastes that may be generated from each remediation option is important, given that waste management issues can limit available options. For example, if soil contains hazardous waste, excavation and off-site disposal may be cost prohibitive. Air emissions limitations may eliminate certain treatment options or mean that off-gas treatment may be necessary. Handling of treated effluent is a common challenge for groundwater pump and treat systems.
- RCRA regulations that address the handling and disposal of waste can affect the selection of remedies or specific designs, particularly to minimize the generation of hazardous waste during remediation.
- Air emissions from treatment technologies may be subject to the Maximum Achievable Control Technology (MACT) Rule for Site Remediation – The MACT final rule (40 CFR Part 63, subpart GGGGG) was published on October 8, 2003. It establishes national emission standards for hazardous air pollutants from site remediation activities. The rule covers remediation of contaminated environmental media, such as soils, groundwater or surface water. The affected sources subject to control are: process vents, remediation material management units, and equipment leaks. Currently, the final rule exempts emissions from site remediation when covered under CERCLA or RCRA CA programs (but this exemption has been challenged in court). The rule does not provide an exemption of cleanups conducted under alternative authorities, such as state voluntary programs. Even with the current exemption, the MACT applies to all cleanups not performed under a permit or 3008(h) order.
- Effluent disposal can be an issue – what do you do with treated groundwater? Options and considerations include:
 - Surface water discharge – National Pollution Discharge Elimination System (NPDES) permit
 - Exfiltration gallery – shallow disposal
 - Underground injection well – Underground Injection Control (UIC) permit required
 - Publicly-Owned Treatment Works (POTW) – may be cost prohibitive: (1) Is a pipeline required?, (2) Is a connection available nearby?
 - Permitted industrial pre-treatment facility – are the waste stream and process compatible?
- Some remediation wastes (soil, sludge) may have to be transported by truck for disposal to a non-hazardous or hazardous waste facility.

References

- Federal Register (FR). 2003. 40 Code of Federal Regulations (CFR) Part 63. National Emission Standards for Hazardous Air Pollutants; Site Remediation. Final Rule. 68 FR No. 195. October 8.
- EPA. Office of Air and Radiation Web Site. Includes link to the Proposed Rule from 2002 (<http://www.epa.gov/ttn/oarpg/t3/meta/m6058.html>).
- National Petrochemical and Refiners Association (NPRA) Website. Information on Site Remediation MACT and link to Final Rule Promulgated on October. Accessed On-line at: <http://www.npra.org/issues/environmental/other/remediation.cfm>.



Waste Management








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Notes:

Purpose of Slide

- Discuss solid wastes (remediation not investigation).

Key Points

- The handling and disposal of solid wastes is governed by RCRA regulations.
- Remediation technologies may generate large volumes of wastes that require transport for disposal or processing.
- A method to handle these wastes, room for staging, and a safe, accessible means of transport must be factored into remedy selection.
- The top photographs show waste soil being loaded into a roll-off container and covered roll-off containers being staged before disposal.
- The lower right photograph shows a dump truck being loaded for direct transport to a waste facility.
- Adequate space for staging containers should be available.
- In the upper left photograph, over 20 containers (40 cubic yards each) of contaminated soil excavated from a ditch were staged, awaiting characterization and disposal.

References

- None.



Selecting the Remedy: Remedy Matrix



Criteria	Pump and Treat	Air Sparge	Bio-remediation
Implementability	1 (effluent discharge)	3	2 (injection permit)
Cost (2 X Factor)	4	6	2
Effectiveness (3 X Factor)	3	6	9
Total	8	15	13

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Notes:

Purpose of Slide

- Show the utility of a matrix to compare and select remedies. Also point out that the threshold and balancing criteria are useful in evaluating options because they address both policy and field considerations important for selecting a remedy.

Key Points

- Feasibility studies are not required under RCRA CA, but facilities often evaluate multiple technologies for site cleanups. One effective way to select a remedy from a number of alternatives is to develop a matrix of remedial options, evaluation criteria, and associated weighting factors for the evaluation criteria. The speaker will describe the rows and columns shown on this slide. The scale used for each item ranges from 1 for low score to 3 for high score; these scores are then weighted as shown on the table.
- Weighting factors are established to represent the importance of a criterion to a facility. For instance, in this example, the facility considers effectiveness to be the most important criterion and it is weighted by a factor of 3.
- In the example shown, the technology selected for implementation would be air sparging based on the selection criteria and weighting factors applied.
- This screening approach can be implemented before complete characterization of the facility is accomplished. For instance, air sparge could be tentatively selected as the most appropriate remedy based on current information, with a subsequent pilot test used to evaluate the implementability of the remedy (for example, adequate radius of influence). Based on pilot test results, air sparge might remain as the final remedy or another remedy may be more deemed more appropriate. In this case, air sparge was appropriate for one part of the site and bioaugmentation was used for another part of the site.
- It is not always necessary to prepare a CMS containing detailed evaluations and descriptions of various remedial alternatives considered for the facility. The CMS or equivalent document need only present the selected remedial alternative and the basis for its selection. This streamlined approach is more efficient and cost effective than presenting the full range of technologies considered.

References

- None.



Green Remediation Evaluation

	<i>ZVI-Clay In Situ Treatment</i>	<i>Excavation & Off-Site Disposal</i>	<i>Ex-Situ Thermal Desorption</i>	<i>Soil Vapor Extraction</i>	<i>Capping</i>
<i>Tons of CO₂ Equivalents</i>	85	252	586	306	21

Adapted From: Deborah Goldblum (EPA). 2007. Integrating Sustainability into EPA's Cleanup programs. Region 3: RCRA Dupont Pilot. June 27.

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Notes:

Purpose of Slide

- Present a potential additional row in a broader remediation technology matrix to address green remediation - in this case, carbon dioxide (CO₂) emissions from a variety of alternative remedies under consideration are compared.

Key Points

- This is from an EPA Region 3 pilot study, which focused on integrating sustainability into cleanups and identified sustainability goals, performance measures, and implementation options.
- Sustainability performance measures included consideration of greenhouse gases produced, resources consumed (land, soil, water), and energy consumed.
- This table shows the greenhouse gas emissions calculated based on implementation of five remedial options (ZVI is zero valent iron). In addition to the threshold and balancing criteria, this type of information can be used in the evaluation and selection of a remedy.

References

- EPA. 2007. Integrating Sustainability into EPA's Cleanup Programs. Region 3 RCRA DuPont Pilot. Author Deborah Goldblum. June 27.



Summary

- ❖ Remedy selection includes
 - Policy considerations
 - Field considerations
- ❖ The regulator's focus is on achieving a protective and effective remedy within a reasonable timeframe.

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Module 7 – Selecting and Approving a Protective Remedy

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Notes:

Purpose of Slide

- Summarize the key points of this module.

Key Points

- The participants will have reviewed and learned about a variety of considerations for selecting remedies and achieving a Remedy Decision.
 - Only some of these considerations are technical (related to hydrogeology, chemistry, and transport of contaminants); policy considerations are also important.
 - It is important to remember that field considerations, such as access and right of way, also can impact remedy selection and implementation.
- We have discussed the importance of a results-based approach and the application of the flexibility allowed under the RCRA CA program to select protective remedies that will meet cleanup criteria in reasonable timeframes based on current and reasonably anticipated uses.

References

- None.

Module 08
Remediation Technologies



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



February 2009 Module 8 - Remediation Technologies 1

Notes:Purpose of Slide

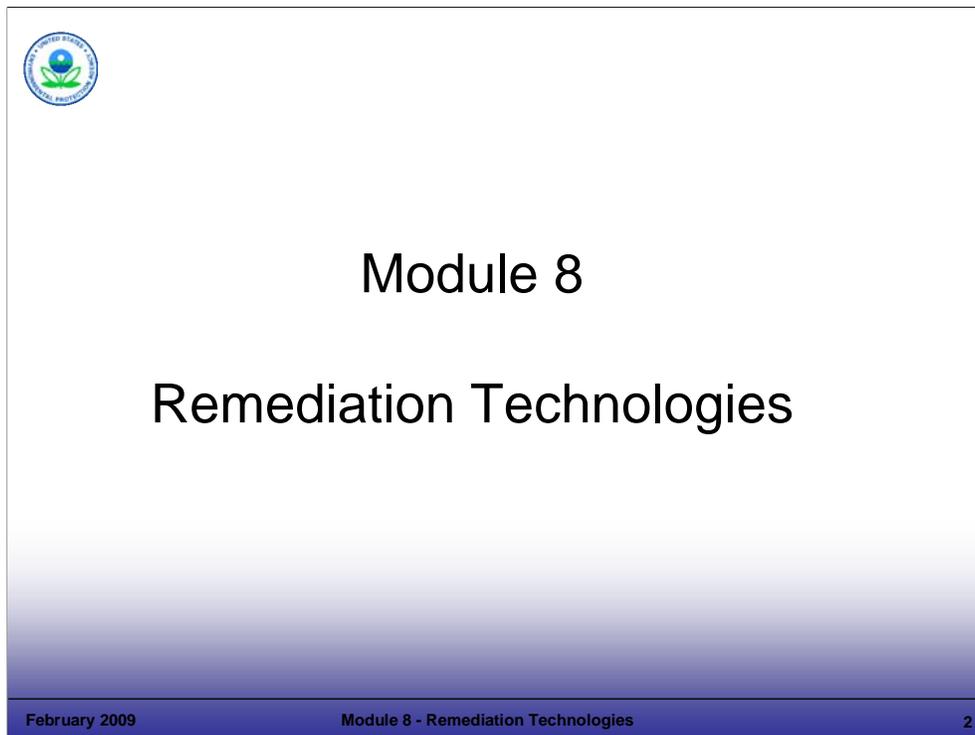
- Holder slide for Module 8, Remediation Technologies.

Key Points

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

References

- None.



Notes:

Purpose of Slide

- Holder slide for Module 8, Remediation Technologies.

Key Points

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

References

- None.



Module Overview

- ❖ Common remediation technologies
- ❖ Remediation considerations for non-aqueous phase liquids

February 2009

Module 8 - Remediation Technologies

3

Notes:

Purpose of Slide

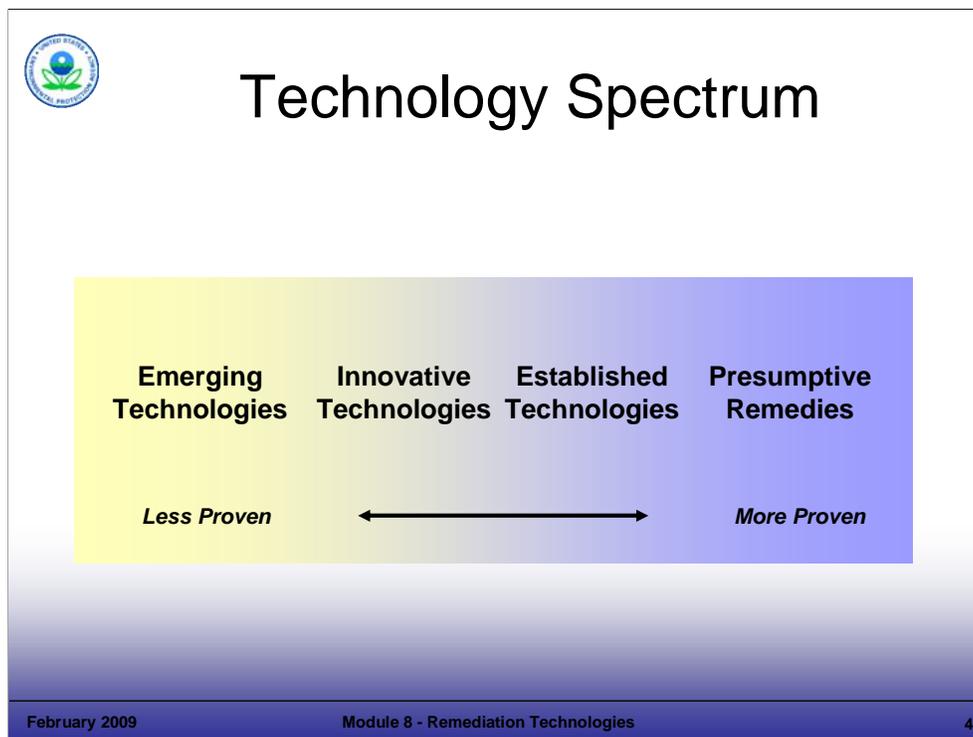
- Introduce Module 8, Remediation Technologies.

Key Points

- The primary purpose of this module is to present and discuss remediation technologies, which support existing CA and other remedies. Knowledge of these technologies is important to remedy selection, implementation, and achievement of the 2020 Vision. This module presents common remediation technologies primarily for soil and groundwater contamination found at corrective action (CA) sites. Sediment remediation will be touched on and most of the treatment technologies for soil (particularly ex situ) also are applicable to sediment. Many of these existing technologies will continue to be used in the foreseeable future.
- This module also discusses technologies and approaches associated with a special category of contamination, non-aqueous phase liquids (NAPLs).

References

- None.



Notes:

Purpose of Slide

- Introduce the remedy, or technology, spectrum.

Key Points

- The remedy spectrum can be thought of as a progression from less proven, developing technologies to more proven technologies for remediation. The status of a technology depends both on technology (for example, bioremediation) and its application. Bioremediation may be presumptive and proven for wood treatment sites, but less developed and innovative for application at another type of site.
- "Presumptive remedies" is a Superfund tool that refers to standardized preferred response actions for municipal landfills, wood treatment, volatile organic compounds (VOCs) in soil, contaminated groundwater, and metals in soil. The U.S. Environmental Protection Agency (EPA) recognized that certain types of sites have similar characteristics that lend themselves to preferred technologies. These presumptive remedies streamline remedy selection and allow an early focus of data collection to support design and implementation of the remedy.
- Presumptive remedies include: (1) bioremediation, thermal desorption, or incineration for organics and immobilization for metals at wood treatment sites; (2) soil vapor extraction (SVE) for VOCs in soil; (3) a phased approach to groundwater remediation; and (4) reclamation and recovery or immobilization for metals in soil.
- An established technology is a technology for which cost and performance information is readily available. Only after a technology has been used at many different sites and the results have been fully documented is that technology considered to be established.
- An innovative technology is a technology that has been field-tested and applied to a hazardous waste problem at a site; but it lacks a long history of full-scale use. More cost and performance information is generally needed to evaluate the technology for wider use.
- An emerging technology is one that is undergoing bench-scale testing in which a small version of the technology is tested in a laboratory; these technologies generally have not been tested at full-scale use.

References

- EPA. 1996. Presumptive Response Strategy and Ex-situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites. EPA-540-R-96-023. October.
- EPA. 2005. Road Map to Understanding Innovative Technology Options for Brownfield's Investigation and Cleanup. Fourth Edition. EPA-542-B-05-001. September.



Common Soil Remediation Technologies

- ❖ Excavation and *ex situ* treatment/disposal
- ❖ Solidification/stabilization
- ❖ Soil vapor extraction

February 2009 Module 8 - Remediation Technologies 5

Notes:

Purpose of Slide

- Introduce commonly used soil remediation technologies for CA cleanups.

Key Points

- These technologies – excavation, solidification/stabilization, and SVE – are some of the most commonly used technologies for addressing contaminated soils and source materials. Of the sites addressed under the EPA Superfund Program between 1982 and 2002, 89 percent of the soil remedies involved these three technologies.
- There are also a number of technologies that have been used less frequently; however, these also can be considered for soil cleanups. Examples of these technologies include: soil washing, in situ thermal treatment, and bioremediation. Descriptions of these technologies and their potential uses can be found on EPA's CLU-IN Website and various other government agency and non-government organization websites such as those provided by the Interstate Technology Regulatory Council (ITRC), Federal Remediation Technology Roundtable (FRTR), U.S. Army Corps of Engineers (USACE), and Department of Energy (DOE). Note that these newer technologies are innovative for some applications but can be presumptive for certain applications where they have been successfully applied over time (for example, bioremediation for wood treating sites).

References

- Clu-In Web Site. Accessed On-Line at: <http://www.clu-in.org/>.
- Federal Remediation Technologies Roundtable (FRTR) Website. Accessed On-line at: <http://www.frtr.gov/>.
- Department of Energy (DOE) Website. Accessed On-line at: <http://www.em.doe.gov/pages/emhome.aspx>.
- Interstate Technology Regulatory Council (ITRC) Website. Accessed On-line at: <http://www.itrcweb.org/>.



Soil Excavation

- ❖ Removes contaminated soil and commingled materials (waste, sludge, and debris) for management.
- ❖ Excavated soil can be treated by various *ex situ* technologies.
- ❖ On site placement of treated soil may be an option.



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Module 8 - Remediation Technologies

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Notes:

Purpose of Slide

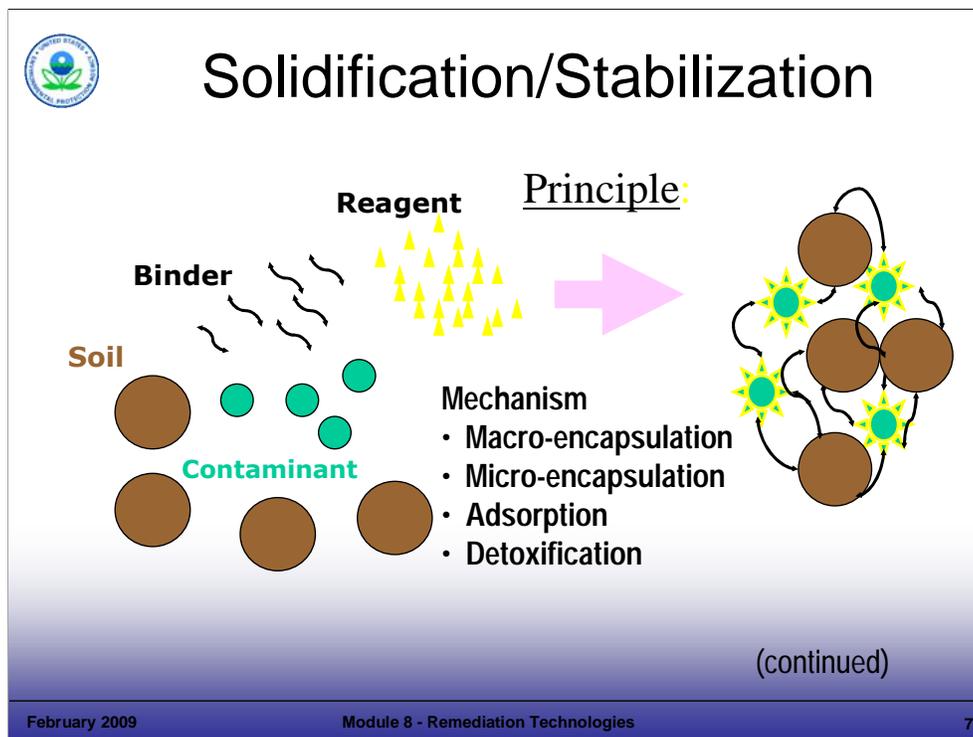
- Discuss soil excavation.

Key Points

- Excavation is primarily used to remediate small volumes of highly contaminated soil; however, it has also been used for large soil volumes when other, more-sophisticated technologies would be less effective or more costly.
- Excavation involves removing contaminated soil and commingled materials (for example, buried wastes and debris) for subsequent treatment and disposal or reuse.
- A number of methods are commonly used to manage excavated source material, including on-site or off-site solidification/stabilization, incineration, thermal desorption, and landfilling.
- Contaminated soil that exhibits a characteristic or contains a listed hazardous waste is subject to hazardous waste rules including Land Disposal Restrictions (LDRs). The Phase IV LDR Rule created a new treatability group, contaminated soil. The treatment requirements for this group are discussed in Module 9.
- After treatment, soil may be reused as backfill if it meets applicable site cleanup goals for soil (and is not otherwise regulated as a hazardous waste, which is subject to LDR requirements). Soil that cannot be economically treated for reuse may require disposal, after appropriate treatment, in an appropriate land disposal unit.

References

- None.

**Notes:**Purpose of Slide

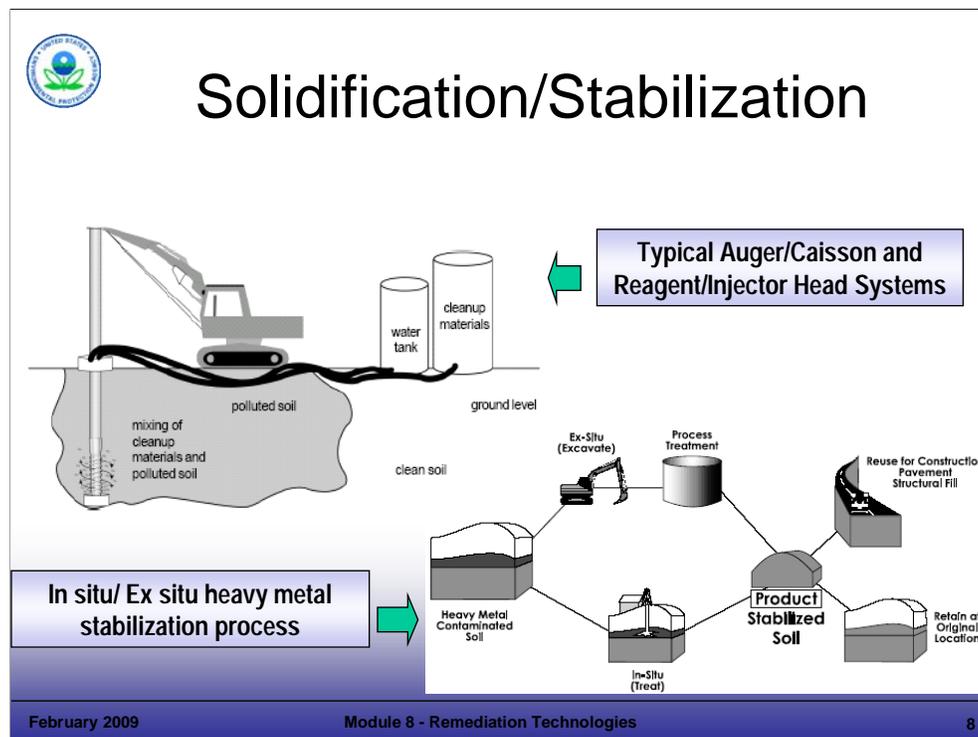
- Discuss Stabilization/Solidification (S/S) as a treatment process.

Key Points

- S/S refers to a group of cleanup methods that prevent or slow the release of harmful chemicals from polluted soil or sludge. S/S methods do not destroy contaminants, but act to eliminate or reduce the solubility or mobility of contaminants by generally decreasing the surface area of the soil or other material exposed to leaching.
- Solidification refers to processes that encapsulate a waste to form a solid material and to restrict contaminant migration by decreasing the surface area exposed to leaching and/or by coating the waste with low-permeability materials. Solidification can be accomplished by a chemical reaction between a waste and binding (solidifying) reagents or by mechanical processes. Solidification of fine waste particles is referred to as microencapsulation, while solidification of a large block or container of waste is referred to as macroencapsulation (Solidification/Stabilization Use at Superfund Sites).
- Stabilization refers to processes that involve chemical reactions that reduce the leachability of a waste. Stabilization chemically immobilizes hazardous materials or reduces their solubility through a chemical reaction. The physical nature of the waste may or may not be changed by this process (Solidification/Stabilization Use at Superfund Sites).
- These two methods are often used together to prevent exposure to harmful chemicals.

References

- Conner, J. R. 1990. *Chemical Fixation and Solidification of Hazardous Wastes*. Van Nostrand Reinhold. New York.
- EPA. 1999. Solidification/Stabilization Resource Guide. EPA-542-B-99-002. April.
- EPA. 2000. Solidification/Stabilization Use at Superfund Sites. EPA-542-R-00-010. September.
- EPA. 2001. A Citizen's Guide to Solidification/Solidification. EPA-542-F-01-024. December.
- LaGrega, M. D., Buckingham, P. L., Evans J. C. 1994. *Hazardous Waste Management*. McGraw-Hill Series in water resources and Environmental Engineering.
- EPA. 2004. Record of Decision (ROD) for Avtex Fibers Site, including Stabilization of Soils with Metals. EPA-ROD-R03-04-601. Accessed On-line at: <http://www.epa.gov/reg3hwmd/super/sites/VAD070358684/index.htm>.
- Yong, R. N. 2000. *Geoenvironmental Engineering: Contaminated Soils, Pollutant Fate and Mitigation*, 307 pp. CRC Press, Boca Raton, FL.
- EPA. 2007. Annual Status Report. Twelfth Edition. EPA-542-R-07-012. September. Accessed at the Clu-In Website at: <http://clu-in.org/asr/>.
- Sanjay K. Mohanty. 2004. Powerpoint Presentation: Solidification/Stabilization. Civil & Environmental Engineering Department. University of Hawaii at Manoa. December.



Notes:

Purpose of Slide

- Discuss S/S applications.

Key Points

- S/S can be used to treat excavated soil. In most cases, excavated soil is mixed with treatment materials in a pug mill or by other means and the S/S soil is returned to the ground on the site, if rules allow such placement.
- Although less frequently used, a number of in situ S/S applications have also been developed. These include methods where the binders are introduced into the ground and mixed with the contaminated soil (for example, using vertical auger mixing, shallow in-place mixing, and injection grouting). The challenge with in situ S/S methods is achieving uniform mixing of soil and binders.
- To date, most S/S applications have been used to address metals in soil. The primary treatment binders have been Portland Cement, soluble phosphate, fly ash, lime, bitumen, asphalt, and proprietary blends.
- Limitations on the usefulness of S/S may include:
 - Most S/S technologies are not effective for organics;
 - S/S can significantly increase the volume of the materials that need to be disposed;
 - Cement-based agents can weather and disintegrate over time; thereby, releasing contaminants;
 - Future site use may be hindered by the presence of treated materials; and
 - Long-term effectiveness of S/S has not been demonstrated for many contaminants.

References

- See previous page.
- Sanjay K. Mohanty. 2004. Powerpoint Presentation: Solidification/Stabilization. Civil & Environmental Engineering Department. University of Hawaii at Manoa. December (used for slide).



Soil Vapor Extraction (SVE)

- ❖ Vacuum applied to soil in unsaturated zone
- ❖ Removes volatile organic compounds (VOCs) and some semi-volatile organic compounds (SVOCs)
- ❖ Can be used alone or combined with air sparging

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Notes:

Purpose of Slide

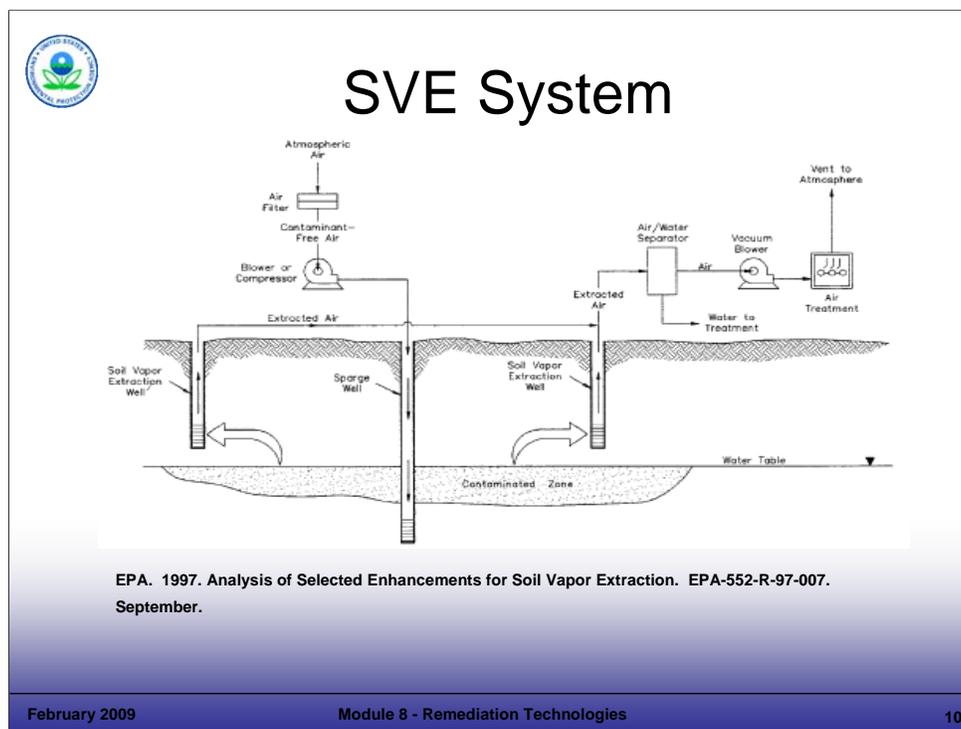
- Introduce soil vapor extraction (SVE).

Key Points

- SVE is a technology used in situ in unsaturated (vadose) zone soils. A vacuum is applied to the soil using SVE wells to induce a controlled flow of air and remove VOCs and some semi-volatile organic compounds (SVOCs) from the soil.
- SVE can be used in conjunction with air sparging of underlying groundwater to extract mobilized contaminants or can be used as a stand-alone technology to treat soil contamination.
- Vertical SVE wells are typically used at depths of about 5 feet but have been successfully applied to much greater depths. Horizontal SVE wells (installed in trenches or horizontal borings) can be also be used, as applicable.
- This technology is considered the preferred presumptive remedy for VOCs in soil.
- A consideration in SVE application is that off gas may require treatment, such as by activated carbon, to eliminate possible ambient air impacts.
- Factors that may limit the applicability and effectiveness of SVE include:
 - Tight soils may not allow sufficiently high vacuums to remove contaminants;
 - Large screen intervals are required in extraction wells for soil with highly variable permeabilities or stratification; and
 - Soil with high organic content or that is extremely dry, has a high sorption capacity for VOCs, which results in reduced removal rates.

References

- EPA. 1996. User's Guide to the VOCs in Soils Presumptive Remedy. EPA/540/F-96/008. July. Accessed On-line at: <http://www.epa.gov/superfund/policy/remedy/presump/finalpdf/vc.pdf>.



Notes:

Purpose of Slide

- Illustrate a SVE system.

Key Points

- This slide depicts a SVE system used in conjunction with an air sparging system to remediate contaminated groundwater. The central part of the slide depicts an air sparge source and a well that may be used in conjunction with the SVE system.
- A vacuum system collects vapor from subsurface wells (horizontal or vertical) and vents it to the atmosphere. Collected vapor may require treatment before release to the atmosphere.
- The vacuum source may be a liquid ring vacuum pump (very high vacuum), a positive displacement blower (moderate vacuum), or even a centrifugal blower (low vacuum).

References

- EPA. 1997. Analysis of Selected Enhancements for Soil Vapor Extraction. EPA-542-R-97-007. September.
- EPA. 2006. Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice. EPA-542-R-05-028. March.



Remediation Approaches to Contaminated Sediments

- ❖ Dredging and excavation
- ❖ In-situ capping
- ❖ Monitored Natural Recovery (MNR)
- ❖ In-situ treatment
- ❖ Institutional controls (e.g., fish advisories or fishing bans)

<http://www.epa.gov/superfund/health/conmedia/sediment/ssrc.htm>



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Notes:

Purpose of Slide

- Introduce various remedial approaches to sediment and compare these to soil remedial approaches.

Key Points

- Dredging and excavation are the most common means of removing contaminated sediment from a water body. Once excavated, ex-situ treatment and disposal remedies similar to those for soil can be employed.
- Capping technologies provide a separation barrier that (1) isolates contaminants from benthic organisms, (2) stabilizes sediment and prevents re-suspension and transport, and (3) chemically isolates contaminants to reduce dissolved and colloidal transport. Benthic organisms populate only the top few centimeters of sediment. The specific habitat conditions and associated capping requirements are evaluated as part of the feasibility study. Thin layer capping (compared to other caps that can be several feet thick) can be used to enhance monitored natural recovery (MNR) by providing some isolation and time for MNR to occur. Thin layers are often constructed of native material and may be only a few inches thick.
- MNR, with or without institutional controls (ICs), may be an appropriate remedy that uses natural processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants. MNR is terminology specific to sediments and differs from monitored natural attenuation (MNA) in that for MNR, isolation and mixing through natural sedimentation, versus transformation for MNA, is the process most relied on. An ecological risk assessment provides information important to MNR and other remediation approaches.
- In-situ treatment addresses sediment in place. For example, caps containing reactive materials (such as, activated carbon and zero-valent iron) further limit the transport of contaminants into the water column by bonding with the contaminants. Bio-enhancement amendments can be added (for example, an electron donor) to accelerate biodegradation processes.
- ICs may be required in addition to remediation approaches; for example, fish advisories or fishing bans may be instituted for a period of time.
- Resources like the Superfund Sediment Resource Center can provide Project Managers with site specific support for challenging sediment remediation questions.

References

- EPA Contaminated Sediment web site. <http://www.epa.gov/superfund/health/conmedia/sediment/ssrc.htm>
- EPA. 2006. Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. EPA-540-R-05-012. December.
- Electrical Power Research Institute (EPRI). 2006. Reactive Capping for Non Aqueous Phase Liquid-Sediments: An In-Situ Evaluation of Effectiveness and Ease of Implementation.



Examples of Mechanical Dredges for Sediment

- A. Cable Arm Corp. Dredge
- B. Bean Company Horizontal Profiling Grab (HPG) Dredge, New Bedford Site

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Notes:Purpose of Slide

- Illustrate mechanical dredging.

Key Points

- This slide depicts mechanical dredging. The distinction between mechanical dredging and excavation is that the mechanical dredge operates on a floating platform.
- The source for the first photograph is Cable Arm, Corporation. The source for the second photograph is Barbara Bergen, EPA.

References

- EPA. 2005. Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. EPA-540-R-05-012. December



Common Groundwater Remediation Technologies

Ex-Situ Technologies/Approaches

- ❖ Pump & Treat
- ❖ Multi-Phase Extraction
- ❖ Air Stripping
- ❖ Carbon Adsorption

(continued)

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Notes:Purpose of Slide

- Introduce common groundwater technologies likely to be encountered at CA sites.

Key Points

- This slide shows some of the common ex-situ groundwater remediation technologies in use. Each will be covered in this section.

References

- None.



Common Groundwater Remediation Technologies

In-Situ Technologies/Approaches

- ❖ Air Sparging
- ❖ Bioremediation
- ❖ Chemical Oxidation
- ❖ Permeable Reactive Barrier
- ❖ Monitored Natural Attenuation

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Notes:Purpose of Slide

- Introduce common groundwater technologies likely to be encountered at CA sites.

Key Points

- This slide shows some of the common in-situ groundwater remediation technologies in use. Each will be covered in this section.

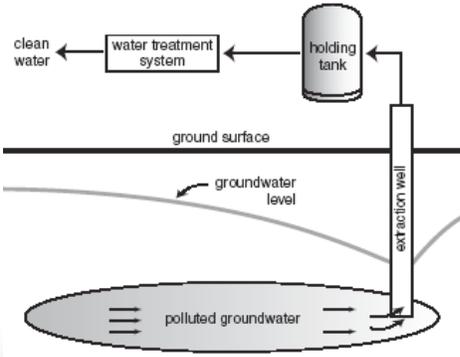
References

- None.



Groundwater Extraction (Pump and Treat)

- ❖ Can be effective in controlling contaminant migration and reducing contaminant mass.
- ❖ Recovery wells may be drilled vertically or horizontally or trenched (interceptor trench).



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Notes:

Purpose of Slide

- Introduce pump and treat technology.

Key Points

- Groundwater pump and treat (P&T) systems are commonly used to contain dissolved phase contaminant plumes, reduce migration, and remove mass. P&T is not generally effective as the sole remedy for achieving groundwater cleanup criteria; however, experience has shown that it can be quite effective in reducing the size of a dissolved contaminant plume.
- In P&T systems, one or more groundwater recovery wells are used to extract (pump) groundwater that is then treated, usually in an on-site treatment system.
- P&T systems have been used for groundwater remediation at many RCRA CA facilities and over 90% of Superfund sites.
- Groundwater extraction systems may include vertical or horizontal recovery wells or infiltration trenches.
- Factors that may limit the applicability and effectiveness of groundwater P&T include:
 - Many contaminants tend to be absorbed in the soil matrix and cannot be removed completely by groundwater pumping;
 - P&T is not applicable to sites with high residual saturation and aquifers with low hydraulic conductivity;
 - The capital and on-going operating costs of treatment systems is generally high because the P&T system will likely require a long time to operate to achieve the groundwater cleanup goals; and
 - Biofouling of recovery wells and treatment system components is a common problem that can severely affect system performance.

References

- EPA. 2001. A Citizen's Guide to Pump and Treat. EPA 542-F-01-025. December.
- EPA OSWER. 1996. Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites. Final Guidance. OSWER Publication 9283.1-12. EPA 540-R-96-023. October.



Vertical Recovery Wells







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Notes:

Purpose of Slide

- Show drill rigs in action – vertical drilling.

Key Points

- A Rotasonic drill rig is a relatively recent drilling innovation that is used to install wells with minimal waste and to provide soil cores with little smearing. This technique uses a rotating drill bit vibrating at a high frequency as the bit is advanced. A wheel-mounted rig is shown on the left and a track mounted unit is shown on the right.
- A typical submersible pump used in recovery wells is shown in cross-section on the right of the slide.
- Pumps are selected based on well yield results and how much head is required to lift and transport the water.
 - Small, submersible, recovery pumps are usually single-phase electric motors (up to about 2-3 horsepower [HP]);
 - Larger recovery pumps are usually three-phase motors (as small as 1 HP and up to 100 HP or more); and
 - Pneumatic pumps (direct acting or piston type) may be used in some applications. They have unique advantages and work very well at low flow rates.

References

- None.



Horizontal Recovery Wells





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Notes:

Purpose of Slide

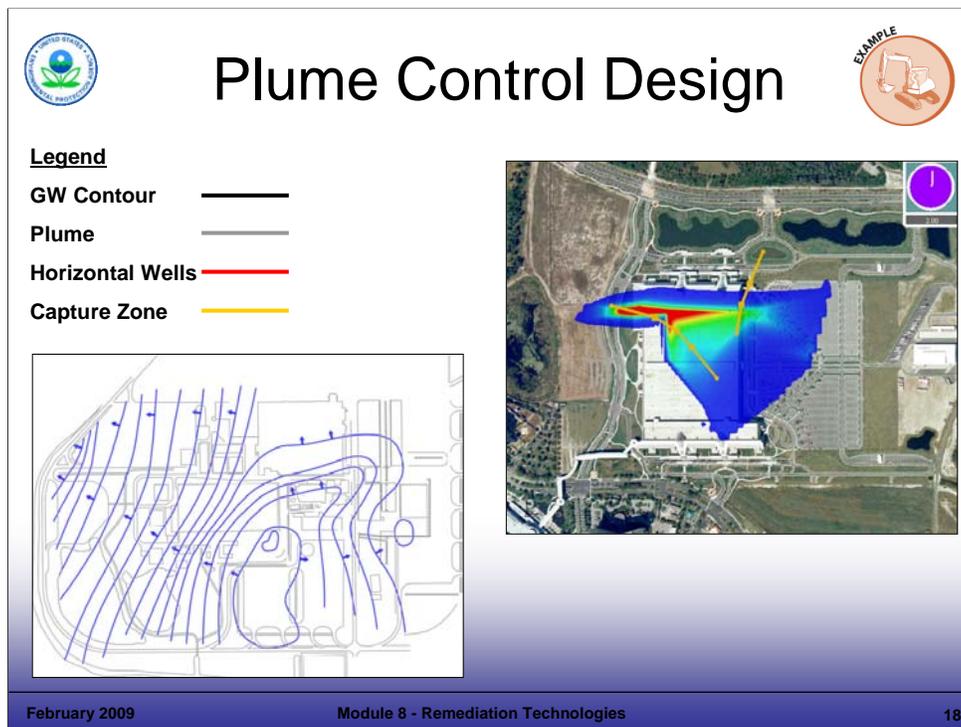
- Show installation of horizontal recovery wells.

Key Points

- Horizontal wells can be installed by conventional trenching techniques such as using a backhoe or by specialty machines similar to chain-type trenchers.
- The photograph on the left shows a trenched horizontal well being installed using a special machine (one-pass trencher) that lays the perforated or slotted pipe at the bottom of the trench. Backfill material (sand, soil, gravel) is continuously fed through the hopper to fill the trench as the machine advances. The depth of these horizontal wells is generally limited to 30 feet below grade; however, depths of up to 50 feet or more are possible with advanced equipment.
- The second photograph shows another technique for horizontal drilling, using a computer controlled, remotely-guided drill head to bore the hole. This method allows placement of wells under existing structures without interfering with operations. In this application, two horizontal wells - 900 feet and 1200 feet in length - were installed under an active defense manufacturing facility.
- For drilled horizontal wells, the drill head has an entrance point and exit point and, once begun, the borehole must be completed without stopping. The well casing may be steel or polyethylene pipe, which is connected to the drill rod at the exit hole and then pulled back through the hole.

References

- None.

**Notes:**Purpose of Slide

- Demonstrate a model of plume spread then capture (video clip will be included).

Key Points

- This graphic shows a contaminant plume as it spreads under a manufacturing facility (gray shadow).
- Horizontal wells were installed under the facility to capture the plume (red lines).
- The plume shrinks as water is extracted, as shown by the changes in contour lines.
- The resulting capture zone is shown by the yellow lines.
- The resultant controlled plume with two horizontal wells operating is shown last.

References

- None.



Notes:

Purpose of Slide

- Show installation of groundwater extraction trench.

Key Points

- Extraction trenches are similar to horizontal recovery wells, but are much simpler applications. They are installed by conventional trenching techniques such as a backhoe.
- This extraction system includes a trench and drain, a collection sump, and a submersible pump. This system was selected for this site, primarily because of the site's low groundwater flux. The system was constructed to capture a small, well-defined groundwater plume (more specifically, it captures groundwater moving downgradient in the zone perpendicular to the trench and drain and above a competent bedrock).
- The photograph on the left shows the extraction trench during installation. The trench was about 15 feet deep. The second step in constructing the trench and drain is completing the drain. A perforated drainage pipe was run along the length of the trench. It was suspended a few inches above the trench bottom (on a 3/4-inch-minus-drainage gravel bedding) and slopes toward the sump. The trench was backfilled with drainage gravel and a geotextile fabric was placed above the gravel to minimize transport of fine-grained soils into the 4-inch perforated drainage pipe bedded in the drainage rock. A clean-out port was installed at the upgradient side of the trench and drain to facilitate flushing of the drain pipe with water. This removes any solids accumulation from the pipe. A collection sump placed at the downstream end of the trench allows intermittent- and variable-rate pumping based on changes in groundwater flux. Modeling of the contaminants expected in the recovered groundwater indicated that concentrations would be below the limits established for discharge to the publicly-owned treatment works (POTW). Therefore, groundwater collected in the sump discharges to the City POTW in accordance with city discharge limitations. Discharges are monitored to verify concentrations meet discharge limitations.
- In this example, if it is determined that the VOC concentrations in the recovered groundwater exceed the City's discharge limits and cannot be accepted by the City under the terms of a variance, the facility will install an air stripper to pretreat recovered groundwater before discharge to the POTW.
- After installation, the trench and drain were backfilled above the drainage gravel and a berm was constructed. The berm helps to divert stormwater runoff from the area around the trench and drain.

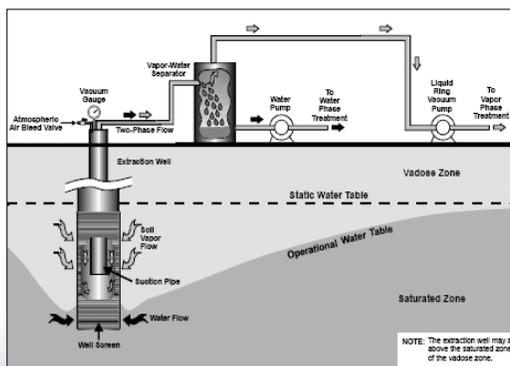
References

- None.



Multi-Phase Extraction

- ❖ Vacuum applied to well to extract groundwater and vapor simultaneously
- ❖ Water table lowered around well, exposing previously saturated zone to vacuum extraction



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Notes:

Purpose of Slide

- Introduce multi-phase extraction.

Key Points

- Multi-phase extraction (MPE) is sometimes referred to as dual-phase extraction. In MPE, a vacuum is applied to recovery wells and is used to extract both groundwater and soil vapors simultaneously. The vacuum source may be a liquid ring vacuum pump or a dry pump.
- Groundwater is removed from the recovery well by a vacuum that is applied to a drop pipe in the well. Vapor is removed from the recovery well by a vacuum that is applied to the well above the water table. As groundwater is extracted from the well and the water level around the well drops, the well screen is exposed and vapors from the soil are drawn into the casing by the vacuum system.
- Factors that may limit the applicability and effectiveness of MPE include those applicable to groundwater P&T and SVE systems (including high operating costs and biofouling). As with SVE systems, a consideration in system application is the potential need for off-gas treatment.

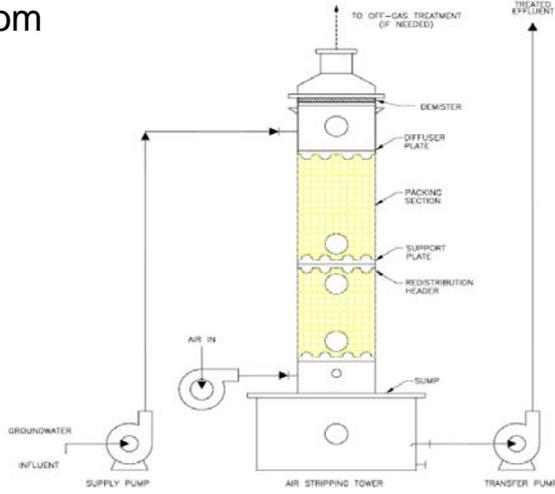
References

- EPA. 1997. Presumptive Remedy: Supplemental Bulletin, Multi-Phase Extraction Technology for VOCs in Soil and Groundwater. EPA 540-F-97-004. April. Accessed On-line at: <http://www.cluin.org/download/toolkit/finalapr.pdf>.
- EPA. 1997. Analysis of Selected Enhancements for Soil Vapor Extraction. EPA-542-R-97-007. September. Accessed On-line at: <http://www.cluin.org/download/remed/sveenhmt.pdf>



Air Stripping

- ❖ Transfers VOCs from treated water to ambient air
- ❖ Fouling may be problem at some sites

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Notes:

Purpose of Slide: Introduce air stripping.

Key Points

- Air stripping is commonly used for ex-situ treatment of recovered groundwater. It is usually the treatment part of P&T systems.
- Air stripping is a phase separation technology. Air is forced counter-current to water flowing through the stripper, which transfers VOCs from the water to the air.
- The stripability of a compound is a function of Henry's Law constant, an equilibrium constant that defines the behavior of the compound in relatively dilute contaminant concentrations.
- Air to water ratios are based on the specific compounds being removed. Typically, a ratio of air to water (volume) of 50:1 to 100:1 is used.
- Pretreatment of groundwater is sometimes required. Filtration is the most common pretreatment to remove suspended solids. Dissolved inorganics (such as calcium) may be treated in several ways to control fouling. Unoxidized iron may require special consideration, including: oxidation and filtration, sequestering agents, or frequent cleaning.
- This slide shows a typical vertical air stripping tower (AST) known as a packed column; plastic packing material is used to create more surface area for air/water contact.
- Water enters the top of the tower through a spray nozzle and trickles down through the packing material in the column. Air is forced upward by a blower and exits through a baffle or mesh mist eliminator at the top.
- Treated water collects in the sump and is transported using a pump for further treatment (as necessary) and disposal.
- Off-gas treatment (usually granular activated carbon) and/or an air permit may be needed for operation of the air stripper. Air dispersion modeling using ISCST or TSCREEN is frequently used during design to plan for, and address, potential air impacts.
- The following factors may limit the applicability and effectiveness of the air stripping process:
 - Energy costs for operating air strippers are typically high;
 - Fouling of the packing material and other stripper components with minerals (iron, scale) and biological growth is a frequent problem. Fouling reduces efficiency of the stripper and may cause ineffective water treatment. Fouling can be addressed by pre-treatment of water or routine cleaning and packing change-out; and
 - Air stripping is not effective for inorganics or VOCs with low Henry's Law constants (for example, acetone and phenol).

References

- FRTR. 2002. Remediation Technologies Screening Matrix and Reference Guide. Version 4.0. January.

 **Air Stripper Types** 



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Notes:

Purpose of Slide

- Illustrate different types of air strippers.

Key Points

- Air stripping devices come in many shapes and sizes.
- Horizontal tray strippers use stacked trays with small holes to allow the water to flow downward while the air flows upward.
- Diffused aerators use sparge pipes with small diameter holes, submerged in tanks, to inject air into the water.
- The pictures above show clockwise, from upper left:
 - Horizontal tray stripper, 200 gallons per minute (GPM);
 - Packed column tower, 35 GPM, 75 feet high;
 - Two packed column towers, 300 GPM each; and
 - Packed column tower, 90 GPM, 45 feet high.

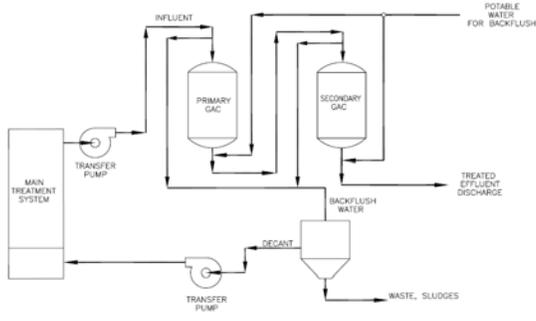
References

- None.



Granular Activated Carbon (GAC)

- ❖ Removes low contaminant concentrations in groundwater and off-gas streams
- ❖ GAC may be regenerated on site or off site



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Notes:

Purpose of Slide

- Introduce carbon as a treatment technology.

Key Points

- Granular activated carbon (GAC) adsorption is a common technology that is used for primary or secondary treatment of effluent streams. As a secondary treatment, it is used to polish the effluent from a primary treatment system or to act as a backup system in case the primary treatment allows breakthrough. GAC is also a common adsorbent used to treat SVE and air stripper off-gases.
- GAC is used to treat a range of VOCs.
- The relatively low initial capital cost of GAC systems makes them particularly attractive for short-term SVE applications when dilute concentrations of VOCs are present.
- Carbon may be regenerated on site or may be taken to a treatment facility for processing.
- A schematic of a typical GAC system is shown in the slide, with primary and secondary units. After breakthrough occurs in the primary unit, the secondary unit takes over as the primary treatment unit. The spent primary unit is then regenerated or replaced and becomes the secondary unit. Potable water is used to backwash the GAC units to remove solids and some contaminants.
- The following factors may limit the applicability and effectiveness of the process:
 - The presence of multiple contaminants can impact process performance;
 - Streams with high suspended solids and oil and grease may cause fouling of the carbon and may require pretreatment;
 - Costs are high if used as the primary treatment on waste streams with high contaminant concentration levels; and
 - GAC is not effective for treating VOCs with high polarity (for example, alcohols and organic acids) or high vapor pressures (for example, vinyl chloride and methylene chloride).

References

- FRTR. 2002. Remediation Technologies Screening Matrix and Reference Guide. Version 4.0. January.



GAC Units





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Notes:

Purpose of Slide

- Present a photograph of large carbon vessels.

Key Points

- These dual units each contain 20,000 pounds of GAC. They treat the groundwater effluent from an air stripping system prior to discharge to a POTW.
- The design flow rate for this system was 400 GPM. Concentrations were low at these units and the units were mainly intended as a final polish, not for primary removal.
- VOCs were removed in an air stripping system ahead of the GAC units. The GAC units also captured SVOCs not removed by air stripping.
- Size was selected based upon projected loading of the contaminants and the desired change-out frequency for the bed. In this case, only four change outs a year were estimated.

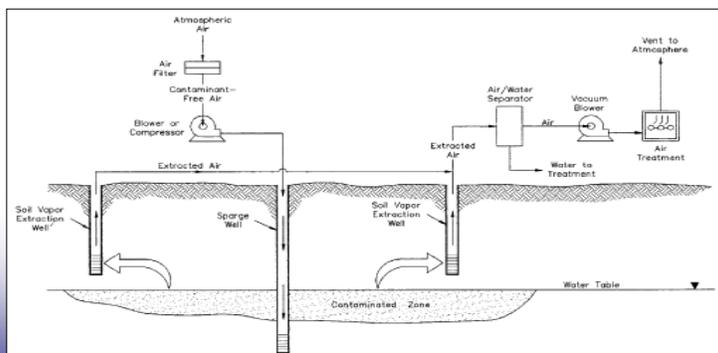
References

- None.



Air Sparging

- ❖ Air injected into aquifer
- ❖ Transfers dissolved and adsorbed VOCs into vapor phase
- ❖ Dependent on soil permeability
- ❖ Relatively inexpensive



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Notes:

Purpose of Slide: Introduce in situ air sparging.

Key Points

- Air sparging is similar to air stripping except that the process operates in situ. Air is injected under pressure into a contaminated aquifer where it strips VOCs from the groundwater by volatilization. The volatilized VOCs are flushed up into the unsaturated zone. A SVE system is often used to remove the generated vapors from the unsaturated zone. A SVE system may not be needed where the water table is shallow, where there is no impervious overlying layer (like pavement), and where VOCs in the generated vapors do not exceed air discharge limits or present risks to human health and the environment.
- A significant advantage of air sparging over P&T for groundwater remediation is that contaminants desorb more readily into the gas phase than into groundwater, thereby overcoming the diffusion-limited extraction of VOCs from groundwater. Also, air sparging has relatively low operation and maintenance costs and therefore, is cost effective when large quantities of groundwater require treatment.
- A side benefit at some sites is the increased dissolved oxygen level in the groundwater from the aeration, which may enhance bioactivity.
- Air is injected through sparge points that are installed as traditional drilled wells or as small-diameter, direct push technology wells.
- The air source is usually a positive displacement blower or conventional air compressor.
- Factors that may limit the applicability and effectiveness of air sparging include:
 - Fine-grained, low permeability soils limit the migration of air in the subsurface; this limits the effectiveness of air delivery and vapor recovery;
 - Heterogeneity, due to lithologic variations or fractures, may cause channeling and create preferential flow paths away from the area of contamination. A low-permeability layer overlying the aquifer would prevent volatilized vapors migrating from groundwater to be captured by effectively the vapor extraction system; and
 - Aquifer clogging or plugging may occur when increased iron precipitation or biomass accumulation caused by oxygen injection changes aquifer characteristics.

References

- Groundwater Remediation Technologies Analysis Center. 1996. Technology Overview Report: Air Sparging. TO-96-04. October.



Air Sparging Units





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Notes:

Purpose of Slide

- Present photographs of mobile and permanently installed systems.

Key Points

- Sparging systems may be mobile, trailer, or skid mounted units for short term deployment or fixed units for longer term operation.
- Protection of equipment from weather is important to provide for cost effective operation and to avoid premature failure. Sun, rain, and temperature conditions should be considered.
- The unit on the left is a 2,000-pound trailer and can be easily relocated. An electric power drop is required, but this usually is a relatively low cost item.
- The unit on the right is a fixed system installation with weather protection. The expected service life is 4 to 5 years. However, the equipment has a longer usable life and could be relocated to another site.

References

- None.



Bioremediation

- ❖ Microorganisms degrade or transform contaminants to less toxic forms
- ❖ Site specific – need good field data and pilot study
- ❖ Reasonably fast results
- ❖ Requires careful monitoring

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Notes:

Purpose of Slide

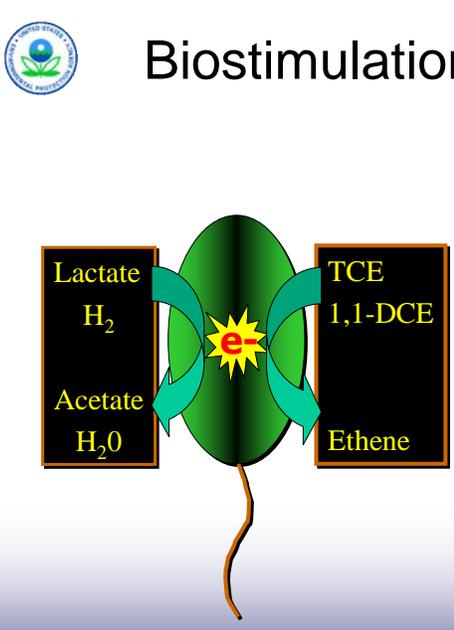
- Introduce and discuss bioremediation of chlorinated solvents.

Key Points

- This process is commercially available.
- Bioremediation implementation can include specific requirements based on site conditions.
- This treatment can be a relatively fast process.
- This approach requires careful monitoring in order to control the process.

References

- EPA. 2000. Engineered Approaches to In Situ Bioremediation of Chlorinated Solvents: Fundamentals and Field Applications. EPA 542-R-00-008. July.
- Department of Defense Strategic Environmental Research and Development Program (SERDP). 2004. Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents. Prepared by Parsons Corporation for Strategic Environmental Research and Development Program (SERDP). August.



Biostimulation/Bioaugmentation

- ❖ Biostimulation is the injection of amendments
- ❖ Bioaugmentation is the injection of bacteria
- ❖ Unique applications for chlorinated solvents (TCE, 1,1,1-TCA, 1,1-DCE)

Source: Dr. Eric Petrovskis

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Notes:Purpose of Slide

- Review the bioaugmentation and biostimulation processes.

Key Points

- Biostimulation is the practice of using existing on-site bacteria and stimulating their growth through the addition of food sources.
- Bioaugmentation involves the injection of active cultures into the contaminated area and requires careful monitoring of site conditions to ensure successful remediation. Pre-conditioning of the aquifer through a chemical amendment is required before injection of the microbes.
- For bioaugmentation, microbes convert chlorinated compounds as part of their digestive process.

References

- EPA. 2000. Engineered Approaches to In Situ Bioremediation of Chlorinated Solvents: Fundamentals and Field Applications. EPA 542-R-00-008. July.
- Department of Defense Strategic Environmental Research and Development Program (SERDP). 2004. Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents. Prepared by Parsons Corporation for Strategic Environmental Research and Development Program (SERDP). August.



Bioremediation Pilot Study






40 Billion Bugs

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Notes:

Purpose of Slide

- Provide an example of a bioremediation pilot study.

Key Points

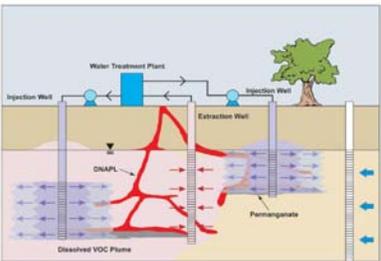
- Limited scale bioremediation pilot studies can be performed from mobile units.
- Such tests have a low capital cost and moderate monitoring cost.
- Groundwater is extracted and processed through the bio-trailer. The groundwater parameters are logged (ORP, pH, temperature, flow rate), amendments are added to the stream, and the stream is then trickled back into the aquifer.
- For this site, the aquifer was first prepared with a re-circulating solution of lactate.
- Tracer tests were used to confirm flow paths and to ensure a good distribution of nutrients into the source area.
- Microbes were injected after favorable conditions were achieved (for example, anaerobic conditions, lactate distributed).
- At sites like this, biological fouling becomes an issue when the remediation is successful.
- The equipment required for such a bioaugmentation pilot study is minimal.
- For this site, the microbes in this unit were grown in a university laboratory in the Southeast. Similar cultures are now commercially available.
- Inert nitrogen is used as a gas blanket to protect anaerobic bacteria. Under slight pressure, the nitrogen assists in the transfer of the bacteria.

References

- None.



Chemical Oxidation




- ❖ Chemical oxidants destroy range of VOCs, SVOCs, PAHs, PCBs, pesticides
- ❖ Ozone, permanganate, hydrogen peroxide/iron (Fenton's reagent), persulfate
- ❖ Applied through injection or injection/recovery

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Notes:

Purpose of Slide

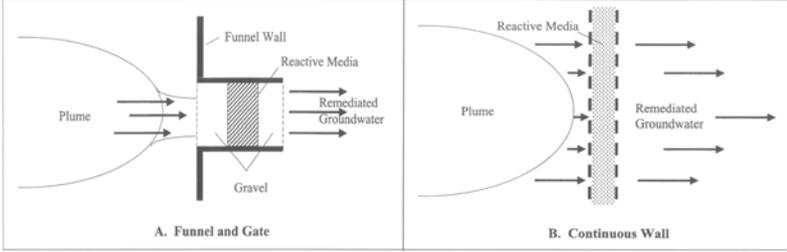
- Discuss chemical oxidation.

Key Points

- Chemical oxidation involves the treatment of contaminants in groundwater or soils to convert them chemically to nonhazardous or less toxic compounds. A wide range of organic contaminants are amenable to chemical oxidation including: volatile and semivolatile organics, polynuclear aromatic hydrocarbon (PAH) compounds, polychlorinated biphenyl compounds (PCBs), and pesticides.
- Commonly used chemical oxidants include: ozone, permanganate, hydrogen peroxide plus iron catalyst (or Fenton's reagent), and persulfate.
- Chemical oxidants are typically injected into the aquifer using direct push technology, injection wells, and fracturing/injection methods. In order to improve the distribution of chemicals in the aquifer, a recirculation system may be used (like the one pictured in the slide). One or more wells are used to distribute chemicals more evenly in the aquifer and to recover treated groundwater, which is then reinjected.
- Factors that may limit the applicability and effectiveness of chemical oxidation include:
 - Natural oxidant demand may be high in some aquifers due to organics and metals, which substantially increases the amount of oxidant required and the costs.
 - Some oxidants may contain elevated levels of heavy metals or may mobilize naturally occurring metals, creating groundwater quality issues;
 - Oxidation may mobilize and spread contaminants, so good hydraulic control is important;
 - Health and safety issues (heat, explosion) are associated with the handling of strong oxidants. The photograph in the slide shows a strong exothermic reaction created by a chemical oxidant; and
 - Aquifer permeability may be reduced by the reactions of some oxidants.

References

- EPA. 1998. Field Applications of In Situ Remediation Technologies: Chemical Oxidation. EPA 542-R-98-008. September.
- EPA. 2006. Engineering Issue: In Situ Chemical Oxidation. EPA 600-R-06-072. August.
- ITRC. 2005. *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*. 2nd edition (ISCO-2). In Situ Chemical Oxidation Team. Accessed On-line at: <http://www.itrcweb.org/documents/isco-02.pdf>.



The diagram illustrates two types of Permeable Reactive Barriers (PRBs). Diagram A, labeled 'A. Funnel and Gate', shows a groundwater plume being directed by a 'Funnel Wall' into a 'Gate' containing 'Reactive Media' and 'Gravel'. The output is 'Remediated Groundwater'. Diagram B, labeled 'B. Continuous Wall', shows a 'Plume' intersecting a vertical wall of 'Reactive Media', with 'Remediated Groundwater' flowing through it.

Permeable Reactive Barriers

- ❖ Passive *in situ* technology that treats a variety of contaminants.
- ❖ Zero-valent iron is common reactive medium but other materials also used.
- ❖ Mineral precipitation over time may reduce system effectiveness.

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Notes:

Purpose of Slide: Present permeable reactive barriers.

Key Points

- Permeable reactive barriers (PRBs) are in situ, permeable treatment zones designed to intercept and treat contaminated groundwater.
- PRBs use reactive metals or other media to treat a variety of chlorinated organics, metals, and radionuclides. Zero-valent iron is one of the most commonly used media, but PRBs have also used GAC, limestone, compost, oxygen release compounds, zeolites, and other materials.
- As shown in the above diagrams, PRBs are designed to create a flow path or conduit for contaminated groundwater. The most commonly used PRB configuration is a continuous trench in which the treatment material is backfilled. The trench is perpendicular to, and intersects, the groundwater plume. Another frequently used configuration is the funnel and gate, in which low-permeability walls (the funnel) direct the groundwater plume toward a permeable treatment zone (the gate).
- Typical PRB installation methods include excavation using slurry wall methods, continuous trenching machines, and vertical hydrofracturing.
- A typical lifespan for a PRB is 10 to 30 years. Because a PRB is a passive technology, long-term operation and maintenance costs are small compared to active groundwater remediation systems.
- Factors that may limit the applicability and effectiveness of PRBs include:
 - Precipitation of minerals such as calcium and carbonates can reduce PRB reactivity and permeability over time;
 - Preferential pathways may be produced in the reactive media due to different permeabilities between PRBs and the surrounding aquifer materials; and
 - Capital costs may be high.

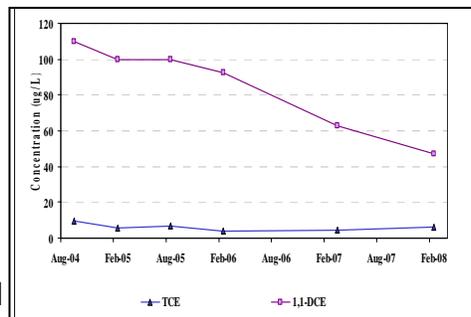
References

- EPA. 1998. Permeable Reactive Barrier Technologies for Contaminant Remediation. EPA 600-R-98-125. September.
- ITRC. 2005. Permeable Reactive Barriers: Lessons Learned/New Directions. February.



Monitored Natural Attenuation

- ❖ MNA relies on naturally occurring processes
 - Biodegradation and abiotic degradation
 - Volatilization
 - Sorption and chemical stabilization
 - Dispersion and dilution



(continued)

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Notes:

Purpose of Slide

- Introduce monitored natural attenuation (MNA).

Key Points

- MNA refers to the use of natural attenuation processes as part of the overall site remediation.
- MNA includes various physical, chemical, or biological processes that, under favorable conditions, act to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater.
- These naturally occurring processes can include biodegradation and abiotic degradation, volatilization, sorption, chemical stabilization, dispersion, and dilution.

References

- EPA. 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water. EPA 600-R-98-128. September.
- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action. EPA530-R-04-030. Update. April.
- EPA. 1999. Use of Monitored Natural Attenuation at Superfund, RCRA CA, and Underground Storage Tank Sites. OSWER Directive 9200.4-17P. April.



Monitored Natural Attenuation

- ❖ Conditions/expectations
 - Cleanup time is reasonable
 - Source mass/volume is defined
 - Plume is stable

- ❖ Performance monitoring
 - Attenuation rates meet expectations
 - Changing environmental conditions
 - Detect undesirable transformation products
 - Verify plume is not expanding

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Notes:

Purpose of Slide

- Continue discussion of MNA.

Key Points

- MNA can be an appropriate remedial option when the facility can demonstrate that the remedy is capable of achieving facility-specific groundwater cleanup criteria in a reasonable cleanup timeframe compared to other active remediation alternatives.
- Site assessment must be detailed because beneficial site information associated with active remediation will not be available.
- A fundamental premise is that the plume is not expanding (that is, it is either naturally stable, shrinking, or actively controlled).
- Monitoring is important to compare the stated expectations and modeling results (if performed) to actual results.
- Changing environmental conditions can impact natural attenuation. For example, changing water quality parameters such as dissolved oxygen (DO) and pH can have an impact.
- Potentially undesirable transformation products that may be recalcitrant can be present and may need to be addressed.

References

- EPA. 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water. EPA 600-R-98-128. September.
- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action. EPA530-R-04-030. Update. April.
- EPA. 1999. Use of Monitored Natural Attenuation at Superfund, RCRA CA, and Underground Storage Tank Sites. OSWER Directive 9200.4-17P. April.



Non-aqueous Phase Liquids (NAPLs)

- ❖ NAPLs do not mix with water; form separate phase
- ❖ Present special challenges for groundwater remediation
- ❖ Light- and dense- NAPLs (LNAPLs and DNAPLs) can be mixed at a site
- ❖ NAPL remedies should be protective but realistic

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Notes:

Purpose of Slide

- This slide introduces non-aqueous phase liquid (NAPL) remediation.

Key Points

- NAPLs are liquids that are sparingly soluble in water.
- Because NAPLs do not mix with water, they form a separate phase, which greatly complicates remediation of NAPL-impacted groundwater.
- NAPLs can be lighter than water – light non-aqueous phase liquids (LNAPLs) or more dense than water – dense non-aqueous phase liquids (DNAPLs).
- Common LNAPLs include: fuels, lubricants, and petroleum-based chemical feed stocks.
- Common DNAPLs include: chlorinated solvents, such as tetrachloroethylene and trichloroethylene (TCE).
- If the type of waste released at a facility would form NAPL, then the presence of NAPL should be assumed. Some sites with large source areas of NAPL have plumes that have migrated for miles.
- Some sites can have both LNAPLs and DNAPLs present – for example, a hazardous waste treatment facility that managed both chlorinated solvents (for example, TCE, a DNAPL) and non-chlorinated solvents (for example, benzene, a LNAPL). If these solvents become mixed, they can form a neutrally buoyant mixture that is extremely difficult to locate in the subsurface because of its unpredictable behavior – it neither floats on the water table nor sinks to the top of a confining layer.
- EPA's general expectation for remediation of NAPL sites is that the remedy be protective but realistic. In some cases, this will mean removing sufficient contaminant mass to stabilize the NAPL and make sure the problem is not getting worse. In other cases, it may not be feasible to locate the NAPL for a number of reasons such as geologic complexity of the site. In these cases, the remediation goals for the facility should reflect the possibility that low cleanup criteria may not be achievable because of the continuing presence of NAPL.
- We will discuss LNAPL and DNAPL remediation approaches and issues in the next few slides.

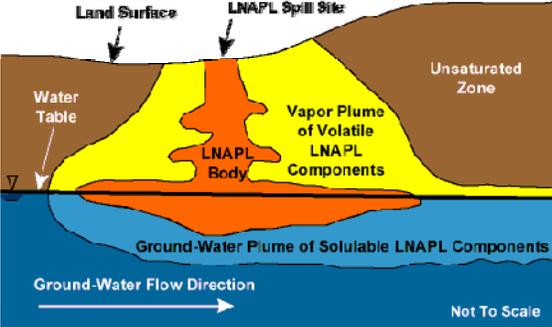
References

- EPA. 1995. EPA Groundwater Issue: Light Nonaqueous Phase Liquids. EPA/540/S-95/500.
- EPA. 2004. DNAPL Remediation: Selected Projects Approaching Regulatory Closure. EPA 542-R-04-016. December.
- Interstate Technology Regulatory Council. 2003. Technology Overview. An introduction to Characterizing Sites Contaminated with DNAPLs. September.
- ITRC. 2000. Technology Overview. DNAPLs: Review of Emerging Characterization and Remediation Technologies. June.



LNAPLs

- ❖ Fuels, lubricants, and petroleum-based chemical feed stocks
- ❖ “Float” on the aquifer (like an iceberg)
- ❖ Continuous source of groundwater contamination
- ❖ Difficult to characterize and remediate



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Notes:

Purpose of Slide

- Introduce LNAPL remediation.

Key Points

- Most LNAPLs consist of commonly used hydrocarbon fuels, lubricants, and chemical feed stocks. Petroleum refineries and facilities with releases of spent non-halogenated solvents (for example, benzene, ethyl benzene, toluene, styrene, xylene) would represent common types of RCRA CA sites with LNAPL problems. Hazardous constituents that are soluble in hydrocarbons (for example, some pesticides and pentachlorophenol) may be associated with LNAPL at some sites.
- As shown in the figure, LNAPL migrates downward through the subsurface under the influence of gravity. Above the water table, volatile LNAPL forms a vapor plume near the source area. If it reaches the water table, the LNAPL spreads laterally and begins to dissolve slowly in groundwater. Because LNAPL is less dense than water, it tends to accumulate at the groundwater surface.
- LNAPL at or near the water table will move vertically as the ground-water elevation fluctuates. This phenomenon, known as “smearing”, can distribute LNAPL over a significant vertical interval above or below the water table at any given time. LNAPL here can act as a continuing residual source of contamination.
- The physical properties of LNAPLs, including low solubility, low specific gravity, and a tendency to adsorb to aquifer materials, make LNAPL contamination very difficult to characterize and remediate in the subsurface.

References

- EPA. 1995. EPA Groundwater Issue: Light Nonaqueous Phase Liquids. EPA/540/S-95/500.
- Interstate Technology Regulatory Council. 2003. Technology Overview. An introduction to Characterizing Sites Contaminated with DNAPLs. September.
- ITRC. 2000. Technology Overview. DNAPLs: Review of Emerging Characterization and Remediation Technologies. June.



LNAPL Remediation

- ❖ Traditional approaches:
 - P&T
 - Recovery trenches/drains
 - SVE
 - Containment
 - Excavation
- ❖ Emerging approaches (*in situ*):
 - Thermal treatment
 - Chemical oxidation
 - Surfactant/co-solvent flushing
 - Bioremediation

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Notes:

Purpose of Slide

- Introduce different remediation technologies for LNAPL sites.

Key Points

- The basic theory behind LNAPL source removal is that it will reduce the mass of material contributing to the release associated the source and reduce the cost and duration of achieving site closure. It follows that, after removing the source area (area containing or inferred to contain LNAPL), residual groundwater plumes may be amenable to further remediation approaches (for example, MNA). Both traditional and emerging approaches to LNAPL remediation will be discussed.
- A number of remediation technologies are applicable to LNAPLs including such traditional approaches as: P&T, recovery trenches and drains, SVE, dual phase extraction, containment, and excavation.
- Emerging technologies that are being used for LNAPL remediation include thermal treatment, chemical oxidation, surfactant/co-solvent flushing, and bioremediation.
- Emerging refers to technologies that are subject to greater on-going research and development.
- Descriptions of some of these technologies have already been presented and several others will be described in the following discussion of DNAPL remediation technologies.
- Many of the same technical challenges that face DNAPL remediation will be associated with LNAPL remediation. These will be discussed in the following slides.

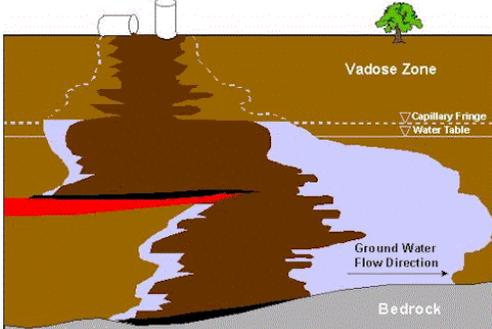
References

- FRTR. 2002. Remediation Technologies Screening Matrix and Reference Guide, Version 4.0. January.
- Interstate Technology Regulatory Council. 2003. Technology Overview. An introduction to Characterizing Sites Contaminated with DNAPLs. September.
- ITRC. 2000. Technology Overview. DNAPLs: Review of Emerging Characterization and Remediation Technologies. June.



DNAPLs

- ❖ Primarily chlorinated solvents and PAHs
- ❖ Sink in aquifer
- ❖ Continuous source of groundwater contamination
- ❖ Extremely difficult to characterize and remediate



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Notes:

Purpose of Slide

- Introduce DNAPL remediation.

Key Points

- Remediation of DNAPLs is one of the greatest technical problems associated with cleanup of many RCRA CA sites.
- Most DNAPLs consist of commonly used chlorinated solvents, such as PCE and TCE, and PAHs (such as pentachlorophenol and benzo(a)pyrene).
- The physical properties of DNAPLs, including low solubility, high specific gravity, and a tendency to adsorb to aquifer materials, make them very difficult to characterize and remediate in the subsurface.
- Because DNAPLs are more dense than water, they tend to migrate downward in the aquifer until they encounter an impermeable layer where they accumulate. They then act as a continuing source of groundwater contamination as they slowly dissolve in the surrounding groundwater.
- As will be discussed in the next few slides, DNAPLs are extremely difficult to characterize and remediate at most sites.

References

- Interstate Technology Regulatory Council. 2003. Technology Overview. An introduction to Characterizing Sites Contaminated with DNAPLs. September.
- ITRC. 2000. Technology Overview. DNAPLs: Review of Emerging Characterization and Remediation Technologies. June.



DNAPL Remediation

- ❖ Traditional approaches:
 - P&T (for containment of dissolved)
 - Containment
 - Excavation
- ❖ Emerging approaches (*in situ*):
 - Thermal treatment
 - Chemical oxidation
 - Surfactant/co-solvent flushing
 - Bioremediation

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Notes:

Purpose of Slide

- Introduce different remediation technologies for DNAPL sites.

Key Points

- The basic theory behind DNAPL source removal is that it will reduce the mass of material contributing to the release associated with DNAPL and reduce the cost and duration of achieving site closure. It follows that, after removing the source area, residual groundwater plumes may be amenable to further remediation approaches (e.g., such as MNA). Both traditional and emerging approaches to DNAPL remediation will be discussed.
- There was a time when traditional P&T technology was considered to be a viable remedy for DNAPL sites. With experience, however, it has been found that DNAPLs tend to adsorb strongly on soils in the aquifer and that the relatively small contaminant mass removed by most P&T systems in most geologic settings will not significantly deplete DNAPL source areas over time, which leads to extremely long cleanup timeframes.
- P&T has been used effectively at some sites, however, to contain the spread of groundwater contamination downgradient of DNAPL source areas.
- Other containment measures that have been used at DNAPL sites include cutoff walls, such as slurry walls, and PRBs. These passive containment measures have the benefit of low O&M requirements but they must be maintained for long periods of time.
- In cases where the extent of DNAPL is small and has been well characterized, excavation of DNAPL-containing soil above and below the water table (and subsequent treatment and disposal) has been used.
- EPA has identified several emerging DNAPL source reduction technologies as being promising in achieving regulatory closure at a number of DNAPL sites. These closures were associated with a wide range of approved closure and cleanup criteria, many of them risk-based, with target cleanup levels varying as much as five orders of magnitude. The technologies included:
 - In situ thermal treatment technologies such as steam injection, six-phase heating, in-situ thermal desorption, and radio-frequency heating;
 - In situ chemical oxidation, such as Fenton's reagent, ozone, and sodium permanganate;
 - In situ surfactant/so-solvent flushing, which involves injection of aqueous solutions (e.g., alcohols or electrolytes) that aid in solubilizing the DNAPL and subsequent extraction of the solubilized DNAPL for above-ground treatment; and
 - In situ bioremediation, involving injection of electron donors and microbial populations.

References

- EPA. 2004. DNAPL Remediation: Selected Projects Approaching Regulatory Closure. EPA 542-R-04-016. December.
- Interstate Technology Regulatory Council. 2003. Technology Overview. An introduction to Characterizing Sites Contaminated with DNAPLs. September.
- ITRC. 2000. Technology Overview. DNAPLs: Review of Emerging Characterization and Remediation Technologies. June.



DNAPL Remediation Challenges

- ❖ Traditional regulatory approaches
- ❖ Determining DNAPL mass and distribution difficult and costly
- ❖ Uncertainties of long-term remedial effectiveness and costs – no reliable metrics
- ❖ Limited availability of performance and costs for aggressive technologies

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Notes:

Purpose of Slide

- Discuss various DNAPL remediation challenges.

Key Points

- Traditional EPA policy (for example, the 1996 ANPR) has generally supported active remediation of DNAPL source areas, which may or may not be stable. However, practical experience, groundwater modeling, and laboratory studies by EPA suggest that DNAPL cannot be totally removed and that containment is a viable option to control DNAPL releases.
- EPA's groundwater policies have traditionally stressed groundwater restoration to maximum contaminant levels (MCLs). However, experience has shown that meeting MCLs at almost all DNAPL sites is technically infeasible. EPA's technical impracticability (TI) guidance reflects that understanding (Slide 12 of Module 7). Under RCRA, you do not need to establish cleanup criteria that lead to TI, but for states that require MCLs as cleanup criteria for groundwater, a TI waiver may be necessary.
- A number of technologies have been applied to assess DNAPL, including direct push technology, surface geophysics, and membrane interface probes. However, because of the unpredictable nature of DNAPL distribution in the subsurface and the need for very complete information on its nature and extent before it can be remediated, DNAPL assessments are often time consuming and expensive.
- Even among experts, there is great uncertainty and disagreement as to the effectiveness and ultimate costs of DNAPL remediation. There are no reliable metrics (for example, mass removal versus groundwater concentrations) at this time to measure the overall effectiveness of DNAPL remediation.
- Because most of the aggressive remedial technologies for DNAPLs are emerging, there is scarce cost and performance information for full-scale cleanups. These uncertainties in costs, coupled with uncertainties in performance, can be disincentives for the regulated community to pursue active DNAPL remediation.

Reference

- FR. 1996. ANPR. 61FR19432. May 1.
- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action. EPA530-R-04-030. April.
- Interstate Technology Regulatory Council. 2003. Technology Overview. An introduction to Characterizing Sites Contaminated with DNAPLs. September.
- ITRC. 2000. Technology Overview. DNAPLs: Review of Emerging Characterization and Remediation Technologies. June.



DNAPL Realities

- ❖ Even 99% DNAPL removal can leave a significant groundwater contamination source
- ❖ Few DNAPL sites will be cleaned up to MCLs with current technologies
- ❖ No cook book – different cleanup levels are appropriate based on site-specific factors and risks
- ❖ Focus on managing risks based on reasonably anticipated land use

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Notes:

Purpose of Slide

- Present some of the current realities we are faced with in addressing DNAPL sites.

Key Points

- There is an ongoing debate regarding the utility of partial DNAPL source removal. Some studies have shown that leaving even a tiny fraction of the source area will contribute to an ongoing groundwater contamination problem.
- It is apparent from the current state of DNAPL remediation technologies that very few sites will be able to close with MCLs met in all aquifers.
- Because of the unpredictable nature of DNAPL contamination at most sites and the inherent difficulties in remediation of DNAPLs, assessment and remediation will not generally lend themselves to standardized approaches. Instead, the challenge will be to address each site in terms of its unique characteristics and the potential risks presented by DNAPLs at the site. EPA's position has been that remediation of DNAPL should focus primarily on containment and stabilization of DNAPL source areas, coupled with remediation of the dissolved portion of the plume to meet cleanup criteria.

References

- None.



DNAPL Excavation






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Notes:

Purpose of Slide

- Present and discuss a cross section of excavation at a DNAPL site.

Key Points

- As a result of a DNAPL investigation at the DOT site presented earlier, a former borrow pit and disposal site were excavated where there was evidence of DNAPL.
- The DNAPL source area was relatively large but other technologies could not remove 95% of the DNAPL – the amount necessary to justify the remedy in this case.
- The investigation focused on the area most likely to contain DNAPL. TCE and 1,1,1-TCA were the compounds sought.
- Excavation began by removing the clean backfill from the previous excavation; over 65,000 cubic yards of clean overburden were removed.
- Excavation of the suspected source areas revealed that the DNAPL was dispersed in very fine fissures within the soil as shown in the photograph on the left. Residual traces of the compounds were also found on top of the clay confining unit; over 75,000 cubic yards of additional contaminated soil were removed and treated.
- The resulting excavation is shown above (a former groundwater monitoring well is shown near the center). The excavated area was left as a pond.
- The source was successfully removed in two steps:
 - The original source was comprised of drums containing waste solvents that were removed.
 - The later source that was excavated was DNAPL, either residual from the buried drums or liquid that was released directly into the soil.

References

- None.



Green Remediation

- ❖ Green Remediation is the practice of considering **all** environmental effects of remedy **implementation** and incorporating options to maximize the **net environmental benefit** of cleanup actions.
- ❖ Strategies:
 - Efficient use of energy and resources
 - Reduce negative impacts to the environment
 - Minimize pollution at its source
 - Reduce waste

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Notes:

Purpose of Slide

- Introduce the concept of green remediation and provide an overview

Key Points

- EPA defines green remediation as shown above. Green remediation reduces the environmental “footprint” of site remediation by reducing the negative impacts to the environment caused by remediation activities.
- Strategies for approaching green remediation and sustainable land use include:
 - Efficient use of energy and natural resources
 - Reducing the negative impacts of remediation activities to the environment[
 - Minimizing pollution at its source rather than exporting contamination off site.
 - Reducing the generation of waste through various means.
- EPA has articulated its thoughts and approaches to green remediation in an April 2008 Technology Primer on Green Remediation. Also, EPA and a number of other federal agencies (e.g., Army, Navy, Air Force and DOE) have green remediation websites which provide useful guidance and case studies, particularly EPA’s CLU-IN web site.

References

- EPA. 2008. Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites. EPA542-R-08-002. April.
- EPA CLU-IN website (www.clu-in.org/greenremediation)



Green Remediation Practices

- ❖ Energy requirements
 - Use renewable energy
 - Maximize efficiency of remediation equipment
- ❖ Air emissions
 - Use clean fuels
 - Reduce releases of toxic pollutants, greenhouse gases, and dust
- ❖ Water requirements
 - Reduce fresh water consumption; maximize water reclamation/reuse
 - Reduce surface water quality impacts

(cont.)

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Notes:

Purpose of Slide

- Introduce a number of green remediation practices

Key Points

- EPA has developed a number of strategies and best management practices for green remediation:
- **Energy requirements:**
 - Use renewable energy such as solar & wind to power equipment
 - Maximize efficiency of remediation equipment through system designs that minimize high energy demands & conducting RSE's
- **Air emissions:**
 - Use clean fuels (e.g., low sulfur, biofuels, hybrids) for excavation and transportation equipment
 - Reduce releases of toxic pollutants, greenhouse gases, and dust through efficient use and servicing of machinery and vehicles, dust suppression, and filters
- **Water requirements:**
 - Reduce fresh water consumption; maximize water reclamation/reuse through capturing and storage of rainfall & reusing treated wastewater
 - Reduce water quality impacts on nearby surface water by minimizing runoff

References

- EPA. 2008. Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites. EPA542-R-08-002. April.
- EPA. CLU-IN Web site (www.clu-in.org/greenremediation).



Green Remediation Practices

- ❖ Land & ecosystem impacts
 - Inventory ecological species, land contours, and drainage patterns
 - Relocate sensitive or threatened species
- ❖ Waste generation
 - Reuse uncontaminated excavated soil
 - Recycle waste & scrap materials
- ❖ Long-term stewardship
 - Install renewable or passive energy systems for long-term site controls
 - Construct remediation structures to complement site redevelopment

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Notes:

Purpose of Slide

- Continue discussion of green remediation practices

Key Points

- EPA has developed a number of strategies and best management practices for green remediation:
- **Land & ecosystem impacts:**
 - Inventory ecological species, land contours, and drainage patterns prior to remediation to help recreate original conditions
 - Relocate sensitive or threatened species
- **Waste generation:**
 - Reuse uncontaminated excavated soil for onsite backfill or habitat creation
 - Recycle waste & scrap materials during construction & demolition
- **Long-term stewardship:**
 - Install renewable energy or passive energy systems for long-term site controls
 - Construct remediation structures (e.g., swales, ponds) that complement site redevelopment

References

- EPA. 2008. Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites. EPA542-R-08-002. April.
- EPA. CLU-IN Web site (www.clu-in.org/greenremediation).



Green Remediation Case Study



- ❖ Objective was to recover hydrocarbons from groundwater at RCRA site
- ❖ Strategy was to use renewable energy systems – solar & wind energy
- ❖ Use 6 wind turbines to operate compressors for hydraulic skimming pumps & to generate electricity to power 9 submersible pumps and fluid-gathering system
- ❖ Use 6 photovoltaic panels to power recovery wells & submersible pumps
- ❖ Recycle recovered petroleum product at adjacent oil refinery



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Notes:

Purpose of Slide

- Present green remediation case

Key Points

- This case study is for the St. Croix Alumina Plant in St. Croix, Virgin Islands
- This RCRA facility needed to remediate hydrocarbon contamination in groundwater as described in the slide.
- The results of the green remediation approaches used at the facility resulted in the following accomplishments:
 - Recovered over 200,000 gallons of free-product
 - Integrated renewable-energy sources to meet increasing portions of the recovery system's energy demand
 - Avoided air emissions associated with electricity consumption
 - Provided for beneficial use of recovered material
 - Avoided off-site transportation and disposal of free- product, along with the associated air emissions

References

- EPA. CLU-IN Green Remediation Web site (www.clu-in.org/greenremediation).



Summary

- ❖ Remediation technologies support RCRA CA progress
- ❖ Resources and tools are available to support Project Managers
- ❖ Remember to focus on technologies that will support appropriate, protective & sustainable actions for current and reasonably anticipated uses

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Module 8 - Remediation Technologies

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Notes:

Purpose of Slide

- Review key points included in Module 8, Remediation Technologies.

Key Points

- Review the key points of this module.

References

- None.

Green Remediation Resources



Green Remediation is evolving rapidly –resources below provide a starting point for exploration.

Web Sites:

EPA's Office of Solid Waste and Emergency Response (OSWER): Green Remediation Tool Box, Technical Information, Profiles & Case Studies of Green Remediation, Technical Assistance, and Additional Resources. www.cluin.org/greenremediation

Association of State and Territorial Solid Waste Management Officials (ASTSWMO): ASTSWMO Greener Cleanups Task Force. www.astswmo.org

California Environmental Protection Agency/Department of Toxic Substances Control: Green Remediation Initiative. www.dtsc.ca.gov/OMF/Grn_Remediation.cfm

Minnesota Pollution Control Agency: Green Practices for Business, Site Development, and Site Cleanups. www.pca.state.mn.us/programs/p2-s/toolkit/index.html

Wisconsin Department of Natural Resources: Remediation and Redevelopment Program/ Wisconsin Initiative on Sustainable Cleanups (WISC). <http://ua.dnr.wi.gov/org/aw/rr/cleanup/wisc.htm>

Illinois Environmental Protection Agency: Bureau of Land's Greener Cleanup Initiative <http://www.epa.state.il.us/land/greener-cleanups/>

Presentations:

California Department of Toxic Substances Control Green Remediation Initiative: Presentation by John Scandura, CA DTSC. August 2008. ASTSWMO Federal Facilities Managers Symposium, San Diego, CA

Maximizing the Environmental Benefits of Site Remediation: Presentation by Gary King, Illinois Environmental Protection Agency. April 2008. ASTSWMO Mid-Year Meeting, Mobile, AL.

Wisconsin's Approach to "Greener" Cleanups: Presentation by Mark F. Giesfeldt, WISC, remediation and Redevelopments Program. April 2008. ASTSWMO Mid-Year Meeting presentation, Mobile, AL.

Green Remediation: Opening the Door to Field Use: Presentation by Kira Lynch, EPA and Sandra Novotny, EMS. July 2008. National Association of Remedial Project Managers (NARPM) 2008 Training, Portland, OR.

Documents:

Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites: EPA Technology Primer. April 2008.

Introduction to Green Remediation: Incorporating Sustainable Practices into Site Remediation: EPA Quick Reference Fact Sheet. February 2008.

Guidelines for Making Environmentally-Sound Decisions in the Superfund Remedial Process: EPA. May 1993.

Incorporating Sustainable Environmental Practices into Site Remediation of Contaminated Sites: An Introduction. EPA Quick Reference Fact Sheet. April 2008.

Greener Cleanups – How to Maximize the Environmental Benefits of Site Remediation: Illinois Environmental Protection Agency, February 2008.

Module 09
Managing Remediation Waste



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



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Notes:Purpose of Slide

- Holder slide for Module 9, Managing Remediation Waste.

Key Points

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

References

- None.



Module 9

Managing
Remediation Waste

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Notes:

Purpose of Slide

- Holder slide for Module 9, Managing Remediation Waste.

Key Points

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

References

- None.



Module Overview

- ❖ Key questions to answer concerning management of remediation waste
- ❖ Sources and types of remediation waste
- ❖ Determining when contaminated media are Resource Conservation and Recovery Act (RCRA) hazardous wastes
- ❖ Provisions for managing hazardous remediation waste
- ❖ Other regulatory considerations

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Module 9 - Managing Remediation Waste

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Notes:

Purpose of Slide

- Present module overview. Module addresses: (1) U.S. Environmental Protection Agency (EPA) regulations and policies applicable to remediation waste and (2) various technical issues associated with remediation waste management. Examples are used to illustrate concepts described in this module. Site managers should focus on a safe remedy – using the regulations and guidance developed for remediation waste.

Key Points: The module will cover:

- Key questions that site managers should answer to properly determine their management options for remediation waste.
- Types and sources of remediation waste and how EPA has issued regulations and policies for managing remediation wastes that differ from, and provide flexibility from, requirements for “as generated” hazardous waste.
- Determining when remediation waste is Resources Conservation and Recovery Act (RCRA) hazardous, including a discussion about the RCRA “contained-in” policy.
- Provisions for managing RCRA hazardous remediation waste, including discussion of:
 - The Area of Contamination Policy;
 - Special remediation waste management units, such as Corrective Action Management Units (CAMUs), Temporary Units (TUs), and staging piles, created for RCRA CA to provide flexibility from otherwise applicable RCRA design and operating standards;
 - Variances from land disposal restriction (LDR) treatment standards and alternative LDR treatment standards for contaminated soils and hazardous debris that may be used instead of the LDR standards developed for “as generated” waste.
 - EPA’s policy regarding the application of LDR standards to re-injected groundwater;
- Other regulatory considerations that may apply to the management of remediation waste, such as permits needed for surface waste discharges, management of polychlorinated biphenyl compound (PCB) remediation wastes, EPA’s Contaminated Sediments Strategy, and compliance with the Clean Air Act Maximum Achievable Control Technology (MACT) standards, will be discussed.
- Options for managing hazardous remediation waste at cleanups that would otherwise require a RCRA permit (for example, cleanups performed under State Superfund or other authorities).

References

- None.



Managing Remediation Waste: What's the Issue?

- ❖ “As-generated” waste versus remediation waste
- ❖ RCRA Subtitle C requirements apply to hazardous remediation wastes
- ❖ Incorporating remediation waste management into the overall exit strategy

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Notes:

Purpose of Slide

- Introduce the issue of remediation waste management and link the topic to the overall exit strategy

Key Points

- Realizing the unique nature of remediation wastes and that RCRA regulations for “as generated” wastes from industrial activities were acting as disincentives, EPA has promulgated a number of regulations and policies since the mid-1980's to provide practical approaches to managing remediation wastes. This module will discuss the special rules and policies in detail.
- With respect to managing remediation waste, there are several key questions site managers need to answer to determine whether and how those special rules and policies may apply:
 - The first and most critical question to answer regarding management of remediation waste is whether the waste must be managed under Subtitle C regulations because it exhibits a hazardous waste characteristic or contains a RCRA listed hazardous waste (HW).
 - When developing an exit strategy, don't forget to incorporate waste management into the plan

References

- None.



Types of Remediation Wastes



- ❖ Wastes disposed at site, for example:
 - Sludges
 - Containerized wastes
- ❖ Media/debris contaminated by solid waste or hazardous waste (HW), for example:
 - Soil surrounding sludge
 - Groundwater

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Notes:

Purpose of Slide

- Introduce broad types of remediation wastes.

Key Points

- Remediation waste is defined in 40 Code of Federal Regulations (CFR) 260.10 as “all solid and hazardous wastes, and all media (including groundwater, surface water, soils, and sediments) and debris, that are managed for implementing cleanup.”
- Remediation waste may be RCRA hazardous; generators should make a determination as to which wastes need to be managed as hazardous waste taking into account available information about the wastes and policies covering the management of remediation waste, such as the “contained-in” policy.
- Some remediation wastes consist of media contaminated by HWs (for example, soil surrounding F006 sludge). These may be regulated under the more flexible remediation waste requirements that will be discussed in this module.
- Some remediation wastes are identified HWs previously disposed at a site (for example, F006 sludge and the containerized waste solvent shown on this slide).
- An important concept – even if a HW was disposed at a site before the effective date of its coverage under RCRA (for example, before November 1980), once it is removed/excavated at the site, it is “generated” and becomes subject to all applicable RCRA HW regulations for that waste (including LDRs).

References

- Code of Federal Regulations (CFR). 40 CFR 260.10.



Sources of Remediation Waste



- ❖ Assessment – drilling waste, pumped groundwater
- ❖ Clean-up – excavated wastes and soils, dredged sediments, abandoned drums, debris, and recovered groundwater
- ❖ Long-term operation and monitoring (O&M) – treatment residues, spent filters

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Notes:

Purpose of Slide

- Introduce typical sources of remediation waste at RCRA CA facilities.

Key Points

- Investigation-derived waste (IDW) is typically produced during site investigations in the form of drill cuttings from soils borings and well installation, groundwater produced by well development and sampling, and other forms of waste associated with site investigation activities (for example, spent personal protection equipment (PPE) and supplies).
- The largest volume of remediation waste is typically generated during cleanup activities and includes residuals such as excavated wastes (for example, sludge, drums, contaminated soils) and recovered groundwater.
- Lesser volumes of remediation waste may be generated during long-term operation and maintenance (O&M) such as spent filters, spent activated carbon, and solids (sludges or sediments) in settling tanks from groundwater treatment systems.

References

- None.



Managing Remediation Waste: Key Questions to Ask

- ❖ Am I dealing with RCRA hazardous waste?
- ❖ If yes, do the RCRA unit and management standards apply?
- ❖ If yes, do the RCRA LDR standards apply?
- ❖ What other regulatory requirements apply?

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Notes:

Purpose of Slide

- Identify key questions and decisions that regulators and owners or operators (o/o's) must address regarding the management of remediation waste generated during the RCRA corrective action (CA) process.

Key Points

- Realizing the unique nature of remediation wastes and that RCRA regulations for "as generated" wastes from industrial activities were acting as disincentives, EPA has promulgated a number of regulations and policies since the mid-1980's to provide practical approaches to managing remediation wastes. This module will discuss the special rules and policies in detail.
- With respect to managing remediation waste, there are several key questions site managers need to answer to determine whether and how those special rules and policies may apply:
 - The first and most critical question to answer regarding management of remediation waste is whether the waste must be managed under Subtitle C regulations because it exhibits a hazardous waste characteristic or contains a RCRA listed hazardous waste (HW).
 - If remediation waste is subject to the RCRA HW regulations, then one must assess how the waste will be managed and determine whether other RCRA HW regulations will apply (for example, a hazardous remediation waste will be placed in a roll-off box for disposal off-site).
 - Hazardous remediation waste may be subject to the RCRA LDRs depending on how the waste is managed. If subject to LDRs, the waste will need to meet applicable LDR treatment standards before it may be land disposed unless a variance is obtained.
 - Other non-RCRA regulatory requirements may apply to the management of remediation waste, such as Toxic Substances Control Act (TSCA) regulations for the cleanup and management of PCB wastes, Clean Water Act requirements regarding surface water discharges, and Clean Air Act site remediation MACT requirements for emission of air pollutants.

References

- None.



Am I Dealing With Hazardous Remediation Waste?

- ❖ Generator must determine if waste is hazardous
- ❖ Definition of remediation waste at 40 CFR 260.10
 - Is it a hazardous waste?
 - Is it a media that:
 - Exhibits a characteristic?
 - Contains a listed waste?

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Notes:

Purpose of Slide

- Introduce discussion of determining whether remediation waste is hazardous under RCRA.

Key Points

- Remediation waste is defined in 40 CFR 260.10 and means all solid and hazardous waste, and all media (including groundwater, surface water, soils, and sediments), and debris that contains listed HW or that themselves exhibit a hazardous characteristic and are managed for implementing cleanup.
- Under 40 CFR 262.11, generators are responsible for determining if a remediation waste is hazardous.
- The process for determining whether a waste is hazardous is two-fold:
 - The waste is a listed hazardous waste (F-, K-, P-, or U-code listed hazardous wastes) and/or
 - The waste exhibits one of the characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity)
- In addition, wastes may be hazardous under the mixture and derived from rules located in 40 CFR 261.3. These rules discuss when waste mixtures and wastes derived from the treatment, storage, or disposal of HW are considered HW. (Note: The next several slides discuss the “contained in” rule and how that applies to environmental media).

References

- CFR. 40 CFR. 260.10.
- CFR. 40 CFR. 262.11.
- CFR. 40 CFR 261.3.
- EPA. 1998. Management of Remediation Waste Under RCRA. EPA530-F-98-026. October.
- Federal Register (FR). 1990. National Contingency Plan Final Rule-making. March 8. Page 8758.



Determining When Contaminated Environmental Media are Hazardous

Contaminated environmental media are not presumptively hazardous waste




Contaminated Environmental Media Must be Handled as HW when:

- ❖ Exhibits a characteristic
- ❖ Contains listed HW (based on source)

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Notes:

Purpose of Slide: Define and discuss the “contained-in” policy and how it applies to the management of contaminated environmental media.

Key Points

- Contaminated environmental media, in and of itself, is not HW and, generally, is not subject to regulation under RCRA. Environmental media is not considered solid waste because it is not “disposed of,” so media contaminated with RCRA HW cannot be considered hazardous under the RCRA “mixture rule.”
- Contaminated environmental media can become subject to regulation under RCRA if they “contain” HW. The “contained-in” policy forms the basis for applying RCRA Subtitle C requirements to mixtures of environmental media and HW. If contaminated environmental media contain HW, they are subject to all applicable RCRA requirements until they no longer contain HW.
- The “contained-in” policy requires contaminated environmental media to be managed as HW when they contain one or more listed HWs or exhibit one or more characteristics of HW.
- Media do not need to be managed as HW if they do not exhibit a hazardous characteristic and they do not contain hazardous constituents above site-specific health-based levels; this determination is referred to as a “contained out” determination.
- Authorized States interpret application of the “contained-in” policy on a case-by-case basis and make “contained out” determinations, which are discussed later in this module. In non-authorized states, EPA makes this determination.
- The “contained-in” policy also applies to media containing P- and U-listed wastes, which are discarded or off-specification commercial chemical products or intermediates and their spill residues. Some have questioned how the “contained-in” policy applies to P- and U- contaminated media because of 40 CFR 261.33(d). EPA clarified the interpretation of the applicability of the “contained-in” policy to P- and U-listed wastes in a February 17, 1995, EPA Memorandum, “P and U Listed Wastes and the Contained-in Policy.” This memorandum states that the RCRA “contained-in” policy applies to P- and U- listed wastes in the same manner as for other listed wastes. In other words, if the implementing Agency determines that the media do not contain a P- or U-listed waste, they would not be a HW.

References

- FR. 1998. Preamble to the LDR Phase IV Rule. 63 FR 28621. May 26.
- EPA. 1995. P and U Listed Wastes and the Contained-In Policy. EPA Memorandum. February 17.



Applying LDRs to Remediation Waste





- ❖ **At the point of generation**
- ❖ **When first actively managed**
- ❖ **Retroactivity of listings may apply**

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Notes:

Purpose of Slide: Introduce key concepts regarding the applicability of LDRs to remediation waste; reaffirm that LDRs do not “attach” in areas of contaminations or CAMUs.

Key Points

- The point of generation for remediation wastes is when they are first removed from the land or area of contamination. If these remediation wastes contain listed HW, then LDRs “attach” when they are generated or “actively managed,” regardless of the date of their original disposal. Active management is defined as physically disturbing remediation waste through removing, excavating, mixing with other waste, or other on-site treatment.
- Excavation of soil contaminated from a recent or current spill of HW or product would represent a new point of generation in the affected media and the soil would be prohibited from land disposal until it meets applicable LDR treatment standards (unless a site-specific risk-based variance is obtained) because the contaminating waste (spill of HW or product that is considered hazardous when disposed of) was prohibited from land disposal and LDR treatment standards were not met prior to the spill.
- Deliberately mixing HW with media to change the treatment requirements (for example, to the Phase IV LDR soil treatment standards) is prohibited.
- Normal mixing of soil during remediation is allowed (from 63 FR 10 page 28621; May 26, 1998):

The Agency notes that the normal mixing of contaminated soil from various portions of a site that typically occurs during the course of remedial activities or in the course of normal earthmoving and grading activities is not considered intentional mixing of soil with non-media or prohibited soil with non-prohibited soil and, therefore, is not a type of impermissible dilution.

- LDRs “attach” to remediation wastes depending on the circumstances of disposal, as described in the following examples:
 - If a HW was disposed prior to the LDR effective date for that waste, then LDRs have not yet attached to that waste (or associated soil or debris). If a successful “contained out” determination is made for the remediation waste while it remains in situ, then the remediation waste can be managed as non-hazardous and does not have to meet the LDR treatment standards.
 - Under the above disposal scenario, if the remediation waste is excavated (that is, “actively managed”) before a “contained out” determination is made, then LDRs “attach” at the time of the active management and will continue to apply even after a successful “contained out” determination is made. In this case, LDRs must be met or an LDR variance would be required.
 - If the HW was disposed of after the LDR effective date for that waste, then LDRs have already attached to that waste (and associated soil and debris) and will continue to apply regardless of when a “contained out” determination is made. In this case, LDRs must be met or an LDR variance would be required.

References

- FR. 1993. Land Disposal Restrictions for First Third Scheduled Wastes. Final Rule. 53 FR 31148.
- FR. 1988. Phase IV LDR Rule. 63 FR 28751. May 26.



Source of Contamination Presumption



Regulator should not presume waste (or contaminated media) is a listed HW unless it is known to be a listed waste, or derived from, a listed waste



Source not known to be listed

+

Leachate is < TCLP concentrations

=

Waste or media is non-hazardous

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Notes:

Purpose of Slide

- Describe EPA's policy on the source of contamination presumption.

Key Points

- To determine whether a waste is a listed HW, the source (activity or industrial process that generated the waste) must be known. Project managers are not required to presume that a remediation waste contains a listed HW unless affirmative evidence supports this assumption.
- Project managers should make reasonable efforts to determine whether a remediation waste contains a RCRA-listed waste based on available information such as facility business records or documentation of processes used at the facility.
- If an affirmative determination cannot be made about the source of the contamination, the contaminated media can be considered not to contain a listed HW and therefore, would not need to be managed as a HW unless it was shown to exhibit a hazardous characteristic.

References

- EPA. 1998. Management of Remediation Waste Under RCRA. EPA 530-F-98-026. October.
- FR. 1988. Preamble of the Proposed and Final National Contingency Plan. 53 FR 51443 (December 21) and 1990 (55 FR 8758, March 8).
- EPA. 1989. Superfund Land Disposal Restrictions (LDRs) Guide #5: Determining When LDRs Are Applicable to CERCLA Response Actions. OSWER Directive 9347.3-OSFS. July.

It's All About the Source

Different Sources with Equal Concentrations

Drill Cuttings, PCE at 15 mg/kg

FACILITY A
HAZARDOUS (F002)

FACILITY B
NON HAZARDOUS

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Notes:

Purpose of Slide

- Point out the importance of source identification when determining if media contains listed HW.

Key Points

- In this example, drums of drill cuttings were generated during site investigations at two different facilities. Sampling showed the same concentration (15 milligram per kilogram (mg/kg) PCE) in the containerized materials from both sites.
- At Facility A, it was determined that a listed HW (spent solvent – F002) was the source of the PCE in the drill cuttings. The drill cuttings were determined to be subject to full RCRA regulation. (Because the drill cuttings were above the State's health threshold for PCE, the State did not make a "contained-out" determination.)
- At Facility B, the source of the PCE was not identified after good-faith efforts, so it was determined that the cuttings did not contain F002 or any other listed HW. The cuttings were also tested for Extraction Procedure (EP)-Toxicity using the Toxicity Characteristic Leaching Procedure (TCLP) and did not not exceed any regulatory levels. Therefore, the Facility B drill cuttings were not subject to the RCRA HW regulations (but, because of the PCE concentration, would likely be managed as non-hazardous, contaminated media).
- This example illustrates how the same type of material may require different management approaches under RCRA.

References

- None.



Over-Management of Media Can be Costly






<u>Handling issues:</u>	<u>Disposal Cost (150 drums):</u>
Twenty 50-ft, 2-inch monitor wells: 120 drums	Hazardous \$14,000
Three 50-ft, 4-inch recovery wells: 30 drums	Nonhazardous \$2,800
<u>Regulatory issues:</u>	
❖ 90-day storage limit	
❖ Compliance with generator regulations – training, inspections, recordkeeping, reporting	

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Notes:

Purpose of Slide

- Provide an example of the cost implications of the “contained-in” determination for contaminated media.

Key Points

- The above example of managing investigation derived waste (IDW) from a contaminated site illustrates the substantial difference in the estimated disposal cost (actually, transportation and off-site disposal) for media determined to be hazardous (\$14,000) versus non-hazardous (\$2,800).
- There would also be additional costs associated with management of HWs on site to comply with the applicable RCRA generator requirements for manifesting, inspections, training, recordkeeping, and reporting.
- These examples show that a presumption that contaminated media generated at a site are HW can have regulatory and cost implications. A more thorough evaluation of the source of contamination presumption and a resulting “contained out” determination may have helped to avoid the costs of containerizing and managing this media as HW.

References

- None.



Proper Application of Media Policies Encourages *More* Treatment Options

**Horizontally Trenched
Recovery Well and
Contaminated Soil Removal**

Groundwater Treatment System





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Notes:

Purpose of Slide

- Provide examples of the positive implications of applying the policies for contaminated media.

Key Points

- These photographs illustrate sites where facilities and regulatory agencies agreed that groundwater and soil did not have to be managed as HW, based on proper application of media policies. As a result, multiple treatment options were available to cost-effectively manage remediation waste.
- The photograph on the right shows a horizontal recovery well that is under construction. The activity is occurring in an established Area of Contamination so the environmental media are not subject to Subtitle C management standards.
- The photograph on the left shows part of a groundwater recovery and off-gas treatment system at a site where the source of contamination principle was applied; there were multiple sources of volatile organic compounds (VOCs) in the groundwater (some of which were listed and some were not), and because the precise source of the contamination was not known, the groundwater did not have to be handled as hazardous. Therefore, the treatment system could be designed at a fraction of the cost. For example, double-walled pipe (shown in the photograph) on the lower-right was not necessary.
- In both cases, media are managed as contaminated, and all appropriate health and safety considerations apply.

References

- None.



Contained Out Determination

- ❖ If media or treatment residue contains listed HW, authorized State (or EPA if State is not authorized) may make a “contained out” determination.
- ❖ This determination is based on direct exposure using a reasonable maximum exposure scenario and use of conservative, health-based, standards
- ❖ These determinations can be made for an entire area of contaminated media before or after extraction or treatment. (The approach could have implications for LDR standards.)

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Notes:

Purpose of Slide

- Discuss the overall process for making a “contained-out” determination.

Key Points

- Media that contain a listed HW have to be managed as a HW. However, the State (or EPA if the State is not authorized) can make a “contained-out” determination if it finds that the levels of hazardous constituents from the associated listed waste do not exceed applicable health-based limits in the media. To determine the applicable hazardous constituents for a given listed waste, Appendix VII in 40 CFR Part 261 can be used to find the hazardous constituents for which the waste was listed. Alternatively, analysis of the original listed waste may be used to determine the applicable constituents.
- The health-based limits used to compare to hazardous constituent concentrations in contaminated media will vary from Region to Region and State to State but are generally based on direct exposure assumptions using a reasonable maximum exposure scenario. Since this determination involves development of site-specific health-based levels, the approval of an authorized State or EPA is required.

References

- CFR. 40 CFR Part 261.
- EPA. 1998. Management of Remediation Waste Under RCRA. EPA530-F-98-026. October.



Site-Wide “Contained Out” Determination





- ❖ Electroplating sludge excavated
- ❖ Surrounding soils over excavated – potentially contain F006 waste
- ❖ “Contained out” request to State for < industrial levels (continued)

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Notes:

Purpose of Slide

- Describe a case study illustrating the application of the “contained out” determination at a RCRA CA facility.

Key Points

- This facility had disposed of a listed HW, electroplating sludge (F006), in five landfills that were excavated as part of revitalization activities.
- The F006 sludge was visually detected during excavation of the landfills by its blue-gray appearance. After the sludge was excavated in a given area, an additional 6 to 12 inches of surrounding soil was removed to ensure that contaminants associated with the sludge were also remediated.
- Because of the proximity of the surrounding soils to the excavated sludge and small amounts of sludge commingled in the soils, the over-excavated soils were considered to potentially contain a listed HW (F006).
- Accordingly, the over-excavated soils were required to be characterized and a “contained out” determination was required to determine if the soils contained HW.
- According to Florida’s Contaminated Media Policy, contaminated media may be “contained out” if: (1) representative sampling shows that contaminant concentrations in the media do not exceed the State’s risk-based soil criteria (Soil Cleanup Target Levels [SCTLs]) and (2) certain media management practices are followed.
- If the contaminated soil concentrations fell under the State’s Industrial SCTLs, the soil could be “contained out” and subsequently managed as a non-hazardous waste in a permitted Subtitle D (nonhazardous) landfill.
- This facility submitted the first formal petition to the State for a “contained out” determination. After a 30-day public notice period of the petition, the State issued a Final Order for its “contained out” decision.

References

- Florida DEP. 2002. Guidance Document: Management of Contaminated Media Under RCRA. August 21 (recently updated).



Site-Wide “Contained Out” Determination – Soil Management: One Possible Strategy

- ❖ Soils > Industrial criteria or TCLP (contained in) = **offsite LDR treatment + Subtitle C landfill disposal**
- ❖ Soils < Industrial criteria and TCLP (contained out) but > Residential criteria = **Subtitle D landfill disposal**
- ❖ Soils < Residential criteria and TCLP (contained out) = **used as on-site backfill**

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Notes:

Purpose of Slide

- Describe how “contained out” process was implemented at a RCRA CA facility.

Key Points

- This slide reviews the soil management approach approved for the site, using the “contained out” determination approved by the State.
- Using this “contained out” process for over-excavated soil, instead of automatically assuming the soil was hazardous under the “contained-in” policy, expedited cleanup by months.

References

- None.



Provisions Applicable to All Hazardous Remediation Wastes

- ❖ Area of Contamination Policy
- ❖ Special units created for management of remediation wastes
 - Corrective Action Management Units (CAMUs)
 - Temporary Units (TUs)
 - Staging Piles

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Notes:

Purpose of Slide

- Introduce a number of specific types of RCRA requirements and associated terms for waste management units.

Key Points

- If remediation wastes are hazardous or subject to Subtitle C regulations, EPA has developed regulations and requirements for several special types of waste management units to provide flexibility in managing hazardous remediation wastes. In most cases, use of these units allows on-site management of remediation wastes without triggering compliance with minimum technology requirements (MTRs) and LDRs.
- An Area of Contamination is not a specific unit, per se, but refers to a designated area of a site where management of remediation waste is allowed without triggering MTRs or LDRs.
- The area of contamination and special units created for managing remediation waste will be discussed in more detail in the following slides.

References

- EPA. 1998. Management of Remediation Waste Under RCRA. EPA 530F-98-026. October 14.



Area of Contamination Policy

- ❖ Area of generally dispersed contamination such as large contiguous area of soil contamination
 - May include old waste disposal units
- ❖ If contamination is in non-contiguous areas, multiple areas of contamination may be used
- ❖ Movement or in situ treatment within area of contamination does not trigger LDRs, MTRs, and other Subtitle C requirements as long as waste is not placed in containers, tanks or non-land based units.

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Notes:

Purpose of Slide

- Define and discuss the use of, and features of, area of contamination for management of remediation wastes. This acronym should not be confused with an enforcement “Administrative Order on Consent” or a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Hazardous and Solid Waste Amendments (HSWA) “Area of Concern.”

Key Points

- EPA introduced the area of contamination concept in the preamble to the National Contingency Plan (NCP).
- An area of contamination is defined as “a discrete area of generally dispersed contamination that can be equated with a RCRA landfill.” An area of contamination is delineated by the areal extent (or boundary) of contiguous contamination. Such contamination must be contiguous, but may contain varying types and concentrations of hazardous substances.
- Areas of contamination can include old landfills or surface impoundments.
- Because the definition of “landfill” would not include discrete, widely separated areas of contamination, an area of contamination would not always encompass an entire site. To address noncontiguous contaminated areas at a site, multiple areas of contamination can be employed.
- Movement of wastes within an area of contamination does not trigger LDRs or MTRs. Consolidation and in situ treatment of HW within the area of contamination, as long as it is managed only in land-based units, does not constitute “disposal”, and does not trigger LDRs or disposal unit standards.
- The area of contamination concept allows wastes to be consolidated or treated without triggering LDRs or MTRs. However, ex-situ treatment (such as incineration or treatment in a tank or container or other non-land based unit) or transfer to another area of contamination will trigger those RCRA requirements.

References

- Federal Register (FR). 1990. area of contamination Concept First Presented in National Contingency Plan. 55 FR 8758. March 8.
- EPA. 1996. Guidance: Use of the Area of Contamination Concept During RCRA Cleanups. Memorandum. March 13.

 Application of Area of Contamination Policy to Hazardous Remediation Waste 



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Notes:

Purpose of Slide

- Provide an example of application of area of contamination policy for managing contaminated media.

Key Points

- An empty underground storage tank that previously contained listed HW solvents was excavated as part of cleanup activities at this RCRA facility.
- The tank showed evidence of past leakage so several feet of surrounding soil was also excavated. The facility concluded that the soil contained HW because the source was known to be a RCRA HW.
- Excavated soil was stockpiled in the immediate area of the tank excavation pending characterization.
- The facility determined, and the State regulatory agency confirmed, that the stockpiled soil was within an area of contamination.
- By storing the contaminated soil in an area of contamination, the requirements associated with establishing a staging pile or CAMU did not have to be met.
- Based on sampling and analysis, concentrations of hazardous constituents in some of the excavated soil were below risk-based levels, so the regulatory agency determined that this soil did not “contain” HW and it was placed back in the excavation. The excavated soil containing hazardous constituents above “contained out” levels were transported to a HW disposal facility. Note, the hazardous soil could have been placed back in the excavation, but the regulatory and facility wished to minimize long-term care obligations.
- This example points out that the use of areas of contamination can streamline the cleanup activity (for example, time associated with permitting a staging pile or CAMU) and waste management costs (facilitating reuse of soil as opposed to off-site disposal).

References

- None.



CAMUs

- ❖ Subtitle C land-based unit used for “CAMU-eligible waste” - provides flexibility in design and treatment standards compared to landfills
- ❖ Disposal CAMU:
 - Minimum design requirements - cap, liner, leachate collection
 - Treatment of Principle Hazardous Constituents
- ❖ Treatment and storage CAMU:
 - Flexible design requirements; same as staging piles
 - May be limited to 2.5 years of operation

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Notes:

- Purpose of Slide: Discuss use of CAMUs for management of remediation waste.
- Key Points
- A CAMU is a special type of land-based unit used for on-site treatment, storage, or disposal of remediation waste. Use of CAMUs is intended to provide flexibility in managing remediation wastes. The CAMU Rule was promulgated in 1993, and used successfully for nearly 10 years. As a result of a law suit, the rules were revised in 2002 and specific restrictions were placed on the use of the CAMU. The final CAMU rule was issued on January 22, 2002.
- CAMUs must be approved by EPA or an authorized State and designated in a permit or order. In certain circumstances, EPA and states (including states that are not authorized for the CAMU regulations) may use other mechanisms to approve CAMUs.
- CAMUs can only be used to manage “CAMU-eligible waste” which includes solid and HW, contaminated media, and debris from cleanup activities. Wastes that are not “CAMU-eligible waste” include “as-generated” waste, waste in intact containers, and bulk and free liquids.
- There are two basic types of CAMUs: (1) disposal CAMUs, where waste will remain after closure and (2) treatment and storage CAMUs, which are used for a limited time and in which wastes will not remain after closure.
- Minimum design and operating standards for disposal CAMUs include:
 - Requirements for a cap, composite liner, and a leachate collection system;
 - CA for releases; and
 - Principle hazardous constituents in the waste must be treated to the LDR Phase IV soil standards before disposal. Principal hazardous constituents are parameters that pose a risk to human health and the environment, either directly or via groundwater migration, that are substantially higher than the cleanup levels for the site (for example, carcinogens above a 10^{-3} cancer risk and non-carcinogens an order of magnitude or greater than the reference dose). The Phase IV soil standards will be described in later slides.
- Design and operating standards for treatment and storage CAMUs:
 - Same standards as staging piles, which will be discussed later in this module;
 - If a CAMU is used for longer than 2.5 years, it must meet the minimum design standards of disposal CAMUs; and
 - Consolidation of cleanup wastes does not trigger compliance with LDRs or MTRs.
- 40 CFR Part 264.555 provides for disposal of CAMU-eligible waste in off-site permitted hazardous waste landfills, if certain conditions are met:
 - Principal hazardous constituents are treated to applicable LDR Phase IV soil standards.
 - The landfill must be a RCRA hazardous waste facility whose permit authorizes receipt of CAMU-eligible wastes.
 - The landfill must notify the regulatory agency of its intent to receive CAMU-eligible waste and receive notification of no objections.
- References
- FR. 2002. Final CAMU Rule. 67 FR 2962. January 22.
- CFR. CAMU Regulations. 40 CFR Parts 264.550, .551, .552, and .555.

 **Use of a CAMU for Disposal of Hazardous Remediation Waste**

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Notes:

Purpose of Slide

- Discuss use of CAMU to manage hazardous remediation waste.

Key Points

- A CAMU was used to manage remediation waste at the U.S. Smelter and Lead Refinery, Inc. (USS Lead) facility.
- This facility operated as a copper and lead refinery and secondary lead smelter.
- Remediation of the site involved excavation of large volumes of contaminated soil, sediment, slag, and debris.
- The remedy chosen involved excavation, consolidation, and on-site disposal using a CAMU.
- The CAMU design included a subsurface slurry wall around the 11-acre CAMU, an engineered final cover, and a long-term ground-water monitoring system.

References

- EPA. 2007. Fact Sheet: USS Lead, East Chicago, Indiana. October. Accessed On-line at: <http://www.epa.gov/Region5/sites/usslead/pdfs/usslead-joint-factsheet-200710.pdf>
- U.S. Steel. Undated. CAMU Photo Archive. Accessed On-line at: <http://www.ussteel.com/corprcra/images/GCR%20Pictures/CAMU/Camu%20Aerial-07j.jpg>.



Differences Between Areas of Contamination and CAMUs

<u>Area of Contamination</u>	<u>CAMU</u>
<ul style="list-style-type: none"> ❖ In situ treatment allowed ❖ Located only in area with contiguous contamination ❖ Consolidation only allowed within area of contamination 	<ul style="list-style-type: none"> ❖ In situ or ex situ treatment allowed ❖ Located in contaminated areas, uncontaminated areas, and off-site ❖ Consolidation allowed from areas inside or outside CAMU

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Notes:

Purpose of Slide

- Describe the significant differences between the use of areas of contamination and CAMUs.

Key Points

- The area of contamination policy addresses only consolidation and other in situ waste management techniques carried out within an area of contamination (that is, wastes may be consolidated or treated in situ within an area of contamination without triggering LDRs or MTRs). The area of contamination policy does not allow ex situ treatment of waste. However, waste may be treated ex situ and then placed in a CAMU.
- An area of contamination may only be located in an area of contiguous contamination, but a CAMU can also be located in uncontaminated areas of a site.
- Wastes cannot be consolidated from different areas of contamination at a site, but wastes from different areas of contamination can be consolidated in a CAMU.
- A further discussion of the differences between areas of contamination and CAMUs is included in the EPA guidance document referenced below.

References

- EPA. 1998. Management of Remediation Waste Under RCRA. EPA 530-F-98-026. October.



Temporary Units (TUs)

- ❖ Non-land-based unit
 - Temporary tank
 - Temporary container storage area
- ❖ Design standards may be Part 264 or 265 requirements for tanks and containers or alternative site-specific standards.
- ❖ Limited to 1 year of operation

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Notes:

Purpose of Slide

- Discuss use of temporary units (TUs) for management of remediation wastes.

Key Points

- The regulations for TUs were promulgated at the same time as the original CAMU final rule. A TU is a non-land-based unit used to manage hazardous remediation wastes. A TU can include temporary tanks and container storage areas.
- Alternative design, operating, and closure standards are available for TUs. EPA or authorized States may specify site-specific design, operation, and closure standards as alternatives to those specified for tanks and containers in Parts 264 or 265. For example, if a TU will be located in a widely contaminated area that will be remediated, it may not be necessary to require secondary containment for the TU.
- Placement of wastes in TUs is not considered land disposal; therefore, LDRs do not apply. However, wastes or treatment residuals that are removed from TUs may be subject to LDRs.
- TUs may only operate for a period of one year, with an opportunity for a one-year extension.

References

- FR. 1993. Final TU Rule. 58 FR 8658. February 16.
- CFR. 40 CFR Part 264.553.



Staging Piles

- ❖ Temporary storage of solid, non-flowing remediation waste
- ❖ Mixing, sizing, blending, or other physical operations allowed, but not treatment
- ❖ Site-specific design/performance standards
- ❖ Limited to 2 years of operation
 - If a pile is located within an area of contamination, this requirement does not apply since it is a land-based unit

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Notes:

Purpose of Slide

- Define and discuss the use of, and features of, staging piles for management of remediation wastes.

Key Points

- A staging pile is an accumulation of solid, non-flowing, remediation waste that is not a containment building and is used only during remedial operations for temporary storage at a facility. A staging pile is a non-land-based unit.
- By definition, staging piles cannot be used to treat remediation waste. However, in the amendments to the final CAMU rule in January 2002, EPA clarified that mixing, sizing, blending, and other physical operations intended to prepare waste for subsequent treatment or management could occur in staging piles.
- Staging piles can be used to store hazardous remediation waste only if standards and design criteria established for the staging piles are followed. Performance standards and design criteria are established by EPA or the authorized State. Staging piles are not subject to LDRs or MTRs.
- Performance standards for a staging pile require that the staging pile: (1) facilitate a reliable, effective, and protective remedy; (2) prevent or minimize releases of HW or constituents to the environment, and minimize cross-media transfer; (3) complete operations within two years unless a 180-day extension is granted (the two year limit starts the first day that the waste is placed in the staging pile); and (4) provide for proper and timely closure. Sufficient information must be provided to EPA or the State to establish site-specific standards and design criteria.

References

- CFR. 40 CFR 264.554.



Remedial Action Plans (RAPs)

- ❖ A special form of RCRA permit that provides an alternative mechanism to a traditional RCRA permit for managing hazardous remediation waste
- ❖ Options for issuing RAPs:
 - Part of existing RCRA permit (permit mod)
 - Stand-alone document
 - Part of other decision document
- ❖ Do not reduce cleanup obligations
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Notes:

Purpose of Slide: Discuss use of Remedial Action Plan (RAPs) as an alternative to RCRA permits for management of hazardous remediation waste.

Key Points

- Often, remedies selected for cleanup sites involve treating, storing, or re-disposing of hazardous remediation waste. RCRA permits are required whenever you treat, store or dispose of HW (unless a specific permit exemption or exclusion applies). Treating, storing or re-disposing of hazardous remediation wastes required the same type of permit as that for as generated process waste management. Traditional RCRA permits, however, were designed for operating HW TSDFs managing as-generated process wastes. The permit procedures, requirements, and contents were designed specifically for those situations. Traditional RCRA permits also require facility-wide CA under RCRA Sections 3004 (u) and (v). Many of these requirements are not well suited to cleanup activities. The intent of the RAP is to expedite remediation efforts performed at sites where HW management is required, including Brownfields and abandoned contaminated lands, by making it easier for a site o/o to obtain permitting for a cleanup. RAPs involve application and approval procedures that differ from traditional RCRA permitting procedures for the management of hazardous remediation wastes. RAPs make permits for treating, storing, and disposing of remediation wastes faster and easier to obtain. Remediation waste management sites can be designated to avoid facility-wide CA. Previously, the process of obtaining a treatment, storage, or disposal permit triggered facility-wide CA requirements. This was a huge disincentive against undertaking cleanup activities requiring a permit. Under the revised definition of a remediation waste management site, this disincentive is removed by stipulating that remediation waste management sites do not constitute facilities requiring CA.
- If alternative state authorities are not practicable for a site, a RAP, which is a special form of a permit, can be used in lieu of a traditional RCRA permit to treat, store, or dispose of hazardous remediation waste at remediation waste management sites. Given this flexibility, EPA believes that it will be possible for EPA and authorized States to develop RAPs that are much more suited to cleanups than current RCRA permits are—that is, a RAP will generally fit the model of a Superfund Record of Decision or an approval of a cleanup workplan, rather than that of a RCRA Part B permit. EPA believes this flexibility is essential for an effective cleanup program. Note that RAPs are not part of State base RCRA programs.
- RAPs can be issued in several ways. A RAP may be issued to a facility with an existing RCRA permit through a permit modification. Alternatively, the RAP may be issued as a stand-alone document or it may be included as part of another document, such as Superfund Record of Decision (where they have been used to specify compliance with substantive RCRA regulations), applicable to remediation activities at a facility.
- The RAP approval process follows the general administrative procedures for issuing environmental permits, consisting of a determination that the application is technically adequate, agency preparation and public notice of a draft RAP, and issuance of the final RAP. RAP modification procedures are also similar to traditional permits. However, while the basic procedures are similar, the process has been significantly streamlined and simplified for RAPs.
- It is important to note that use of a RAP does not affect “how clean is clean” decisions about a facility or the legal obligations of the facility to conduct cleanup activities.

References

- CFR. 40 CFR Part 270 Subpart H (270.70 - 270.230).



RAPs

- ❖ **RAP benefits:**
 - More flexible application requirements
 - Less prescriptive, streamlined public involvement
 - Flexibility in modifying RAPs
 - “Permit as shield” protections
 - Site-wide corrective action not required
 - May be located offsite under certain circumstances
- ❖ **RAP limitations:**
 - No on-site incineration or management of “as-generated” waste

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Notes:

Purpose of Slide

- Explain some benefits and limitations related to the use of RAPs.

Key Points

- RAPs provide several advantages to traditional RCRA permits, including:
 - The information requirements in RAP applications (40 CFR 270.110) replace the detailed information requirements in traditional Part B permit applications. The applicant is only required to provide site-specific information that is relevant to management of its hazardous remediation wastes. EPA or an authorized State may require additional information as needed.
 - Accordingly, the permit writer is freed from addressing prescriptive Part B requirements designed to address production wastes and can tailor the RAP requirements to address the site-specific cleanup setting.
 - The public involvement procedures for RAPs include flexibility for the regulatory agencies and minimal public notice requirements. For example, the following are not required: a facility mailing list, pre-application public meeting, and information repository.
 - The procedures for modifying existing RAPs are more flexible and streamlined than for traditional permits.
 - RAPs provide “permit as shield” protection in that as long as the terms of the RAP are met, the facility is considered to be in compliance with RCRA Subtitle C for enforcement purposes.
 - In order to encourage cleanup, EPA revised the definition of a remediation waste management site and eliminated the requirement for site-wide CA at sites conducting remediation only (that is, no management of production wastes) under RAPs or traditional permits.
 - RAPs are generally issued for on-site remediation purposes. However, an o/o may request a RAP for remediation waste management activities at an off-site location if the o/o believes that such a location would be more protective than the contaminated area or areas in close proximity. An off-site RAP is subject to expanded public participation requirements.
- RAPs have several limitations in their use, including that RAPs may not be used for on-site combustion of hazardous remediation wastes or for the management of “as-generated” HW.

References

- CFR. 40 CFR Part 270 Subpart H (270.70 - 270.230).



Doe Run Company RAP



- ❖ **Purpose** – manage and place lead-contaminated remediation waste excavated from residential yards and other areas in Viburnum, MO
- ❖ **Format** – streamlined document (10 pages)
- ❖ **General conditions** – similar to standard permit (for example, proper O&M, monitoring, recordkeeping and reporting)
- ❖ **Special conditions** – site-specific waste handling procedures

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Notes:

Purpose of Slide

- Provide an example of a RAP issued in Region 7.

Key Points

- The Doe Run Company (Doe Run) Viburnum Facility RAP, issued in 2006 by EPA (MO did not have RAP authorization at the time of issuance) allowed the Permittee to stage, sample, transport, treat and place lead-contaminated remediation waste excavated from residential yards into a CAMU associated with a site cleanup in the area of Viburnum, MO. Some soils also were removed from other areas as a part of a RCRA CA. Portions of the removed waste may be characteristically hazardous for lead (TCLP). In its RAP application, the Permittee requested approval to dispose of an estimated 100,000 tons of remediation waste from the lead-impacted Superfund and RCRA CA sites into the CAMU.
- Unlike the lengthy and all-encompassing requirements of a traditional RCRA permit, the Doe Run RAP distilled the general and site-specific conditions into a 10-page document.
- The general conditions in the RAP read similarly to the general conditions in most RCRA permits, addressing: duty to comply, maintaining proper O&M and site conditions, and recordkeeping/reporting.
- What sets the RAP apart from most traditional RCRA permits is that it is self-contained – most (if not all) of the conditions are spelled out in the RAP itself, such as:
 - Site-specific methods for wastes handling and management;
 - Specific waste characterization protocols (for example, waste sampling frequency and analytical methods);
 - Waste treatment method (2% tri sodium phosphate [TSP] treatment of soils);
 - Specific engineering controls and decontamination requirements; and
 - Decision making protocols for different management methods (for example, treatment of soils with TSP is followed by mixing and curing of soils, which is followed by TCLP analysis for lead); the prescribed management method for the treated soil is then based on TCLP results and comparison of this data to the lead UTS.

References

- EPA. 2006. Draft Remedial Action Plan for Management of Hazardous Remediation Waste, Viburnum Facility, Viburnum, MO, EPA ID # MOD 000 823 252. May 30.



LDR Treatment Standards for Remediation Wastes

- ❖ Variances: EPA and authorized states can grant LDR variances under certain circumstances
- ❖ Alternative LDR standards for new treatability groups:
 - Contaminated soil
 - Hazardous debris

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Notes:

Purpose of Slide

- Introduce concept of variances and alternative LDR treatment standards applicable to contaminated soil and hazardous debris.

Key Points

- The Phase IV LDR Rule created a new treatability groups — contaminated soil and hazardous debris.
- “Soil” was defined in the rule as unconsolidated earthen material or a mixture of earth material with liquids, sludges, or solids that is inseparable by simple mechanical removal methods and is comprised primarily of soil. Deliberate mixing of HW with soil to change its treatment classification is not allowed.
- Debris is defined as solid material exceeding a 60-millimeter (mm) particle size that is intended for disposal and that is: (1) a manufactured object, (2) plant or animal matter, or (3) natural geologic material. Some materials, such as lead acid batteries and scrap metal, are not included in this definition. Debris that contains a listed HW or exhibits a HW characteristic is considered hazardous debris under RCRA and is subject to the LDRs.

References

- FR. 1998. Phase IV LDR Rule. 63 FR 28751. May 26.
- CFR. Universal Treatment Standards. 40 CFR 268.48.
- CFR. Alternate Treatment Standards for Contaminated Soil. 40 CFR 268.49.
- EPA. 2001. Land Disposal Requirements: Summary of Requirements. EPA 530-R-01-007. August.
- EPA. 2002. Guidance on Demonstrating Compliance with the LDR Alternative Soil Treatment Standards. EPA 530-R-02-003. July.



Alternative LDR Treatment Standards

- ❖ New treatability group – contaminated soil
 - 90% reduction in hazardous constituents, capped at 10 times Universal Treatment Standards (UTS)
 - Treatment required for underlying hazardous constituents (UHCs) present at 10 times the UTS
- ❖ New treatability group – hazardous debris
 - Specified technologies (extraction, destruction, immobilization)
 - Debris treated by extraction or destruction technologies is generally not subject to further RCRA Subtitle C Regulation

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Notes:

Purpose of Slide: Introduce concept of alternative LDR treatment standards applicable to contaminated soil.

Key Points

- Contaminated soil that exhibits a characteristic or contains a listed HW may meet either the soil LDR treatment standards or industrial waste treatment standards.
- The contaminated soil LDR treatment standards require a 90 percent reduction in hazardous constituents subject to treatment. However, that treatment does not have to reduce constituent concentrations to below 10 times the Universal Treatment Standards (UTS) for those constituents.
- Some characteristic HWs may require treatment of underlying hazardous constituents (UHCs) in addition to the property being treated (for example, corrosivity). UHCs are constituents that can be expected to be present in the waste at levels above applicable UTSS. Only UHCs that are present at concentrations greater than 10 times their respective UTSS must be treated.
- Hazardous debris must be treated for each "contaminant subject to treatment," using the technology or technologies listed in the alternative treatment standards for hazardous debris in 40 CFR 268.45. The alternative treatment standards for hazardous debris list various extraction, destruction, and immobilization technologies. The extraction technologies include physical extraction technologies (abrasive blasting, grinding, scarification, spalling, vibratory finishing, or high pressure steam or water washing), chemical extraction technologies (water washing and spraying, liquid-phase solvent extraction, vapor-phase solvent extraction), and thermal extraction technologies (high temperature metals recovery thermal desorption). Destruction technologies include biological destruction, chemical destruction (chemical oxidation using specified reagents such as peroxides, chemical reduction using reducing agents such as sulfur dioxide), and thermal destruction (treatment in an RCRA-regulated incinerator or boiler or industrial furnace). Immobilization technologies include macroencapsulation, microencapsulation, and sealing.
- Hazardous debris must be treated using the alternative treatment standards for hazardous debris before being land disposed. RCRA provides a conditioned exclusion for debris treated using either the extraction or destruction technologies (for example, concrete that has been sandblasted). Under the exclusion, hazardous debris that has been treated by one of the technologies specified in the alternative treatment standards and that does not exhibit a characteristic of HW after treatment is not a HW and need not be managed in a permitted HW disposal facility. However, if hazardous debris contaminated with a listed waste is treated only by an immobilization technology specified in the alternative treatment standards, then that hazardous debris must still be managed in a Subtitle C facility.

References

- FR. 1998. Phase IV LDR Rule. 63 FR 28751. May 26.
- CFR. Universal Treatment Standards. 40 CFR 268.48.
- CFR. Alternate Treatment Standards for Contaminated Soil. 40 CFR 268.49.
- EPA. 2001. Land Disposal Requirements: Summary of Requirements. EPA 530-R-01-007. August.
- EPA. 2002. Guidance on Demonstrating Compliance with the LDR Alternative Soil Treatment Standards. EPA 530-R-02-003. July. FR. 1992.
- Alternative LDR Treatment Standards for Debris. 57 FR 37196.
- CFR. 40 CFR 268.45.



Alternative LDR Treatment Standards for Soil (Example)

- ❖ Contaminated soil is considered a hazardous waste subject to LDR with A-waste, concentration 100 mg/kg
- ❖ The Universal Treatment Standard for A-waste hazardous constituent is 2 mg/kg
- ❖ What is the LDR treatment standard for this hazardous remediation waste?
 - 90% reduction ($100 - .9 \times 100 = 10$ mg/kg)
 - capped at 10 x UTS ($10 \times 2\text{mg/kg} = 20$ mg/kg)

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Notes:

Purpose of Slide

- Illustrate concept of alternative LDR treatment standards applicable to contaminated soil using an example.

Key Points

- The instructor will review the example to illustrate LDR treatment standards for soil.

References

- FR. 1998. Phase IV LDR Rule. 63 FR 28751. May 26.
- CFR. Universal Treatment Standards. 40 CFR 268.48.
- CFR. Alternate Treatment Standards for Contaminated Soil. 40 CFR 268.49.
- EPA. 2001. Land Disposal Requirements: Summary of Requirements. EPA 530-R-01-007. August.
- EPA. 2002. Guidance on Demonstrating Compliance with the LDR Alternative Soil Treatment Standards. EPA 530-R-02-003. July. FR. 1992.
- CFR. Alternative LDR Treatment Standards for Debris. 57 FR 37196.
- CFR. 40 CFR 268.45.



Re-injection of Groundwater During Cleanups

- ❖ Re-injected groundwater exempt from LDRs if:
 - Groundwater treated before reinjection (either ex-situ or in-situ)
 - Cleanup protective of human health and the environment
 - Part of RCRA or CERCLA cleanup



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Notes:

Purpose of Slide: Review policies regarding the reinjection of groundwater during cleanups.

Key Points

- Underground injection of groundwater contaminated with HW frequently occurs as part of RCRA and CERCLA cleanups to facilitate groundwater remedies. For example, groundwater containing HW may be extracted, treated, and reinjected into an aquifer as part of a pump and treat remediation system.
- Section 3020 of RCRA addresses underground injection of HW in the context of RCRA and CERCLA cleanups. RCRA Section 3020(a) bans HW disposal by underground injection into, or above, a formation which contains an underground source of drinking water (within one-quarter mile of the well). RCRA Section 3020(b), however, exempts reinjection of treated contaminated groundwater from LDRs if certain conditions are met.
- Under EPA policy, reinjected groundwater is exempt from compliance with LDRs if: (1) it is treated before reinjection and the treatment is intended to “substantially reduce” hazardous constituents in the groundwater. The “substantial reduction” may occur either before or after reinjection; (2) the cleanup is protective of human health and the environment; and (3) the injection is part of RCRA or CERCLA cleanup under RCRA CA or CERCLA 104 or 106 actions.
- EPA interpreted Section 3020 in a December 27, 2000, memorandum. That document discusses the applicability of Section 3020 requirements to groundwater reinjection associated with in-situ groundwater bioremediation, chemical oxidation, and injection of other materials as follows:
 - Amending extracted contaminated groundwater with nutrients, microorganisms, chemical oxidants, or other treatment materials is consistent with the RCRA Section 3020 treatment requirement, as long as the extracted groundwater is amended (or otherwise treated) before reinjection, and as long as the treatment is intended to achieve a substantial reduction of hazardous constituents after reinjection (that is., nutrients or microorganisms are added to groundwater at the surface to assist treatment even if the reduction occurs later).
 - When a commercial chemical is injected into groundwater for in-situ treatment but no groundwater is withdrawn and reinjected, RCRA does not regulate or prohibit the material's injection.

References

- Section 3020 of RCRA.
- EPA. 2000. Applicability of RCRA Section 3020 to In-Situ Treatment of Ground Water. December 27.
- EPA. 1998. Management of Remediation Wastes Under RCRA. October.



Other Regulatory Considerations

- ❖ Clean Water Act (CWA)
 - National Pollutant Discharge Elimination System
 - Section 404 and state rules for wetlands impacts
- ❖ Toxic Substances Control Act (TSCA) (slide follows)
- ❖ EPA's Contaminated Sediment Management Strategy
- ❖ Clean Air Act - Site Remediation Maximum Achievable Control Technology (MACT) Rule
- ❖ Endangered Species Act and related state rules
- ❖ Local rules and ordinances

February 2009

Module 9 - Managing Remediation Waste

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Notes:

Purpose of Slide: Discuss several other regulatory concerns associated with remediation waste management.

Key Points: Project managers should recognize that a number of regulatory programs other than RCRA can apply to CA effort.

- Superfund cleanups are exempted from obtaining permits to comply with other environmental regulations; however, RCRA CA cleanups are not. In planning RCRA CA cleanups, project managers should consider the timeframes and costs associated with obtaining the required environmental permits, such as National Pollutant Discharge Elimination System (NPDES) or Section 404 permits (for dredged spoils), applicable to their sites.
- PCBs released from electrical and other equipment may be present at RCRA facilities; where such contamination is identified in soil, both the TSCA and RCRA may apply to the remediation. TSCA regulations regarding cleanup and disposal options for PCB remediation waste are found at 40 CFR 761.61. The regulations establish three cleanup options for PCB remediation waste: self-implementing; performance-based disposal; and risk-based disposal. Clean up and disposal of PCBs performed under 40 CFR 761.61 is based on the concentration at which the PCBs are present. Under the RCRA LDR program, UTS have been established for PCBs (0.10 mg/L in wastewater and 10 mg/kg in non-wastewaters). PCBs may be considered UHCs in contaminated soil that exhibits a characteristic, and therefore, treatment may be necessary.
- EPA created a Contaminated Sediment Strategy to address the ecological and human health risks that contaminated sediment poses in many U.S. watersheds. The Strategy establishes four goals to manage the problem of contaminated sediment and describes actions the Agency intends to take to accomplish these goals. The goals are: (1) to control sources of sediment contamination and prevent the volume of contaminated sediment from increasing; (2) to reduce the volume of existing (in-place) contaminated sediment; (3) to ensure that sediment dredging and dredged material disposal are managed in an environmentally sound manner; and (4) to develop a range of scientifically sound sediment management tools for use in pollution prevention, source control, remediation and dredged material management.
- In 2003, EPA promulgated the Final National Emission Standard for Hazardous Air Pollutants ("NESHAP") for Site Remediation under 40 CFR Part 63, Subpart GGGGG, also known as the "Site Remediation MACT Rule." It establishes national emission standards for hazardous air pollutants ("HAPs") from remediation of contaminated environmental media, such as soils, groundwater, or surface water. The affected sources subject to control are: process vents, remediation material management units, and equipment leaks. Site remediation activities subject to the final MACT Rule are required to control emissions of 97 specific organic HAP compounds by meeting emissions limitations and work practice standards consistent with application of the MACT. If site remediation does not involve cleanup of materials containing the listed HAPs, then the site is not subject to the rule. The rule exempts emissions from site remediation when covered under CERCLA or RCRA CA programs because those programs require consideration of the same HAP emissions and the RCRA and CERCLA statutes apply more specifically to the remediation process than does MACT under the CAA and, unlike the CAA, authorize site specific means of dealing with remediation activities and their associated HAP emissions. The Final Rule does not apply to a site remediation to clean up leaking underground storage tanks located at a gasoline service station. The Final Rule does not apply to any site remediation conducted at a farm or residential site. Also, the Final Rule does not apply to site remediation conducted at a research and development facility that meets the requirements of CAA Section 112(c)(7). The Rule also exempts certain "short duration" cleanups, but it does not exempt cleanups conducted under alternative authorities, such as state voluntary programs. Under the short-term site remediation exemption, a site remediation at a facility subject to the Final Rule is not subject to the emissions limitations and work practice standards in the final NESHAP for Site Remediation if the site remediation can be completed within 30 consecutive calendar days (as determined from the day on which actual work begins at the site to physically clean up the remediation materials).
- Other potential regulatory requirements associated with protecting endangered species and with local rules and ordinances also should be considered.

References

- 1998. EPA's Contaminated Management Strategy, April. EPA 823-R-98-001.
- FR. 1998. Disposal of PCBs. Final Rule. 40 CFR Parts 750 and 761. 63 FR 35383. June 29.
- FR. 2000. Proposed Rule: Deferral of Phase IV LDRs for PCBs. 65 FR 7809. February 16.
- EPA. 2000. Environmental Fact Sheet on Proposed Deferral of Phase IV LDRs for PCBs as an Underlying Constituent in Soil. EPA 530-F-00-008. February
- FR. 2003. Volume 68, No. 195. 40 CFR Part 63, Subpart GGGGG. National Emission Standards for Hazardous Air Pollutants: Site Remediation; Final Rule. October 8.
- CFR. 40 CFR 761.61.



Regulation of PCB Wastes

- ❖ TSCA – 1976 – PCBs were banned except for “totally enclosed uses”, such as transformers, capacitors, vacuum pumps and hydraulic fluids
- ❖ Disposal Options include:
 - PCB Remediation Waste (40 CFR 761.61)
 - a. Self-implementing Approach
 - b. Performance-based Approach
 - c. Risk-based Approach
 - PCB Bulk Product Waste (40 CFR 761.2)
 - a. Performance-based Approach
 - b. Solid Waste Landfill
 - c. Risk-based Approach
 - d. Daily Landfill Cover or Road Bed

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Module 9 - Managing Remediation Waste

34

Notes:

Purpose of Slide: Describe the law and regulations for the management, disposal and remediation of PCBs.

Speaker Key Points

- TSCA Section 6(e) was enacted in 1976 and required EPA to regulate PCBs.
- The TSCA PCB regulations (40 CFR Part 761) place prohibitions on the manufacture, processing, distribution in commerce, use, and disposal of PCBs and PCB items.
- PCB regulations include owners and/or operators of PCB-contaminated property where the PCB contamination exceeds allowable concentrations under the regulations.
- TSCA authority is only delegated to EPA regions. It can not be delegated to states.
- At the EPA Headquarters level, the use of PCBs is handled under the Office of Pollution Prevention and Toxic Substances (OPPTS), while cleanup and disposal of PCBs are handled by the Office of Resource Conservation and Recovery.
- “PCB Remediation Waste” is waste containing PCBs as a result of a spill, release, or other unauthorized disposal if:
 - Disposed prior to April 18, 1978, and with PCBs currently present at ≥ 50 parts per million (ppm);
 - Original PCB source ≥ 500 ppm beginning on April 18, 1978, and currently any concentration (≥ 1 ppm);
 - Original PCB source ≥ 50 ppm beginning on July 2, 1979, and currently any concentration (≥ 1 ppm); and
 - Any concentration of PCBs, if from an unauthorized source.
- “PCB Bulk Product Waste” is waste containing PCBs if the waste is derived from manufactured products containing PCBs in a non-liquid state, at any concentration where the PCB concentration at the time of designation for disposal was ≥ 50 ppm PCBs.

References

- EPA. Toxic Substances Control Act (TSCA) Regulations, Section 6(e).
- 40 CFR 761 (PCB Regulations). PCB Manufacturing, Processing, Distribution Commerce and Use Prohibitions.
- EPA PCB Web Site. Accessed On-line at: <http://www.epa.gov/epaoswer/hazwaste/pcbs/index.htm>.
- Toxic Substances Control Act (15 USC 2605(e)).



Summary of Module

- ❖ Range of regulations and guidance address management of remediation waste
- ❖ Other regulations also can apply to RCRA CA
- ❖ Understand requirements and plan ahead



February 2009 Module 9 - Managing Remediation Waste 35

Notes:

Purpose of Slide

- Summarize the key take home points associated with Module 9, Managing Remediation Waste.

Key Points

- Remediation wastes will be generated during CA.
- Planning for management of these wastes should be integrated into CA planning.
- Project managers should be familiar with the regulations and polices/guidance for remediation waste management. These allow flexibility in managing remediation waste.
- In considering remediation waste management, understand the regulations and plan ahead to apply the best approach for your site, while ensuring wastes are properly managed.

References

- None.

Module 10
CA Optimization Tools and Challenge Exercise



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



February 2009 Module 10 – CA Optimization Tools and Challenge Exercise 1

Notes:

Purpose of Slide

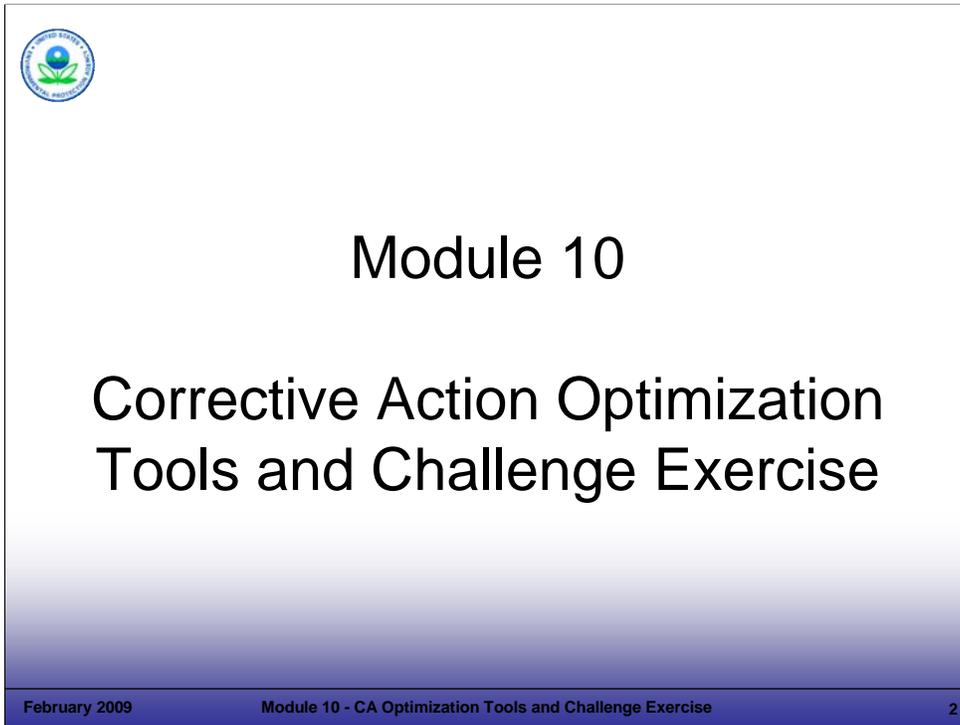
- Holder slide for Module 10, Corrective Action (CA) Optimization Tools and Challenge Exercise.

Key Points

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

References

- None.



Notes:

Purpose of Slide

- Holder slide for Module 10, CA Optimization Tools and Challenge Exercise.

Key Points

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

References

- None.



Module Overview

- ❖ Review concepts covered in Modules 1 through 9
- ❖ Provide a summary reference of approaches and tools
- ❖ Review and discuss these concepts – share ideas and examples of group



February 2009 Module 10 - CA Optimization Tools and Challenge Exercise 3

Notes:

Purpose of Slide

- Provide overview of Module 10, which includes a handout and discussion exercise.

Key Points

- As a break from lecture and PowerPoint overload, we will have an interactive, hand out-based discussion.
- This module provides an opportunity to review and share practical approaches and tools for corrective action (CA).
- The instructor will hand out a Menu of CA Optimization Tools developed for the training course from a variety of information sources. This menu highlights some of the practical approaches discussed in this course.
- The goal is to discuss the currently listed approaches and add more approaches as the course is delivered in each Region.

References

- None.



Challenge Exercise

- ❖ Which tools are you:
 - Currently using?
 - Intend to use?
 - Would like to use but can't?
- ❖ What are the potential obstacles or limitations:
 - Legal / regulatory?
 - Policy?
 - Technical or resources?

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Module 10 - CA Optimization Tools and Challenge Exercise

4

Notes:

Purpose of Slide

- Provide guide to exercise.

Key Points

- The instructor will provide direction for this exercise.

References

- None.



Optimization Tool	Currently Used	Intend to Use	Would Like to Use, But	Obstacles		
				Legal/Regulatory	Policy	Technical or Resource
<i>Regulatory approach</i>						
Performance-based permit	√	√				
Facility-lead agreement		√				
Self-certification			√		√	
Parcel Transfer		√				

February 2009 Module 10 - CA Optimization Tools and Challenge Exercise 5

Notes:

Purpose of Slide

- Overview information to support the exercise.

Key Points

- The instructor will provide direction for this exercise.

References

- None.



Summary

- ❖ Concepts discussed to date can be applied using a variety of practical approaches and streamlining tools.
- ❖ Tools and resources are available to support implementation of these concepts.
- ❖ To GET TO YES, focus on progress rather than process.

February 2009

Module 10 - CA Optimization Tools and Challenge Exercise

6

Notes:

Purpose of Slide

- Summarize the module.

Key Points

- Review the key points discussed or reiterated in this module.

References

- None.

Module 11
Maintaining Effective Remedy Performance



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



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February 2009 Module 11 – Maintaining Effective Remedy Performance 1

Notes:Purpose of Slide

- Holder slide for Module 11, Maintaining Effective Remedy Performance.

Key Points

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

References

- None.



Module 11

Maintaining Effective Remedy Performance

February 2009 Module 11 – Maintaining Effective Remedy Performance 2

Notes:

Purpose of Slide

- Holder slide for Module 11, Maintaining Effective Remedy Performance

Key Points

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

References

- None.



Module Overview

- ❖ Remedy Construction Definition
- ❖ Performance Metrics
- ❖ Facility and Agency responsibilities during system operation
- ❖ Remedial System Optimization
- ❖ Monitoring Institutional Controls
- ❖ Effective Reporting

February 2009

Module 11 – Maintaining Effective Remedy Performance

3

Notes:

Purpose of Slide

- Provide an overview of Module 11, Maintaining Effective Remedy Performance.

Key Points

- We covered the remedy decision determination (CA 400) in Module 7 and remediation technologies in Module 8. In this module, we will review the Remedy Construction determination (CA 550) and then focus on long-term operation and oversight of remedies.
- Performance metrics are established and used to determine if remediation is effective. It is important to have an operation and maintenance (O&M) plan and sampling program in place to provide the data necessary for performance metrics evaluation.
- A remedial system may operate for months, years, decades, or possibly even centuries (recall our Casper, WY example, where cleanup is anticipated to take 400 years). The facility is responsible for properly operating the system; the agency can help make operations run efficiently by working with the facility to establish clear performance standards, allowing flexible sampling, and accepting streamlined reports. A results-based approach during remedy operations is most effective and we will discuss examples of what this means.
- Remedial system optimization means evaluating system performance in terms of progress toward meeting goals and cost effectiveness. Optimization occurs at multiple levels. There is a continuous aspect of optimization during regular performance evaluations (for example, monthly maintenance visits or semiannual sampling events), but there is also a formal optimization process that occurs less frequently known as Remedial System Evaluation; we will discuss both in this module.
- It is important that the institutional control (ICs) components of the remedy that are necessary during remedy construction and/or operation are implemented during this phase of corrective action (CA). In some cases, ICs may not be necessary until subsequent phases of CA. Evaluation of ICs occurs early in the CA process, before remedy selection or construction, as we have discussed in Module 7. In this module we will discuss implementation of ICs and monitoring and maintaining ICs during remedy operation; this responsibility falls on both the facility and the regulatory agency.
- We will also discuss effective reporting approaches that provide the regulatory agency with appropriate information to perform its oversight responsibilities. These reports can include meetings, teleconferences, e-mails, letters, and reports. Effective reporting focuses on providing the right information to support progress, in a clear, succinct, and usable format.

References

- None.



Remedy Construction Defined

- ❖ **Remedy Constructed (RC):**
 - Construction is complete
 - Remedy is fully functional
- ❖ **No Remedy Constructed (NR):**
 - CA already complete
 - No construction necessary

February 2009 Module 11 – Maintaining Effective Remedy Performance 4

Notes:

Purpose of Slide

- Review the Remedy Construction event code (CA550) and definition. This code is also discussed in Modules 2 and 7.

Key Points

- The Remedy Construction milestone is achieved when construction of a facility's remedy is complete and the remedy is fully functional as designed, whether or not final cleanup criteria or other requirements have been achieved.
- The Remedy Construction milestone may also be achieved if construction is not needed to meet the remedial goals.
- The RCRA Code 550 applies when: (1) construction of the remedy(ies) have been completed (RCRA Event Code RC), or (2) the Remedy Decision or other appropriate decision document indicates that no physical construction of a remedy is needed (RCRA Event Code NR).
 - RC – Remedy Constructed. This status code applies after the actual date of the CA 400 - Remedy Decision when either: (1) all necessary physical construction of the last corrective measure has been completed and all remedial systems are fully functional as designed, whether or not final cleanup levels or other requirements have been achieved, or (2) all necessary physical construction and all remedial systems are fully functional as designed as a result of actions prior to the actual date of the CA 400 Remedy Decision, whether or not final cleanup levels or other requirements have been achieved.
 - NR – No Remedy Constructed. This status code applies on the actual date of the CA 400 Remedy Decision if no physical construction of a remedy has been needed since site characterization activities began.
- Remedy Construction for remedies that address the entire facility (including off-site migration of contaminants) should be linked to the "Entire Facility" area. Phased or partial remedies are to be attached to specific areas of implementation and not to the "Entire Facility" area.

References

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



Documenting Remedy Construction Decision

- ❖ Options
 - Letter or memorandum
 - Decision document
- ❖ Getting to the remedy – not the event code
 - is what counts!

February 2009 Module 11 – Maintaining Effective Remedy Performance 5

Notes:

Purpose of Slide

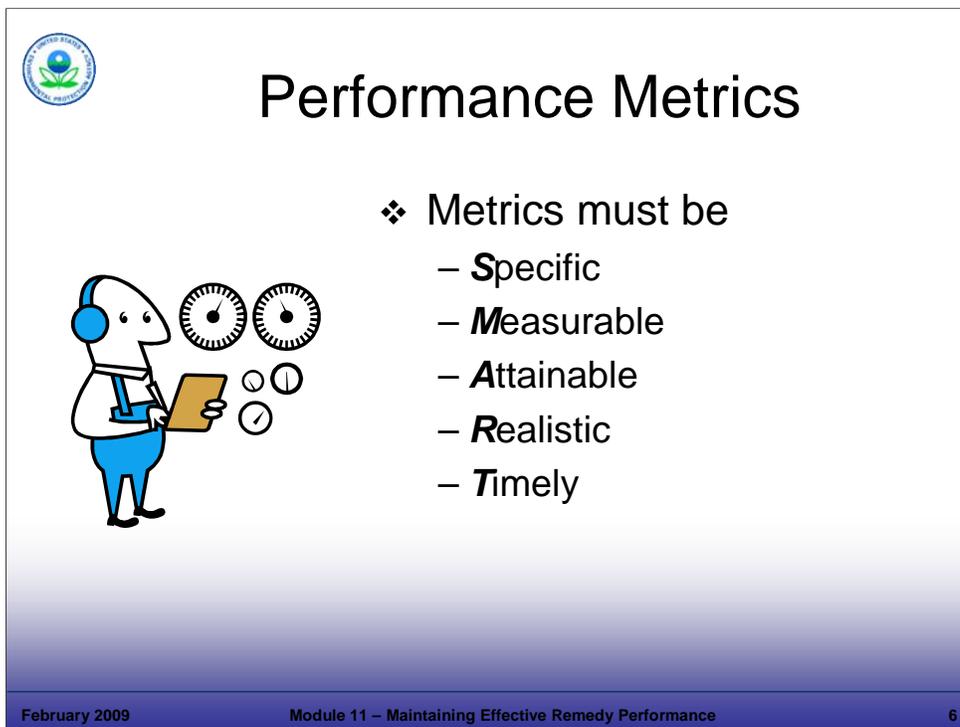
- Explain the process of documenting Remedy Construction.

Key Points

- Options for documentation include a letter or memorandum to the facility or the file or a decision document. To receive recognition for Remedy Constructed as a facility accomplishment, the overseeing agency should provide either: (1) a document (for example, letter to facility, memorandum to file, etc.) confirming the completed construction of the final remedy or (2) an appropriate decision document prepared to indicate that no further remedy is needed.
- Getting to the remedy is the goal. The event code tracks that the goal is being achieved.

References

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



The slide features a circular logo in the top left corner with the text 'ENVIRONMENTAL PROTECTION AGENCY' and 'UNITED STATES OF AMERICA'. The main title is 'Performance Metrics'. To the left of the list is a cartoon character wearing a headset and holding a tablet, with several gears floating around it. The list of metrics is as follows:

- ❖ Metrics must be
 - **S**pecific
 - **M**easurable
 - **A**ttainable
 - **R**ealistic
 - **T**imely

February 2009 Module 11 – Maintaining Effective Remedy Performance 6

Notes:

Purpose of Slide

- Introduce the concept of performance metrics.

Key Points

- Site and remedial system effectiveness is evaluated against performance metrics.
- In addition to *evaluating* effectiveness, performance metrics should provide information for *improving* effectiveness.
- Metrics should be:
 - **S**pecific to avoid ambiguity or misunderstanding;
 - **M**easurable so they can be quantified and compared to standards;
 - **A**ttainable because they are reasonable and achievable;
 - **R**ealistic because they are possible and cost effective; and
 - **T**imely because they can be achieved in the required time frame.

References

- None.



Examples of Performance Metrics

- ❖ Treatment System
 - % Removal
 - Rate of Removal (Mass / Time)
 - Energy Consumption / Mass Removal
 - Unit Cost / Mass Removal
 - % Utilization (actual versus available)
- ❖ Site Control
 - Hydraulic control
 - Groundwater quality trends

February 2009 Module 11 – Maintaining Effective Remedy Performance 7

Notes:

Purpose of Slide

- Discuss examples of performance metrics.

Key Points

- This slide provides examples of the types of calculations that are made to evaluate system effectiveness. Calculated values are compared to reasonably expected values or are used in trend analysis. Developing spreadsheet templates is an effective means to perform calculations and present results. Tables, graphs, and other visual comparisons against baseline data or standards also are useful.
 - Treatment system metrics include the following:
 - % Removal – This refers to treatment system effectiveness. This metric can be tracked with influent/effluent data and is generally reported to the agency.
 - Rate of removal – Concentrations over time or rate of mass removal over time are common metrics used in evaluating treatment system effectiveness. Absolute values and trends can suggest a variety of conclusions:
 - If mass removal is decreasing over time, the reason can be insufficient maintenance (for example, iron fouling) or successful operation (that is., the mass in the aquifer has significantly diminished). In the latter case, there may be a point where the data indicate that a new technology may be needed as a polishing step.
 - Concentrations not decreasing with time might indicate that the wrong technology was selected, or an unknown source is present.
 - Energy Consumption or Unit Cost per Mass Removed – These metrics generally increase with time when system optimization does not occur. For instance, if a pump and treat (P&T) system is effective in removing the area of highest concentration, but equipment usage and energy costs are not streamlined, then the cost per unit of mass removed would increase.
 - % Utilization – This tracks the amount of time systems are operating compared to available time. Systems that are down frequently are generally not efficient or effective.
 - Site Control – These metrics relate to the effectiveness of the treatment system in meeting cleanup objectives. Plume containment (hydraulic control) and contamination reduction (groundwater quality trends) are two primary metrics related to site control.

References

- None.

 <h2 style="text-align: center;">Facility and Agency Responsibilities in Perspective</h2>				
	Regulatory Mechanism Negotiation	Assessment and Interim Measures	Remedy Selection/ Construction	Remedy Operation
Agency Staff Time				
Facility Costs	\$\$\$	\$\$\$\$\$\$	\$\$\$\$\$\$\$\$ \$\$\$\$	\$\$\$\$\$\$\$\$ \$\$\$\$\$\$\$\$
Public Participation				
Human Health & Environmental Benefit				
February 2009 Module 11 – Maintaining Effective Remedy Performance 8				

Notes:

Purpose of Slide

- Remember, although we may think of the most intense regulatory involvement as occurring during assessment and interim measures, the greatest facility expenditures and most significant environmental benefits often occur during remedy operation. Therefore, it is important that the relationship between the facility and regulatory agency be maintained throughout operation so that decisions can be made and implemented efficiently.

Key Points

- This slide was shown in an earlier module; we will review it here – focusing on the Remedy Operation column.
- The regulatory agency and the facility should work together to streamline activities during remedy operation. This can be accomplished through:
 - Regular, but not overly burdensome, communications;
 - Self-implementing decisions, that is, remedial decisions can be made by the facility without the need for agency approval because clear performance standards have been established. Examples of these types of decisions will be provided in slides to follow; and
 - Streamlined reporting.
- The next slide illustrates the importance of self-implementing decisions.

References

- None.



Agency Oversight During Operations

Results-based Concepts:	Benefits:
❖ Holistic Approach	❖ Focus on goals
❖ Tailored Oversight	❖ Faster results
❖ Targeted Data Collection	❖ Resource savings to facility and agency
❖ Performance Criteria	

February 2009 Module 11 – Maintaining Effective Remedy Performance 9

Notes:

Purpose of Slide

- Reiterate the major concepts of results-based CA and the importance of this approach during remedy operation.

Key Points

- These slides provide a refresher on the concepts associated with results-based CA that were discussed in previous modules. The benefits of these concepts include:
 - A focus on goals, rather than a predetermined process;
 - Results that are generally achieved more quickly; and
 - Resource savings to both the facility and the regulatory agency by focusing scarce oversight resources on the most important problems.
- The next set of slides explain facility responsibilities for operating a remedy efficiently and cost effectively and the regulatory agency's responsibilities for providing reasonable oversight. Without the ability to make operational decisions, the facility cannot operate the remedy efficiently or cost effectively. Similarly, the agency needs appropriate information to perform oversight of remedy implementation.

References

- None.



O&M and Site Sampling Activities

- ❖ Routine Maintenance
- ❖ Unexpected Maintenance
- ❖ Performance Monitoring and Reporting
- ❖ Cost Monitoring and Control
 - Proper maintenance
 - System optimization
 - Targeted data collection

February 2009 Module 11 – Maintaining Effective Remedy Performance 10

Notes:

Purpose of Slide

- Proper O&M is important to the successful operation of a remedial technology. Site sampling and monitoring are conducted to evaluate progress toward overall goals – for example, are concentrations declining? Is the zone of capture sufficient? It is the facility's responsibility to maintain remedial systems.

Key Points

- Successful remediation requires close attention to the long-term O&M of any systems installed. When systems are down, there can be long-term effects such as increasing the timeline to achieve cleanup goals. Some remedies, such as an asphalt cap, may require minimal maintenance efforts; others, such as those necessary for complex contamination (for example, dense nonaqueous phase liquids (DNAPLs)), will require active oversight.
- Routine, daily O&M is required on some systems. For others, weekly or monthly maintenance may be sufficient.
- The facility can ensure unexpected O&M needs are met by planning for manpower, supplies, and tools to operate and maintain the remediation system properly.
- Performance monitoring methods will vary depending upon the technologies in use. Examples include:
 - Mechanical – are motors, pumps, and blower pumps running properly?
 - Chemical – are biological conditions being maintained? Are contaminants being removed or destroyed?
 - Regulatory – Are National Pollutant Discharge Elimination System (NPDES) requirements for effluent met? Are air emission limits met?
- Some performance monitoring data will be reported to the regulatory agency, such as:
 - Significant system downtime; and
 - Operational parameters such as: flow rates (P&T), injection rates (bioremediation), and excavation volumes.
 Some facilities will track additional data to maximize system efficiency. For example, some facilities will track reasons for system downtime to determine what back-ups should be in place to keep the system running.
- System O&M costs can far exceed construction costs, so cost controls are important to facilities;
 - Inefficient or improper maintenance can lead to longer cleanup timeframes and more costly cleanups;
 - System optimization means efficiency in all aspects – keeping energy costs, sampling costs, and disposal costs to a minimum while maintaining system performance and site progress toward remediation goals; and
 - Sampling generally represents a significant portion of O&M costs, so it is important to facilities to have an efficient and effective sampling program.

References

- None.



Targeted Data Collection

- ❖ Sampling Frequency
 - Site-specific factors should dictate
- ❖ Analytical Tests
 - Focus on chemicals of concern
- ❖ Sampling Locations
 - May change over time, as cleanup occurs

February 2009 Module 11 – Maintaining Effective Remedy Performance 11

Notes:

Purpose of Slide

- Site monitoring is required to ensure that the long-term objectives of containment and cleanup are on track, where contamination is left in place and remedial goals have not been met. Targeted data collection will reduce resource needs (time, money) without sacrificing data quality, and will provide quicker understanding of system performance.

Key Points

- Sampling should focus on the locations, frequency, and parameters that are necessary to evaluate the system performance.
 - Are concentrations in monitoring wells declining over time?
 - Are anaerobic conditions maintained for biological activity?
- It may not be necessary to sample all wells during all sampling events. For instance, if the estimated cleanup time is many years, then annual or biannual sampling for monitoring wells in the center of the plume may be sufficient.
- Lab analyses for plume delineation should focus on chemicals of concern. Some additional analyses may need to be run for performance evaluation. For instance, geochemical parameters may be necessary when bioremediation is utilized, or additional parameters may need to be sampled to verify compliance with discharge permits.
- Monitoring well locations should serve a purpose, such as:
 - Demonstrate progress toward meeting groundwater cleanup goals (cleanup); or
 - Ensure that the plume is not expanding or moving off-site (containment).
- Appropriate locations for wells may change over time. For instance, as plumes reduce in size, it may be possible to stop sampling and even abandon wells where concentrations meet cleanup criteria. The next several slides will show how the agency and facility can work together to establish self-implementing approaches for sampling.

References

- None.



Performance Criteria



- ❖ A facility has multiple recovery wells and treatment systems
- ❖ The RCRA permit requires agency approval to shut down recovery wells and treatment systems after cleanup criteria are met

(continued)

February 2009 Module 11 – Maintaining Effective Remedy Performance 12

Notes:

Purpose of Slide

- Illustrate the usefulness of establishing performance criteria that allow remedial system optimization.

Key Points

- This is a real-world example. A facility has multiple recovery wells and treatment systems.
- The facility cannot automatically shut down recovery wells when cleanup criteria are met; the RCRA permit requires that the facility request agency approval to shut down recovery wells once cleanup criteria are met.

References

- None.



Example of Cost Associated with Timing

The facility requests agency approval to shut down a recovery well; assume the agency approves this request 8 months later.

- ❖ Cost of approval step:
 - \$15,000/yr X 2/3 yr = \$10,000 operational cost to facility
- ❖ Environmental benefit of approval step:
 - None; the facility has been treating clean water

February 2009 Module 11 – Maintaining Effective Remedy Performance 13

Notes:

Purpose of Slide

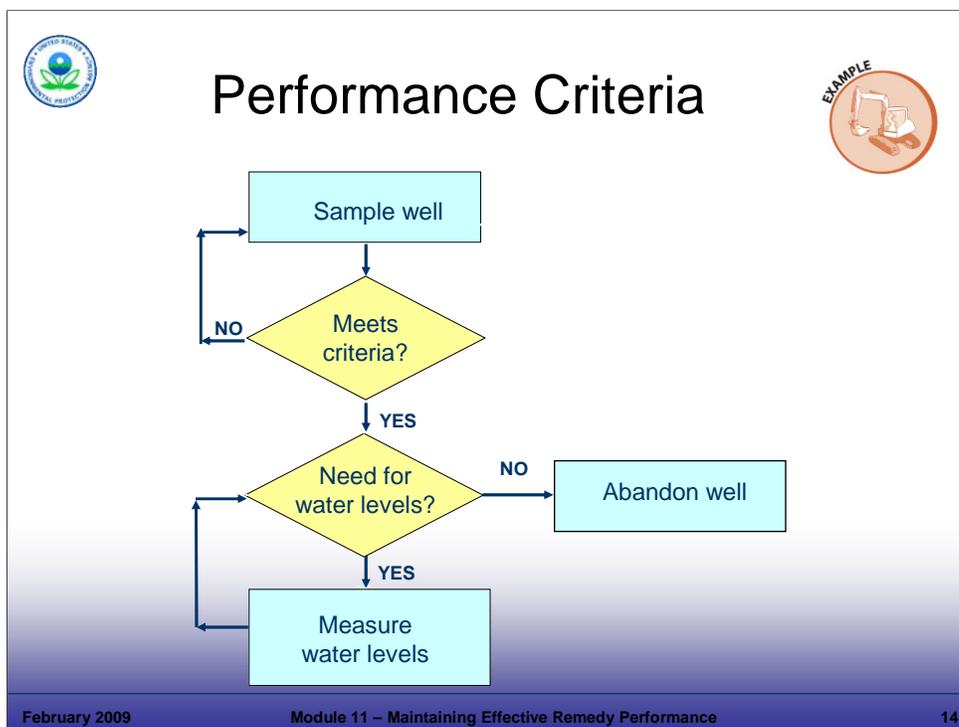
- Example continued.

Key Points

- If we assume that the request to the agency takes 8 months to process, and the cost of operating the recovery well and treatment system is \$15,000 per year, then the 8 months waiting period before agency approval could cost the facility \$10,000 in operational costs, with little or no environmental benefit.
- If a permit or agreement for CA is established with clear performance standards, such as when a well can be shut down, the burden for agency review and approval and the cost to the facility while waiting could be avoided. The environmental outcome is the same.

References

- None.



Notes:

Purpose of Slide

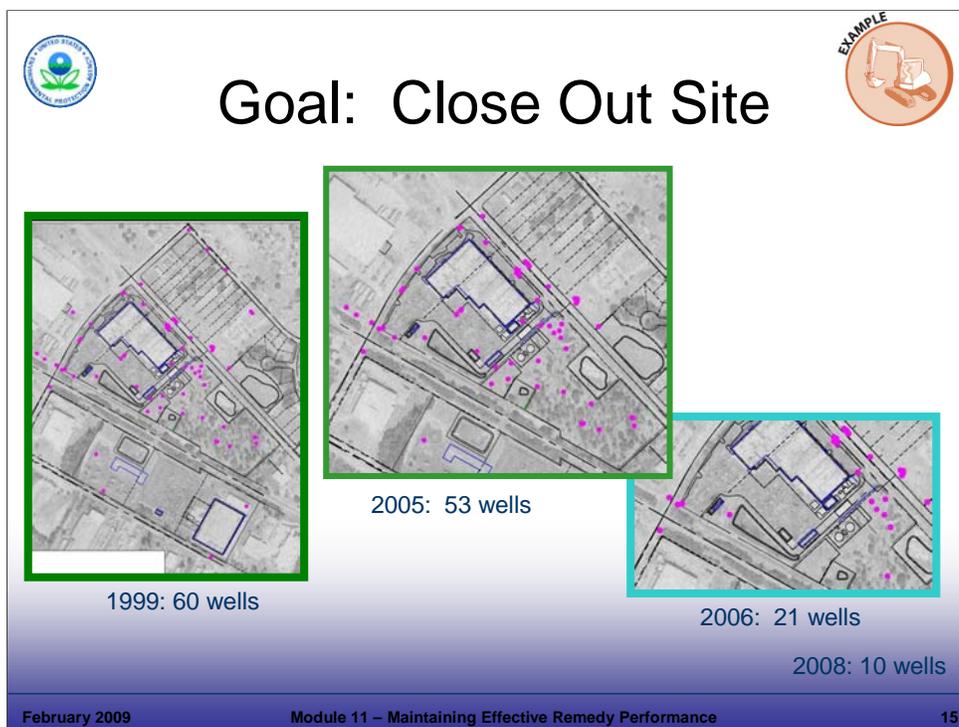
- Show a decision flow chart (which is simplified for illustration purposes) developed cooperatively by a facility and state agency, so that monitoring decisions can be made without the requirement for separate approvals, based on performance criteria.

Key Points

- The subject facility samples for chemicals of concern, and must meet cleanup criteria for "X" rounds before considering well abandonment. "X" would be agreed upon by the regulatory authority and the facility. (There are some details not shown on this slide, such as sampling frequency and cleanup criteria that are in the expanded version of the flowchart).
- If the samples are below cleanup criteria for "X" rounds, then the facility must determine if the well is needed for water levels – if not, it can be abandoned.
- This type of streamlined decision-making approach could be adopted for multiple aspects of CA (for example, including when recovery wells can be shut down, relating to the previous example).

References

- None.



Notes:

Purpose of Slide

- Show how a decision flow chart streamlined decisions and actions at the subject facility.

Key Points

- The facility was moving successfully toward meeting cleanup criteria and set a goal of achieving CA complete without controls by 2008.
- In 1999, there were 60 monitoring wells, represented by the pink dots. Six years later, there were 53 monitoring wells – well abandonment decisions required an arduous decision-making process among the parties.
- The agency and facility realized that a streamlined decision-making process relating to well abandonment could be developed – hence, the flowchart.
- Between 2005 and 2006, 32 wells were abandoned using the flowchart approach.
- The point is that up-front planning and creativity can achieve success and maintain momentum toward achieving cleanup goals.

References

- None.



Remedial System Optimization

- ❖ Systematic evaluation of technologies:
 - Remedy performance
 - Cost effectiveness
- ❖ Considers technological advances
- ❖ Leads to system modifications/technology changes
- ❖ Regulatory mechanism should allow efficient implementation

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Notes:

Purpose of Slide

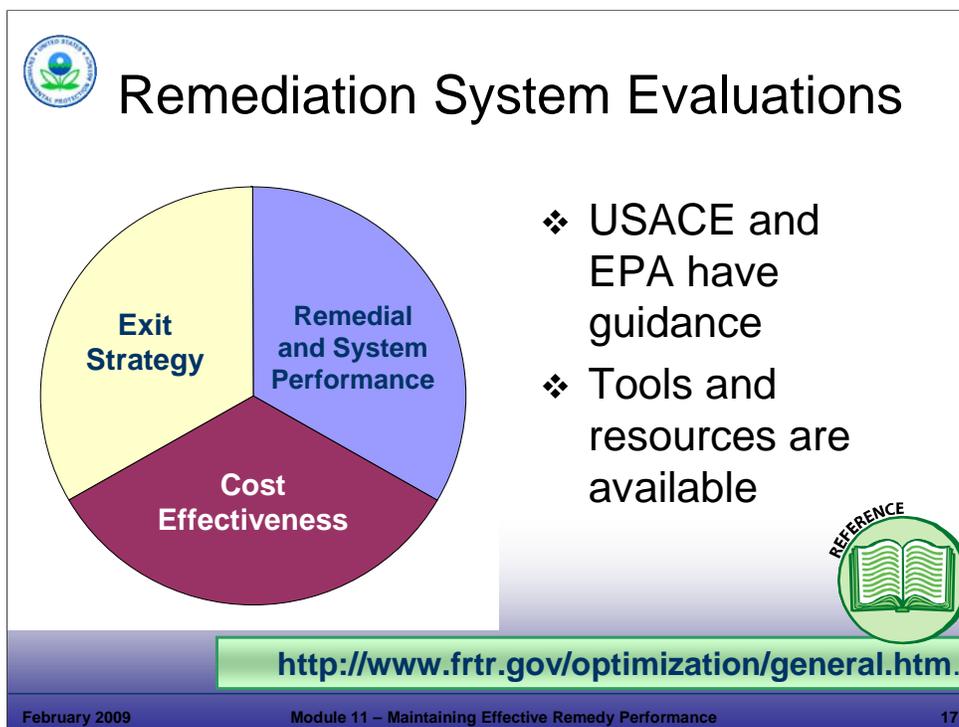
- Introduce the concept of remedial system optimization to improve remedial system performance and cost efficiency.

Key Points

- Once a selected technology has been operating for a period of time (generally a few years), it is usually prudent to perform a Remedial System Evaluation (RSE), also known as Remedial System Optimization (RSO). Site conditions change over time, and remedial systems should reflect the changes.
- Technological advances in remediation are being made continuously. Optimization studies open the door to consider new technologies, sampling methods, and other improvements.
- RSEs generally lead to system modifications that improve performance and reduce overall costs. The agency and facility should work together to allow changes to take place.

References

- EPA. 2001. Groundwater Pump and Treat Systems: Summary of Selected Cost and Performance Information at Superfund-financed Sites. EPA 542-R-01-021b. December.
- EPA. 2005. Roadmap to long-Term Monitoring Optimization. EPA-542-R-05-003. May.
- EPA. 2002. Pilot Project to Optimize Superfund-financed Pump and Treat Systems: Summary Report and Lessons Learned. EPA 542-R-02-008a.
- EPA. 2002. Elements for Effective Management of Operating Pump and Treat Systems. EPA 542-R-02-009.
- EPA. 2005. Cost-Effective Design of Pump and Treat Systems. EPA-542-R-05-008. April.



The diagram is a circular pie chart divided into three equal segments. The top-left segment is yellow and labeled 'Exit Strategy'. The top-right segment is blue and labeled 'Remedial and System Performance'. The bottom segment is maroon and labeled 'Cost Effectiveness'. To the right of the pie chart, there are two bullet points: '❖ USACE and EPA have guidance' and '❖ Tools and resources are available'. Below the pie chart, there is a green circular icon with an open book and the word 'REFERENCE' written around it. At the bottom of the slide, there is a green bar with the URL 'http://www.frtr.gov/optimization/general.htm.' and a dark blue footer bar with the text 'February 2009', 'Module 11 – Maintaining Effective Remedy Performance', and '17'.

Remediation System Evaluations

- ❖ USACE and EPA have guidance
- ❖ Tools and resources are available

[http://www.frtr.gov/optimization/general.htm.](http://www.frtr.gov/optimization/general.htm)

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Notes:

Purpose of Slide:

- Discuss the formal optimization process developed by the U.S. Army Corps of Engineers (USACE) and used by EPA. This is not an activity that the regulatory agency would undertake during RCRA CA. However, understanding the process is helpful because the process leads to system modifications, which the agency generally needs to approve.

Key Points

- A formal RSE process grew out of a need to better use limited resources and reduce costs. More formalized approaches began in 1999 with the USACE and expanded through 2003 with the EPA.
- The initial focus was on P&T systems – 89% of EPA fund-led sites were P&T only; 6% were P&T plus an in situ technology.
- The formal process is known as RSE or can be called RSO. Within the context of this course, RSE and RSO are equivalent. The three key areas of evaluation and optimization are discussed below.
- The Exit Strategy is reviewed for completeness: goals and milestones should be clear (for example, starting with the end in mind). As we learned in earlier modules, the Exit Strategy impacts how and when technologies are implemented.
- Remedial and system performance are evaluated, including: (1) progress toward meeting cleanup goals; (2) degree to which a system component is meeting design expectations; and (3) operational history.
- Cost effectiveness is evaluated, including: labor needs, fuel requirements, life-cycle costs, and disposal costs.
- Each of these items will be discussed on the following slides. Resources available to support these efforts are listed below and include websites, guidance, and case studies.

References

- USACE. Web Site. USACE Remediation System Evaluation (RSE) Checklists. Accessed On-line at: <http://www.frtr.gov/optimization/general/methods.htm>.
- Interstate Technology and Regulatory Council (ITRC). 2004. Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation (RPO-1). September.
- Federal Technologies Remediation Roundtable (FRTR). Web Site. Remediation System Optimization General Web Page. Accessed On-line at: <http://www.frtr.gov/optimization/general.htm>.
- EPA. 2000. USEPA Superfund Reform Strategy, Implementation Memorandum: Optimization of Fund-lead Ground Water Pump and Treat (P&T) Systems. OSWER 9283.1-13. Signed October 31.



RSEs - Exit Strategy

- ❖ Continued use or revitalization (residential or industrial?)
- ❖ Cleanup timeframe, including milestones
- ❖ Cleanup criteria (soil, groundwater)
- ❖ Are cleanup goals the same for the entire facility?

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Notes:

Purpose of Slide

- To optimize a remedial system, it is important to understand the facility's goals. These are expressed through the facility's Exit Strategy.

Key Points

- The RSE should involve *reviewing* the Exit Strategy.
- In evaluating the effectiveness of a remedial system, progress is compared to cleanup goals (remember: goals were discussed in a previous module – goals are the what, where, when of CA). And cleanup goals are established based on the facility's planned uses.
- The cleanup timeframe affects an engineer's view of remediation effectiveness. For instance, if a facility will continue with its current use, there are no exposures, and a plume is not expanding, it may not be as important to show rapid progress toward meeting cleanup levels. It is important to compare progress to milestones, however.
- Understanding the final (or intermediate) cleanup criteria is important in evaluating progress toward meeting those goals.
- Similarly, it is important for the reviewing engineer to be familiar with where cleanup criteria apply (for instance, industrial soil criteria may apply on a part of a facility under continued use, but residential soil criteria may be necessary for parcels that will be sold for unrestricted use).

References

- None.



Remedial and System Performance

- ❖ Site Remedial Effectiveness
 - Concentrations in groundwater decreasing?
 - Plume contained?
- ❖ Treatment System Effectiveness
 - Meeting design expectations?
 - Maintenance issues such as biofouling?
- ❖ Should new technologies be introduced?

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Notes:

Purpose of Slide

- Discuss the second component of RSEs, evaluation of site remedial effectiveness and treatment system effectiveness.

Key Points

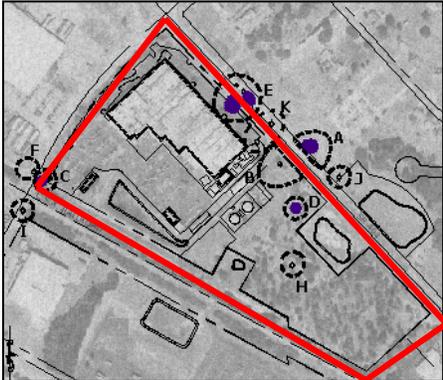
- Site remedial effectiveness is a big-picture look at how well the chosen technology is progressing and meeting milestones. Look at concentration versus time – graph the results and look at the rate of change (slope).
- In the case of P&T systems, capture zones should be reviewed through routine water level measurements and construction of groundwater contour maps to show flow patterns. This information is used to determine if containment is achieved.
- Treatment system effectiveness is a detailed look at whether or not the system meets design requirements (for example, effluent discharge limits or flow rates) and operates efficiently.
- An RSE might identify declining system performance (such as, decreasing flow rates) and recommend system modifications to improve flow rates (such as, more frequent maintenance).
- Contaminant concentrations and flow rates should be used to calculate mass removal rates over time (for example, pounds of volatile organic compounds (VOCs) per month). This is a good metric for system effectiveness.
- The evaluation of site and system effectiveness may lead to a conclusion that different or supplemental technologies should be considered. Complex sites generally may require multiple technologies.

References

- None.



Adding Technologies: Air Sparge




- ❖ Initially one large plume; successful P&T reduced size, then progress stalled
- ❖ Air sparge unit added as a polishing step



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Notes:

Purpose of Slide

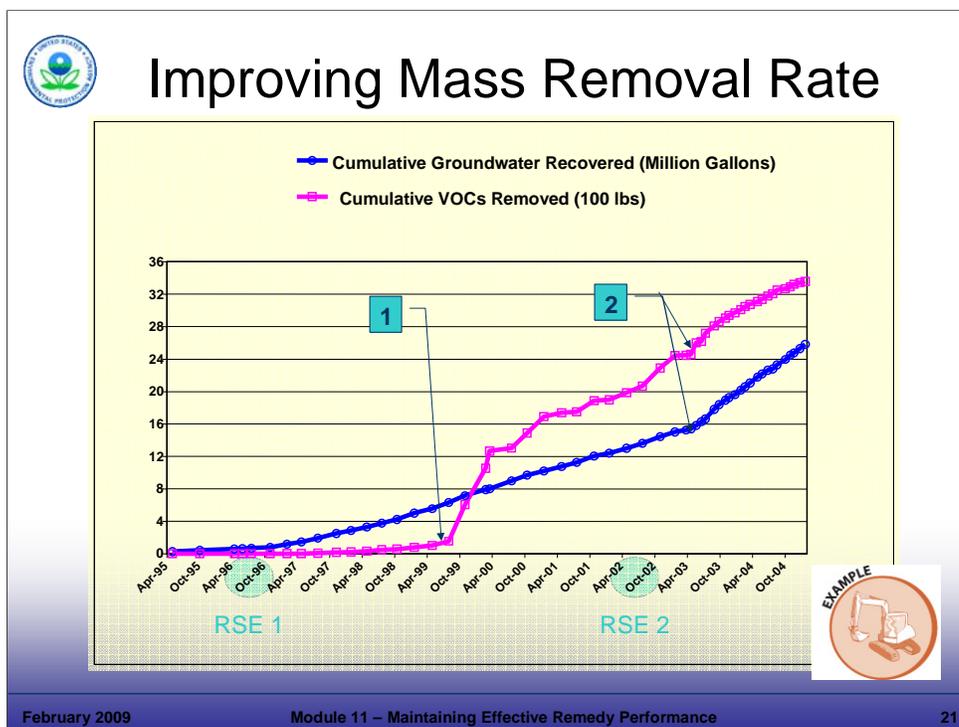
- Describe an example of a remedial technology that was very effective in the early- and mid-stages of remediation. However, progress towards cleanup goals stalled as the concentrations of contaminants (chlorinated ethenes) in groundwater approached maximum contaminant levels (MCLs). (The significant metric is time versus concentration).

Key Points

- In the late 1980s, there was one large plume covering about 1/3 of the site.
- The Exit Strategy called for meeting MCLs, given the facility's location near residences and public water supply wells. No ICs would be used.
- A P&T system was installed, and the plume was reduced to a few "pockets" where groundwater continues to exceed MCLs.
- An RSE was conducted, and air sparging was selected as the final polishing step. A portable unit was constructed and moved from one target location to the next. Since 2005, three "pockets" have been eliminated.
- The facility has performance-based permits, so permit modifications were not necessary to implement the additional technology. During an earlier permit renewal, the facility and agency had incorporated multiple remedial technologies as options for use at the site. Therefore, when the decision to implement a polishing step was made, it could be implemented without a permit modification. Financial assurance obligations actually decreased because the life-cycle cleanup cost estimate decreased with the addition of the air sparge unit (estimated time to cleanup was reduced).
- Estimated savings from implementing this polishing step are \$1.4 million over 8 years. Most of the savings are on the back-end, meaning that cleanup criteria are achieved earlier than they would be if the facility continued with P&T.
- This illustrates one of the guiding principles of this course – that a remedy can change, even if it was designed properly and operated effectively.

References

- None.



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Notes:

Purpose of Slide

- Discuss how technology improvements affect progress toward meeting remedial goals using a real world example.

Key Points

- This graph demonstrates mass removal over time.
- The X-axis is the date (covers the period from April 1995 through October 2005).
- The Y-axis shows cumulative groundwater recovered (in millions of gallons) in blue.
- The Y-axis also shows cumulative VOCs removed (in 100 pound increments) in magenta.
- By looking at this graph we see the following:
 - A flattening of the slope of either line (reduction of slope) is an indication of performance fall-off. The slopes represent the rates of groundwater recovery and VOCs removed, which are metrics.
 - Sharp or sudden changes in slope occur as a result of improved performance. These resulted from major process changes implemented after a RSE/RSO. We will look at two specific points in time.
 - The first change (1) in the magenta line (mass removed) indicates the results of bringing a new treatment process on-line that allowed the removal and destruction of highly contaminated groundwater (millions of parts per billion (ppb)). The rate of groundwater processed did not increase, but the mass removed did. This change took about 3 years to implement, because the site remediation was operating under the old “command and control” approach and permit modification requirements required time before proposed changes could be implemented.
 - The second major change (2) in the magenta and blue lines occurred when new horizontal wells located in a source area were brought on-line. As a result, the volume and mass removal rates both increased. This change was brought on-line much more quickly (in less than one year) under a results-based approach.

References

- None.



Site Changes Drive Optimization

- ❖ Contaminant concentrations
- ❖ Hydraulic recovery
- ❖ Zones of influence not as expected
- ❖ Source areas delineated and removed
- ❖ Natural degradation occurring

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Notes:

Purpose of Slide

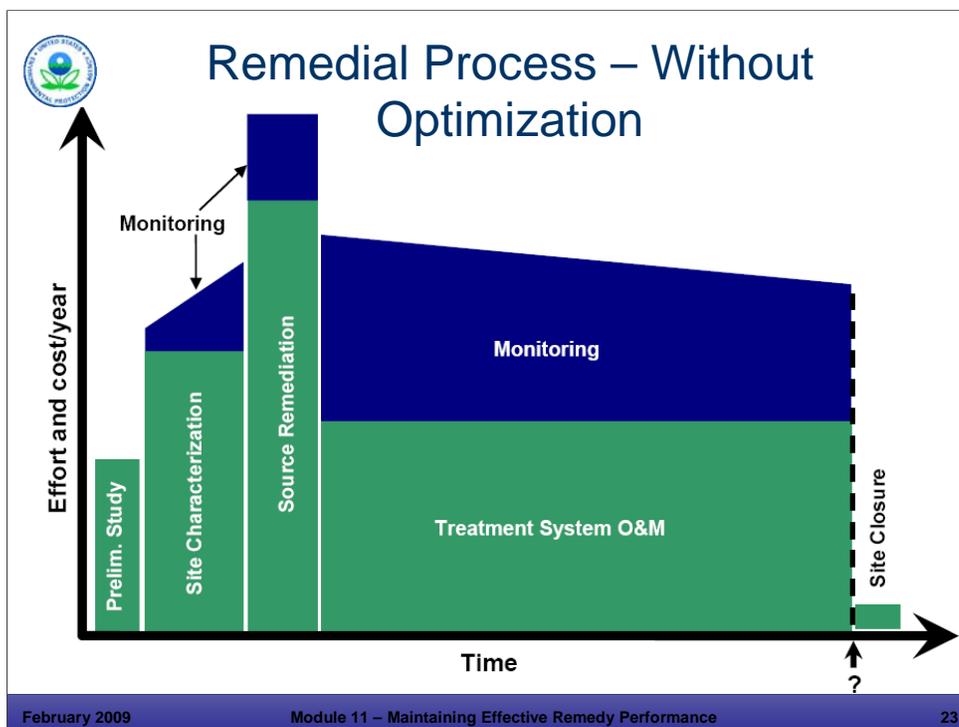
- Discuss the reasons why optimizing remedial systems is important, particularly for those systems that operate for long periods of time or lead to dramatic changes in site conditions. Discussion applies mostly to groundwater.

Key Points

- Site conditions can change over long or short periods of time. For instance, an air sparging unit may achieve rapid reductions in contaminant levels. If the system is modular, sections can be turned off and/or moved to optimize contaminant removal. Site changes that can drive optimization include:
 - Typically contaminant levels (and plume dimensions) decline after years of treatment. Systems and components can be modified, adjusted, consolidated, or even eliminated to reduce operating costs because of reduced treatment needs.
 - In the case of P&T, hydraulic capture needs change with time. Some recovery wells may no longer be required or may need to be modified to perform effectively. Recovery efficiency also declines with time as wells foul and pumps wear out.
 - Sometimes we discover that zones of influence for air sparge or P&T units are not as expected due to unknown geological conditions. Modifications – additions or deletions – may improve the efficiency.
 - Source areas may not be well delineated initially or may change with time. The removal of a large contaminant mass will also change site needs for further remediation work.
 - Natural degradation may change the geometry or chemistry of a plume.
- Optimization is an approach that can be used to efficiently respond to changes as they occur over time.

References

- None.



Notes:

Purpose of Slide

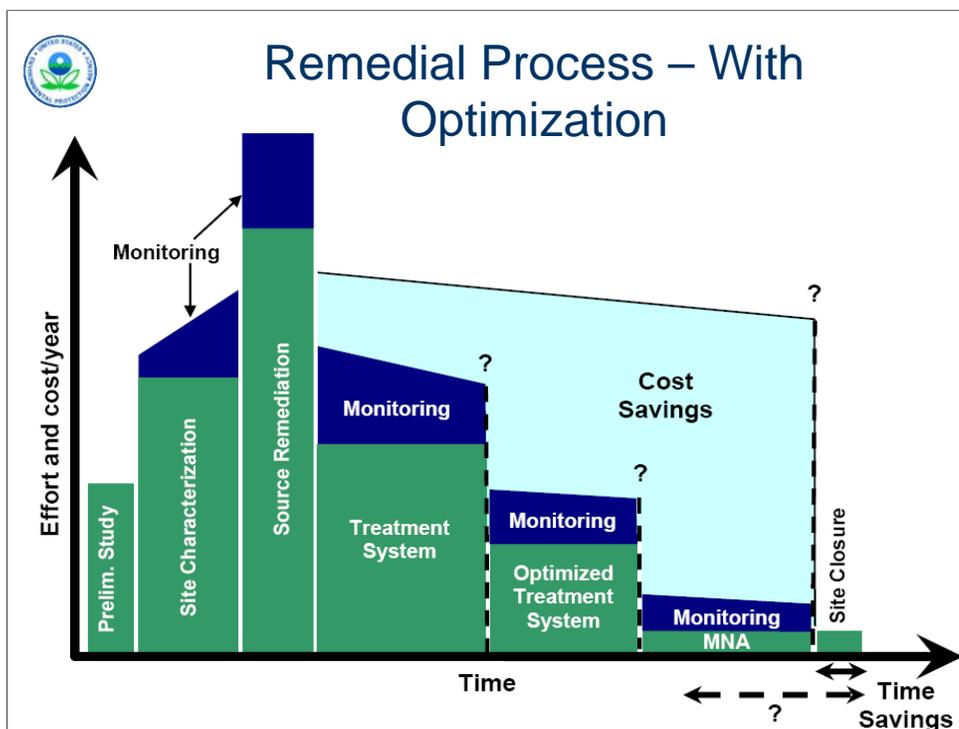
- Review Remedial Process Optimization (similar to RSO and RSE, but focusing on the entire remedial process (including monitoring approaches) to support efficiency in site remediation.

Key Points

- This slide shows the traditional linear approach to site investigation and remediation, without process optimization. In this process, the effort proceeds from characterization to source remediation with on-going monitoring but without reviews for optimization and associated system modifications.
- As the project matures, most of the resources are spent on O&M and monitoring and, for most sites, the project duration is unknown.

References

- ITRC. 2004. Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation.



Notes:

Purpose of Slide

- Show the non-linear remediation paradigm, when remediation process optimization steps are implemented.

Key Points

- Discuss, in general terms, how on-going remediation process optimization can reduce cleanup time and cost.
- Under this approach, site and treatment system metrics are systematically evaluated in order to improve both system operation efficiency and cleanup efficiency.
- The result is a shorter cleanup time, lower cost, and improved predictability.

References

- ITRC. 2004. Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation.



Horizontal Well - Low Flow

- ❖ Why is flow declining?
 - Silt?
 - Iron fouling?
 - Slots clogged with drilling mud?
 - Slot size OK?
 - Biofouling?
 - Pumps?
 - Casing corrosion?



(continued)

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Notes:

Purpose of Slide

- Provide an example of examining operations to improve efficiency. In this example, horizontal recovery wells had been operating for several years and the flow rate was steadily dropping. The total estimated time of cleanup is directly related to flow rates (mass removal rates), so it was important for the facility to trouble-shoot the system to determine the cause and correct it.

Key Points

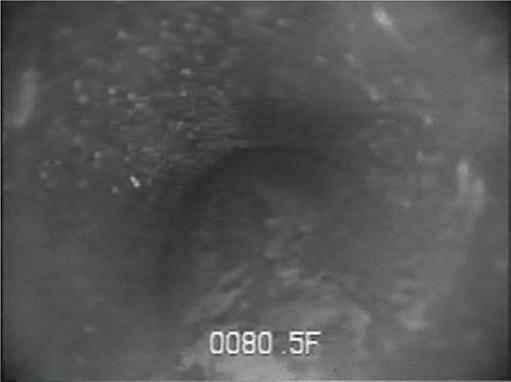
- The engineers identified several possible reasons for flow rates declining, as illustrated in the slide.
- The horizontal well was located in a lithologically tight environment, so the wells were designed with small slot sizes. This helps prevent silt from clogging the well, but the downside is that the well is more sensitive to fouling or clogging.

References

- None.

 **Horizontal Well - Inspection** 

Decided to have the horizontal wells video inspected:



(continued)

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Notes:

Purpose of Slide

- Continue example of trouble-shooting problems to improve operational efficiency (note: video clip).

Key Points

- This is a video taken of the horizontal well.
- The video shows a build up of material on the well; this is the cause of the flow rate decrease.

References

- None.

 **Horizontal Well - Cleaning** 

No known method to mechanically clean such long horizontal wells. Driller custom fabricated a wire brush and used citric acid to scrub the wells.

 Wire bristles welded to drilling rod to specifically fit the well diameter.

 Wells were mechanically scrubbed, washed with citric acid, and then flushed with water.

(continued)

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Notes:

Purpose of Slide

- Continue example and illustrate the solution implemented to increase flow rates and improve system performance.

Key Points

- The wells were mechanically scrubbed, washed with citric acid and flushed with water using a 400 gallon per minute (GPM) pump.
- The driller had to custom fabricate a cleaning tool for the wells.

References

- None.

 **Horizontal Well - Cleaning Successful?** 

HW-1 = 5 gpm HW-2 = 13 gpm

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Notes:

Purpose of Slide

- Continue the example and illustrate the success of the optimization effort (video clip).

Key Points

- This is another video clip taken after the well was scrubbed.
- It shows that the build up has been reduced.
- Flow rates increased and the site was back on track in terms of its Exit Strategy and estimated time to cleanup.

References

- None.



RSE - Cost Effectiveness Evaluation

- ❖ Identify Major Cost Categories
- ❖ Focus on the Highest Percentages
 - 40 to 60% of Costs: Energy Consumption
 - 20 to 40% of Costs: Sampling and Analysis
- ❖ Analyze for Cost Reduction Opportunities
 - Start with the largest costs first

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Notes:

Purpose of Slide

- Remind participants that there are three aspects to RSEs – review the Exit Strategy, complete the system and site performance evaluation, and evaluate cost effectiveness. It is incumbent on facility managers to make prudent decisions relating to CA.

Key Points

- The RSE typically involves performing a cost analysis on an existing facility using historical data.
- Costs are broken into categories and analyzed in detail.
- Identifying the most costly items helps to focus the detailed cost evaluation. It is prudent to focus on the highest cost items first – where there is the best chance of savings.
- The following slides provide examples of modifications recommended in RSEs that lead to significant cost savings and improved system operation. Such changes save resources, while also maintaining or improving the system's environmental performance.

References

- EPA. 2006. 2005 Annual Progress Report for Ground Water Remedy Optimization. EPA 540-R-06-066.
- EPA. 2005. Cost-effective Design of Pump and Treat Systems. EPA 542-R-05-008.



Reducing Energy Costs



- ❖ Initial design for Vapor Recovery System based on 275 lbs/hr VOCs
- ❖ Actual now at 1.5 lbs/hr VOCs

Modifying system process cycle time realized annual energy savings of \$18,000.



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Notes:

Purpose of Slide

- Provide an example where the energy/cost evaluation led to optimizing an air stripping / granular activated carbon (GAC) off-gas treatment system to reduce energy consumption (operating costs).

Key Points

- This system was installed and operated for ten years with no significant changes.
- Design loading for the system was based on initial groundwater concentration data and expected VOC loading.
- Contaminant concentrations dropped dramatically over time (from design conditions) as the site remediation progressed (normal occurrence).
- Steam regeneration of the carbon beds is a major energy cost and occurs on a fixed cycle time. Regeneration was being performed based on initial system design volatile organic compound (VOC) loading (for example, too frequently for current conditions).
- Adjusting the cycle time to reduce the frequency of regeneration based on current VOC loading conditions resulted in a dramatic reduction of energy usage and utility costs, with no change in environmental performance.

References

- None.

 **Reducing Equipment Needs** 

- ❖ Air stripping system initially designed for 4 lbs/hr VOC – two towers in series
- ❖ Actual rate now at 1 lb/hr (continued)

Modifying system to use one tower and reducing blower size realized annual energy savings of \$10,000.



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Notes:

Purpose of Slide

- This is an example where the cost evaluation led to optimization of a treatment system, given that operating conditions had significantly changed – flow rate and concentrations had declined dramatically from design conditions.

Key Points

- The system was designed for higher influent concentrations than current conditions.
- Significant savings were possible by reducing treatment from two air stripping towers in sequence to one and changing out other equipment.
- The regulatory agency will be involved in these types of system changes – through effectiveness reports that describe conditions or recommended modifications, or regulatory issues relevant to the changes. It is prudent to develop lines of communication that will allow these changes to occur expeditiously. Development of performance standards is one mechanism that allows a facility to proceed with reasonable changes in an efficient manner.

References

- None.



Evaluating Costs: A Different Perspective

- ❖ O&M Costs
 - Routine
 - Major Repairs / Replacements
- ❖ Capital Costs
 - Modifications
 - Upgrades
- ❖ Life Cycle Costs
- ❖ \$\$\$ per Unit Mass Removed

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Notes:

Purpose of Slide

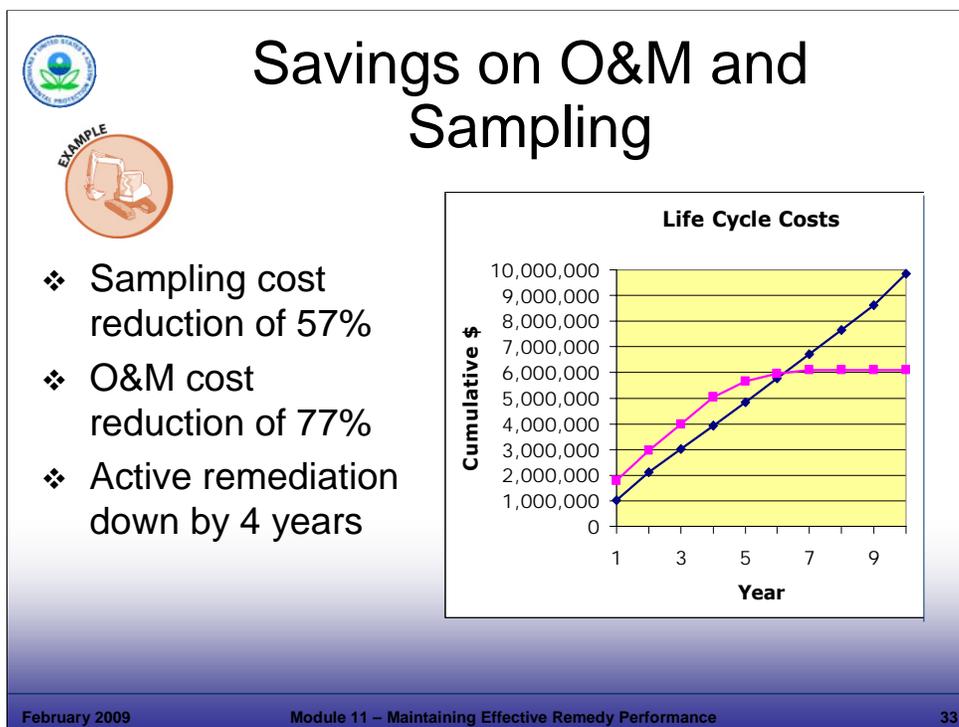
- Illustrate another perspective on cost evaluation, and how priorities vary among facilities.

Key Points

- Previously we looked a number of different cost categories – power, equipment, etc.
- Recurring annual costs are also important to facilities (for example, O&M, capital costs for major improvements or modifications, and life cycle costs).
- Facilities will budget for normal expenses (for example, monthly O&M and annual sampling) but also plan on infrequent major expenses (for example, pump failure every five years).
- Major upgrades and improvements are evaluated as long term investments with a payback or savings.
 - The cost of repairing an old component is compared to the cost of replacement with an improved version. A repair seldom lasts as long as a new unit.
 - Replacing a 5 horsepower (HP) pump with a 1 ½ HP pump may cost \$1,500; however, it may save \$2,000 per year in energy costs (a simple payback of 9 months).
- Some facilities consider life cycle costs most important in evaluating options - more up-front spending may mean lower spending overall as the length of time of treatment or system operation is reduced.
- Other facilities will prefer to keep recurring annual costs at a minimum, even if the life cycle cost is higher.
- Performance can be evaluated on a unit cost basis (\$/ pound, \$/ cubic yard, \$/ hour).

References

- ITRC. 2006. Life Cycle Cost Analysis.
- ITRC. 2006. Above Ground Treatment Technologies.



Notes:

Purpose of Slide

- Show the significant impact that the level of O&M and sampling activities can have on CA costs and cleanup times through a site-specific example.

Key Points

- An RSE was conducted and implemented in years 4 to 5.
- The RSE identified improvements in the sampling plan for the facility, resulting in a 57% reduction in sampling costs:
 - Use of passive diffusion bags (PDBs) for sampling (discussed on the next slide).
 - Elimination of some wells that had been sampled and met cleanup criteria for years.
 - Reduced sampling frequency for all wells, and development of a 2-tiered sampling program, where some wells were sampled less frequently than others.
- O&M costs were reduced by 77%, based on multiple system improvements:
 - The P&T system was treating a fraction of the volume it was designed to treat; the plume was much smaller than it had been. Therefore, influent streams were rerouted and combined.
 - System utilization time was increased by replacing parts, proactive maintenance, and expanding the parts inventory. The effect of these activities was to reduce total estimated time to cleanup by 4 years.
- These savings in cleanup time and life-cycle costs could not have been realized without the results-based approach adopted by the agency.

References

- None.



Sampling Savings: Passive Diffusion Bags

- ❖ VOC sampling of groundwater
- ❖ Permeable bag containing deionized water
- ❖ Contaminants diffuse into DI water
- ❖ Bag retrieved from well and sampled



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Notes:

Purpose of Slide

- Describe the use and advantages of PDBs, such as reduction in costs as illustrated in the previous slide.

Key Points

- PDBs are used for VOC sampling of groundwater.
- A permeable polyethylene bag contains deionized (DI) water.
- The PDB is suspended on a weighted polypropylene line next to the well screen.
- Wells with long screens can have more than one PDB on the same or different lines.
- Contaminants in well water diffuse through the bag into DI water until equilibrium is reached .
- The PDB is retrieved from the well and emptied into sample bottles.
- Use of PDBs generally cuts labor costs associated with sampling by over 50%.
- Many states consider PDB sampling results equivalent to traditional purge and pump sampling results.

References

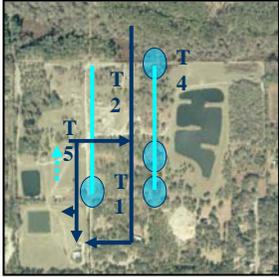
- ITRC. Diffusion Sampler Page of Website. Accessed on-line at: http://www.itrcweb.org/teampublic_DPS.asp.



O&M Savings



- ❖ Modify existing systems
 - Combine influents
 - Reduce power requirements
 - Consolidate equipment
- ❖ Increase system utilization
- ❖ Add technologies
 - Add air sparge unit
 - Eliminate recovery wells
 - Supplement with bioremediation




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Notes:

Purpose of Slide

- Describe the basis of the O&M cost savings using an example.

Key Points

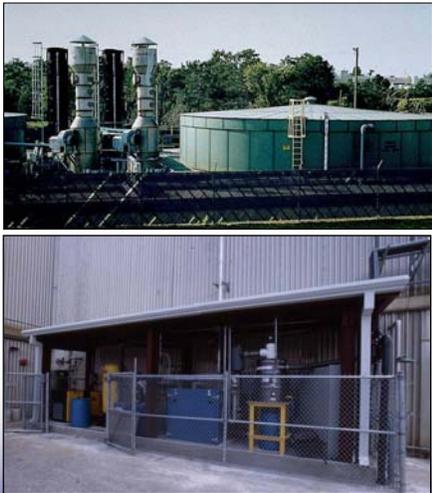
- By combining influent from several recovery wells into one treatment system, the facility saved on power, monitoring, and equipment costs.
- Increasing system utilization (the time the system is operating) reduced the estimated time to cleanup, eliminating years of operating costs.
- Adding technologies also reduced the estimated time to cleanup. This adds significant capital costs but reduces life-cycle costs.

References

- None.



System Design Modification



- ❖ Initial design for 200 gpm, batch before disposal
- ❖ Actual now 25 gpm, direct injection

Capital costs recouped in two years, based on energy savings

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Notes:

Purpose of Slide

- Illustrates a site where a P&T system had operated successfully for many years, warranting system review and modification.

Key Points

- The plume had been reduced in size and groundwater recovery rates were much lower than design conditions.
- The holding tank was eliminated and two air strippers were replaced with trays.
- The payback for capital costs was only 2 years, based on energy savings and reductions in effluent sampling.

References

- None.



Performance Standards

- ❖ Protective of human health and the environment
- ❖ Plume containment
- ❖ Source control
- ❖ Contaminant reduction
- ❖ Certified by a P.E.

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Notes:

Purpose of Slide

- Show how one of the principles of this course – “Think performance standards” (Principle 3 from Module 2) – can positively impact the operation of a remediation system. This approach (using performance standards as tailored oversight tools) illustrates results-based CA.

Key Points

- As we have shown, remediation systems are likely to need modifications or even change completely over time (Remember, another course principle is “Okay for remedy to change”). Therefore, the facility and agency should anticipate the need for change and develop a process that allows the facility to respond quickly to needed modifications.
- 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.
- One approach is to develop a set of performance standards. If the treatment system modification or technology change meets the performance standards, then the facility can proceed without agency approval (remember, the agency already has approved the performance standards). Here are some examples of how these types of standards have been implemented:
 - A facility was planning to dismantle an air sparge unit and allow monitored natural attenuation as a polishing step. The facility evaluated the change against the above performance standards – the action was protective of human health and the environment (HH&E), the plume was contained, the source had been eliminated, and contaminant reduction would continue to occur. The plan was certified by a P.E. The facility notified the agency; separate agency approval was not necessary.
 - A facility was planning to dismantle recovery wells. It determined that the resulting system (fewer recovery wells) would continue to meet these performance criteria. The facility notified the regulatory agency; separate approval was not necessary.
 - A facility selected excavation as a technology to remove DNAPL contamination. The facility determined that the activity would meet the performance standards. The facility notified the agency; separate approval was not necessary.

References

- None.



Implementing Institutional Controls (ICs)

- ❖ Overseeing agency approves
- ❖ Get the right information to the right people at the right time; consider layering ICs for effective outcomes
- ❖ Identify responsibilities of every party
- ❖ Identify costs and include in financial assurance

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Notes:

Purpose of Slide

- Often, the ICs are implemented once active remediation is completed, but ICs are sometimes implemented during remedy operation.

Key Points

- Selection of ICs will vary. Sometimes the o/o will recommend them; sometimes the o/o will analyze and establish them; sometimes ICs will be prescribed by law, or worked out by interested parties. The overseeing agency then reviews and approves the ICs.
- The key to effective ICs is getting the right information to the right people at the right time. EPA recommends layering to achieve this goal. For example, if the remedial objective is to restrict excavation, a possible approach may include a restrictive covenant, and the local government notifies future owners through a “one call” system. The land use restriction may serve to alert future landowners of the land or resource use limitations, and the one call system can provide a warning to excavators or others using the property that may not have access to or knowledge of what is recorded in land records (for example, utility contractors). Other approaches also are possible.
- All parties should have the understanding, authority, and financial capacity to fulfill their responsibilities relating to identifying, evaluating, implementing, and monitoring ICs.
- Cost for ICs must be identified and included in financial assurance.

References

- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.



Monitoring of ICs

- ❖ Important to ensuring long-term effectiveness of remedy
- ❖ Used to determine whether ICs:
 - Remain in place
 - Provide the protection required by the remedy
- ❖ May be the responsibility of more than one party
- ❖ Monitoring opportunities

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Notes:

Purpose of Slide:

- Discuss the importance of monitoring ICs.

Key Points

- In addition to active remediation and engineering controls, ICs will play an important role in many final remedies. Identification and selection of appropriate ICs have been discussed in earlier modules.
- The most critical post-implementation aspect to ensuring the long-term effectiveness of ICs is monitoring as often as necessary to ensure effectiveness.
- The objectives of monitoring are to determine: (1) whether the mechanism remains in place; and (2) whether the ICs are providing the protection as required by the remedy.
- For added protection of HH&E, and to minimize risk, EPA recommends layering (that is, use of more than one IC) and considering different types of ICs. For example, to restrict land use, the regulatory agency may issue an enforcement tool (order), the facility o/o may obtain an easement, and the facility may discuss options with local governments for zoning and assuring awareness of restrictions by recording them in a deed notice and in a state registry of contaminated sites.
- Ongoing site activities present an opportunity for monitoring. For example, monitoring of ICs may occur in conjunction with facility inspections, multimedia inspections, or sampling.

References

- EPA. 2005. Institutional Controls Bibliography: Institutional Control, Remedy Selection, and Post-Construction Completion Guidance and Policy. December.
- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.



Effective Reporting

Lean Reporting:

- ❖ Simple Reports
 - Think “bullets,” not paragraphs
- ❖ Reduced Frequency
 - Annual versus semi-annual
- ❖ Exception Reporting
 - Deviations from the norm

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Notes:

Purpose of Slide

- It is necessary for facilities to provide performance data and system effectiveness information to the regulatory agency, but the reporting format should be simple. Lean reports are preferred by facilities because they can be produced at lower cost than reports with extensive text and generally are preferred by the regulatory agency because the data are presented in a concise format for review.

Key Points

- Historically reports have been voluminous, with much detail and supporting documentation. Facility time to prepare this data and agency time to review this information and provide comments can be lengthy. Lean reporting focuses on efficient and effective reporting. This includes:
 - Simple Reports - Simplification of reports can speed up review effort and time considerably and is more cost efficient. Parties can agree on the most important data items and best formats to support adequate oversight and protective outcomes. Concepts include:
 - Consider bullets, not paragraphs;
 - Use tables, charts, and graph to convey information in lieu of text;
 - Use graphics to describe conditions – for example, plume maps; and
 - Reference standard operating procedures for sampling and other activities, rather than providing lengthy descriptions.
 - Reduced Frequency - Quarterly reports were once common, now semi-annual are the norm.
 - Most older sites are stable and do not change rapidly.
 - Consider changing to annual or even less reporting, when justified.
 - Exception Reporting - Emphasize reports that focus on exceptions or deviations from expected results, rather than many pages of reporting to document non-events (that is, all metrics meeting expectations).
- Lean reporting can also be used for reports associated with system modifications or implementation of new technologies.

References

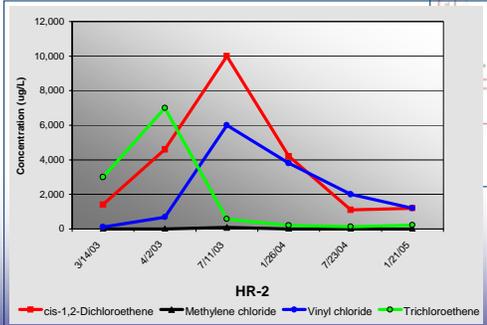
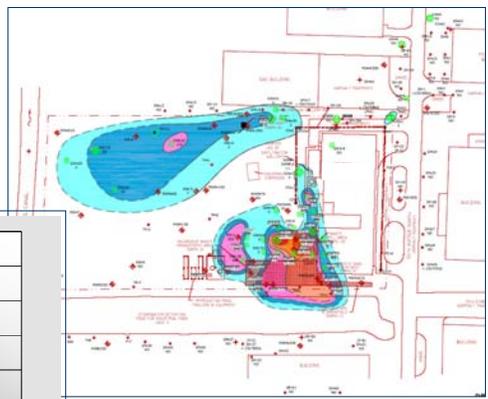
- None.



Effectively Reporting Effectiveness



- ❖ **Keep it Simple & Direct**
- ❖ **Focus on Results**
- ❖ **Use Graphics**
- ❖ **Track Metrics**

- ❖ **Less May be More**
- ❖ **Draw Conclusions**
- ❖ **Make Recommendations**

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Notes:

Purpose of Slide

Provide an example of how to report **remediation system** effectiveness using a lean reporting format.

Key Points

Effectiveness in achieving goals is the primary information to report.

The bullets on this slide illustrate key data use and a leaner approach to reporting.

The instructor will elaborate on this example.

References

None.



Summary

- ❖ Remediation does not end with Remedy Construction
- ❖ Facilities are responsible for adequately maintaining remedies, including ICs
- ❖ Remedies may change over time to reflect changing site conditions and optimize performance

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Notes:

Purpose of Slide

- Summarize the key points addressed in the module.

Key Points

- It will take considerable effort from all stakeholders to meet the ambitious goals of 2020. Once construction is complete, there is still much effort necessary to achieve remediation goals.
- Remediation systems need to be maintained for efficient operation. As plumes decrease in size and concentration, treatment systems should be adjusted accordingly and sometimes technologies should be changed. ICs must be implemented and maintained.
- Over time, remedies may need to be adjusted to reflect changing site conditions and to optimize performance. Facilities and agencies should plan ahead to establish clear performance standards and goals for protective remedies. These results-based approaches can support efficient and effective system optimization and modifications as conditions dictate (for example, through performance-based permits).

References

- None.

Module 12
Corrective Action Complete



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



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Notes:

Purpose of Slide

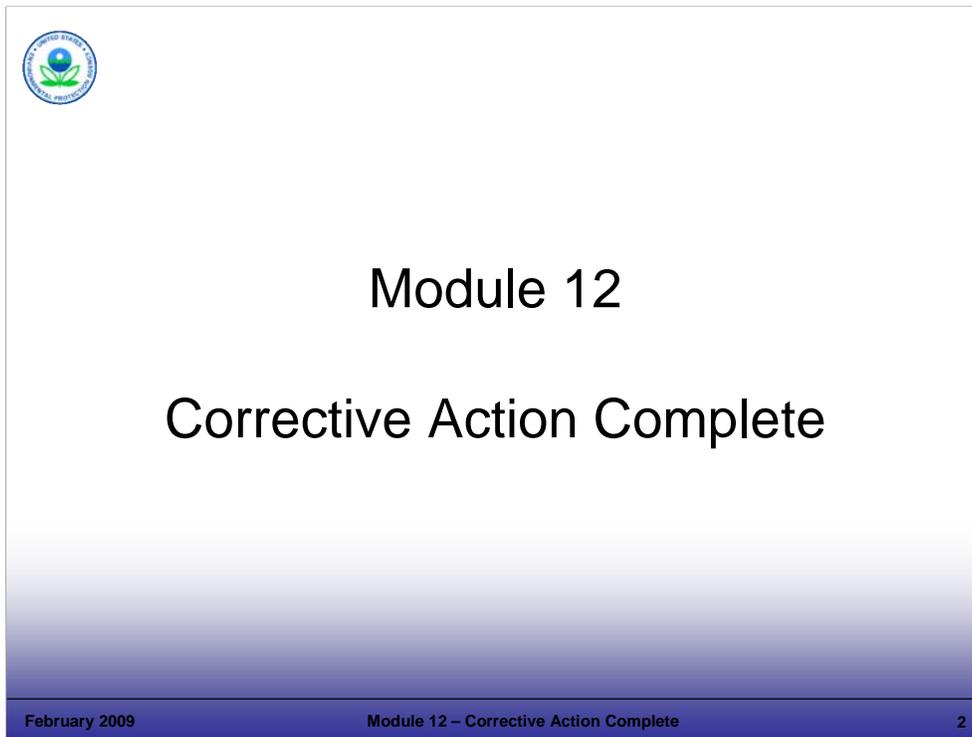
- Holder slide for Module 12, Corrective Action (CA) Complete.

Key Points

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

References

- None.



Notes:

Purpose of Slide

- Holder slide for Module 12, CA Complete.

Key Points

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

References

- None.



Module Overview

- ❖ Review EPA guidance and other methods used to make formal determination that corrective action (CA) is complete
- ❖ Examine approaches to determine that controls are in place and effective
- ❖ Review other types of determinations

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Notes:

Purpose of Slide

- Present the module overview.

Key Points

- In this module, we will review the following:
 - EPA guidance and other methods used to make formal determinations that CA is complete;
 - Approaches to determine that controls are in place and effective; and
 - Other types of determinations.
- We will also revisit long-term stewardship (LTS) and its relation to CA completion and related determinations.
- In other words, we will review how to determine whether we have used a good exit strategy to GET TO YES!

References

- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



Completion Determinations

- ❖ A formal determination is made to:
 - Inform the owner/operator (o/o)
 - Provide opportunity for public comment
 - Help return property to reuse
 - Remove facility from work load universe
- ❖ There are no Federal regulatory requirements for completion determinations

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Notes:

Purpose of Slide

- Examine why we do Completion Determinations.

Key Points

- A formal determination is made to:
 - Inform the owner/operator (o/o) that the milestone has been met;
 - Provide an opportunity for public comment;
 - Help return the property to reuse; and
 - Remove the facility from the work load universe.
- EPA recognizes the importance of an official acknowledgment that CA activities have been completed. A Completion Determination informs the o/o that CA is complete at the facility. The process of making a formal Completion Determination assures that the public has the opportunity to review and comment on the determination. Completion determinations also can help promote the transfer of properties and redevelopment.
- Federal regulations do not provide explicit procedures for making Completion Determinations; therefore, regulators have considerable flexibility. On October 2, 2001, EPA announced draft guidance on Completion Determinations for CA, and on February 27, 2002, EPA issued another draft version of the guidance. After reviewing the comments received, EPA finalized the guidance on Completion Determinations on February 25, 2003. The 2003 guidance ties completion determinations to 40 CFR 264.101 requirement that CA must be conducted to protect human health and the environment and therefore, a completion determination from the State or EPA that CA activities are complete is, in effect, an announcement that the protection of human health and the environment standard has been achieved.

References

- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



EPA Guidance

- ❖ Two types of Completion Determinations
 - CA Complete without Controls
 - CA Complete with Controls
- ❖ Determinations not designed to recognize progress for short-term or intermediate goals

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Notes:

Purpose of Slide

- Review EPA guidance for Completion Determinations.

Key Points

- EPA guidance identifies two types of Completion Determinations, as follows:
 - CA Complete without Controls, and
 - CA Complete with Controls.
- Facilities may obtain both types of determinations: A facility may obtain a CA Complete with Controls or a CA Complete without Controls. If a determination is made that CA is Complete with Controls and circumstances change (for example, if anticipated land use changes) and the facility wishes to achieve CA Complete without Controls, that is acceptable, but not required.
- Determinations are not designed to recognize progress for short-term or intermediate performance goals: EPA recognizes that some CAs may be complex and may include requirements for achievement of several progressive milestones. We have discussed in previous modules several performance goals to measure progress for RCRA CA short-term protection (for example, Environmental Indicators). However, a CA Completion Determination is only made when a remedy achieves the final cleanup goal(s).

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. EPA 530-R-04-030. Update. April.
- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



CA Complete without Controls

- ❖ Occurs when o/o satisfies all obligations under §§3004(u) and (v). Indicates that
 - There is no need for CA in the first place, or
 - Remedy has been successfully implemented and no further activity or controls are necessary, or
 - There is no need for Institutional Controls (ICs) or Engineering Controls (ECs) in order to protect human health and the environment.

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Notes:

Purpose of Slide

- Review the meaning of CA Complete without Controls.

Key Points

- The CA Complete without Controls determination is made when the facility owner has satisfied all obligations under Sections 3004(u) and (v), or there is no need for CA in the first place. EPA recommends this terminology be used to indicate that either there was no need for CA at the facility or, where CA was necessary, the remedy has been implemented successfully, and no further activity or controls are necessary for protection of human health and the environment. We will talk further about this RCRA event code on slide 18.

References

- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



CA Complete with Controls

- ❖ Applies when
 - Corrective measures defined
 - Construction complete
 - Cleanup objectives met
 - Future activities include remedy Operation and Maintenance (O&M), monitoring, and maintenance of ICs and ECs

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Notes:

Purpose of Slide

- Review the meaning and application of CA Complete with Controls.

Key Points

- A CA Complete with Controls determination is made at a facility where:
 - A full set of corrective measures has been defined;
 - The facility has completed construction and installation of all required remedial actions;
 - Site-specific media cleanup objectives for anticipated future use have been met; and
 - Performance of O&M and monitoring actions is required, and/or compliance with and maintenance of any ICs is ensured.
- A CA Complete with Controls determination “provides the o/o with recognition that protection of human health and the environment has been achieved, and will continue as long as the necessary O&M actions are performed, and any ECs and ICs are maintained and complied with.”

Note: The definition of CA Complete with Controls refers to “maintenance” of ICs rather than “implementation.” As we have discussed in previous modules, ICs are implemented and in place prior to a Completion Determination.

References

- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



Long-Term Stewardship

- ❖ Long-term management of information
- ❖ Clear roles and responsibilities
- ❖ Reliable ECs and ICs
- ❖ Accurate life cycle costs
- ❖ Adequate financial assurance and resources
- ❖ Monitoring to ensure enforceability

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Notes:

Purpose of Slide

- Remind participants of the role of, and issues involving, LTS at RCRA CA sites. This slide also provides a segue to following slides that discuss strategies to ensure the reliability of ICs and ECs at CA sites.

Key Points

- As we have discussed in previous modules, LTS is part of maintaining any remedy, in order to ensure long-term protection of human health and the environment. LTS helps ensure that ICs and ECs have been adequately protected. This should be done by ensuring that the following issues have been addressed:
 - Long-term management of information;
 - Clear roles and responsibilities;
 - Reliable ECs and ICs;
 - Accurate life cycle costs;
 - Adequate financial assurance and resources; and
 - Monitoring to ensure enforceability.

References

- Michael Hendershot. EPA Region 3. 2007. Presentation at San Diego Long-Term Strategy Meeting. "Developing Effective and Reliable ICs During the Remedy Selection Process." April.



ICs and Completion Determinations

- ❖ ICs selected in the final remedy must be monitored and enforceable
 - The Uniform Environmental Covenants Act (UECA)
- ❖ If ICs were not included in the selected remedy, should they be added (and if so, what ICs should be added)?



Appendix A of EPA 2003 Draft Guidance.

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Notes:

Purpose of Slide

- Discuss concepts developed to ensure a thorough and consistent approach to assessing the implementation and performance of ICs used in CA remedies. The next several slides will cover those concepts in more detail.

Key Points

- Before remedies are considered complete, regulatory agencies should determine (1) if ICs have been implemented, (2) that ICs will be monitored and are enforceable, (3) who will be enforcing them. The status and performance of ICs (where ICs are considered necessary) is an essential part of determining if the remedy is protective. Monitoring is necessary to ensure that (1) the IC mechanism remains in place; and (2) the IC provides protection as required by the remedy.
- We briefly discussed the Uniform Environmental Covenants Act (UECA) in Module 6. UECA may provide clear rules for the States and federal agencies to create, enforce and modify a valid real estate document (an “environmental covenant”) to restrict the use of contaminated real estate. The UECA makes these covenants enforceable by eliminating legal doctrines that cast doubt on the covenant’s validity. UECA also applies traditional real estate law principles to environmental covenants to ensure they will be preserved over the very long term and be enforceable in accordance with their terms against successive owners of the property and against the parties liable for maintaining “ICs” on the property and performing other duties identified in the covenant.
- We discussed issues associated with establishing and monitoring ICs in Module 11, Maintaining Effective Remedy Performance. When issuing a CA Completion Determination, it is important to again review the performance and effectiveness of ICs used in the remedy.
- At the time of a Completion Determination, the regulatory agency should check whether ICs included in the selected remedy continue to prevent exposure as intended. If ICs were not selected, the review may show that ICs are now appropriate. The appropriate ICs should then be identified and implemented.

References

- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.
- EPA. 2003. ICs: A Guide to Implementing, Monitoring, and Enforcing Institutional Controls at Superfund, Brownfields, Federal Facility, UST, and RCRA Corrective Action Cleanups. Draft. February.
- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.
- Environmental Covenants Web Site. Accessed On-line at <http://www.environmentalcovenants.org/ueca/DesktopDefault.aspx>.



Potential Issues with ICs During Completion Determinations

- ❖ Ensure that ICs are effective and reliable as long as they are needed.
- ❖ How will ICs be monitored?

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Notes:

Purpose of Slide

- Discuss potential issues with ICs when performing Completion Determinations or subsequent review of the remedy's performance.

Key Points

- The agency must review the remedy to ensure that ICs are effective. This can include:
 - For example, a RCRA permit or order may have identified establishing easements or well restrictions as part of the final remedy. The Completion Determination should assess if these mechanisms are in place before the permit or order is terminated.
 - The selected remedy may have specified an anticipated land use with respect to setting the cleanup goal (for example, industrial use). For the completion review, the agency should review if actual or proposed land use changes remain consistent with those assumed by the remedy.
- In addition, the review should consider whether ICs selected and implemented are effective and reliable for as long as they are needed.
- A plan for monitoring ICs over time and indicating who is responsible for such monitoring should be in place. Once such a plan is in place, a Completion Determination can be made.

References

- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.



Procedures for Making Completion Determinations

- ❖ Will vary depending on
 - Permit status
 - Whether CA is subject to an order
 - Whether applied to entire facility or a parcel
- ❖ Should provide opportunity for public comment

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Notes:

Purpose of Slide

- Review the procedures associated with Completion Determinations.

Key Points

- The regulatory agency implementing CA should make a Completion Determination using appropriate procedures and should provide a meaningful opportunity for public comment. Several factors affect procedures for Completion Determinations:
 - The permit status of the facility. If the facility is permitted, the process for making the Completion Determination will generally proceed as a permit modification. If the facility is not permitted, the Completion Determination may be accomplished by several methods. A different approach may be used for a Completion Determination if the facility will continue to operate under a permit, perform post-closure activities at a regulated unit without a permit, or complete clean closure.
 - Whether the CA is carried out under an order. If the facility is implementing CA under an order, the Completion Determination may involve modifying or terminating the order.
 - Whether the determination applies to the entire facility or a portion of it. There is no need to make a determination for a parcel; however, this may be done for the o/o if the o/o or the purchaser requests it, particularly if the parcel will be developed for reuse.
- Completion determination procedures should provide an opportunity for public comment.

References

- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



The Process: CA Complete Without Controls Determination - Entire Facility

- ❖ Use permit modifications
- ❖ Issue a notice at non-permitted facilities
- ❖ Terminate orders

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Notes:

Purpose of Slide

- Review the procedures for CA Complete without Controls Determination for an entire facility.

Key Points

- Use a permit modification for permitted facilities: EPA believes that a permit modification is an appropriate procedure to indicate the regulatory agency's determination that CA is complete. The purpose of the modification would be to terminate the permit, if CA is complete without controls. Current regulations in 40 CFR 270.42 provide procedural requirements for facility-requested permit modifications. In most cases, Class 3 permit modifications are used to indicate completion of CA. If CA is complete without controls, and a permit is terminated, the action means that there are no further controls needed to protect human health and the environment (unrestricted use).
- Address administrative disposition of permit, or issue a notice at non-permitted facilities: At non-permitted facilities where CA is complete and all other RCRA obligations have been satisfied, EPA or the authorized State may acknowledge completion of CA by terminating interim status through final administrative disposition of the facility's Part A permit application. Regulatory agencies may use alternative terminology such as "no permit necessary determination" rather than "permit denial" to avoid confusing the public and possibly causing misperceptions of the facility. Regardless of the terminology, the basis for the decision should state clearly that: (1) no ongoing activities require a RCRA permit; (2) all closure and post-closure care requirements applicable to regulated units have been fulfilled; and (3) all CA obligations, including implementation of long-term monitoring procedures, have been fulfilled.
- Rather than issuing a final permit decision, EPA or authorized States may issue a notice informing the facility and public that the facility has met its CA obligations. However, that approach will not terminate interim status at the facility. Alternative procedures should provide procedural protections equivalent, though not necessarily identical, to those in 40 CFR Part 124 (or authorized State equivalent).
- Terminate order at facilities performing CA under an order: The regulatory agency may consider terminating the interim status CA order if a Completion Determination without Controls decision is appropriate for a facility.
- Remember: informal communications about the status of cleanup activities are not the same as Completion Determinations.

References

- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



The Process: CA Complete with Controls Determination - Entire Facility

- ❖ Permit modifications appropriate
- ❖ Issue notice for interim status facilities
- ❖ If RCRA-regulated obligations remain, no termination of interim status
- ❖ May use other non-RCRA mechanisms to maintain ICs, such as UECA

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Notes:

Purpose of Slide

- Review the procedure for CA Complete with Controls Determinations.

Key Points

- Permit modification procedures are appropriate for permitted facilities: For RCRA-permitted facilities, following the procedures in 40 CFR 270.42 for permit modifications will be appropriate when making a CA Complete with Controls Determination. A permit modification may be put in place to shorten the life of the permit, if there are other enforceable mechanisms in place that result in LTS.
- Issue a notice with opportunity to comment at interim status facilities: For non-permitted facilities, a regulatory agency may issue a notice with an opportunity to comment that provides procedural protections (public comment, response to comments, administrative record). These are equivalent but not necessarily identical to those required by 40 CFR Part 124 (or an authorized State equivalent).
- Should not terminate interim status or an enforcement order if RCRA-regulated obligations remain: If the facility must maintain financial assurance for maintenance or monitoring controls, regulators generally should not terminate interim status or eliminate an order.
- As appropriate, regulators may explore a variety of options, including: permits, orders, and other non-RCRA enforceable mechanisms, such as UECA, to maintain long-term ICs, where appropriate.

References

- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



The Process: Completion Determinations for Less Than the Entire Facility

- ❖ Can be requested by o/o
- ❖ Should be processed in a manner that will not affect portions where obligations remain
- ❖ Consider long-term plan for the facility, ICs, and financial assurance obligations if owner plans to sell property

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Notes:

Purpose of Slide

- Review the procedures for CA Complete Determination for Less than the Entire Facility. Note that portions of facilities can be released with this determination.

Key Points

- Determinations for less than the entire facility are not necessary, but may be useful to an o/o. These can be requested by an o/o, particularly if that portion of the facility will be reused or redeveloped.
- The decision should be processed in a manner that will not affect portions where obligations remain. For example, a permitted facility may seek a CA Completion Determination with or without Controls for a portion of the facility. If a facility has ongoing CA obligations (for example, solid waste management units (SWMUs) at other parts of the facility that still require CA), a permit modification is appropriate. However, the permit should not be eliminated.
- Consider the long-term plan for the facility, ICs, and financial assurance obligations if the owner plans to sell property: If the owner plans to sell the portion not subject to CA because of a Completion without Controls Determination, the regulatory agency should take steps to ensure adequate financial resources to address obligations for CA and/or closure at the remainder of the facility. If an IC is being imposed through a RCRA permit, steps should be taken to ensure that long-term enforceability is not lost through property transfer or permit expiration.

References

- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



Wrap Up “Loose Ends”

- ❖ Ensure closure of RCRA-regulated units via CA has been addressed
- ❖ Ensure other obligations in orders have been addressed
- ❖ Document applicable RCRA performance measures

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Notes:

Purpose of Slide

- Point out that all “loose ends” must be addressed with Completion Determinations.

Key Points

- Ensure that closure of RCRA-regulated units via CA has been adequately addressed: Regulatory distinctions exist between requirements for closure of RCRA-regulated units and CA requirements for SWMUs. RCRA-regulated units are subject to specific standards under 40 CFR Parts 264 and 265, Subparts F, G, and H. However, EPA rules provide flexibility to coordinate and implement closure and CA requirements: The Post-Closure Care Final Rule provides the regulatory agency discretion to impose requirements developed for CA in lieu of the requirements of 40 CFR Parts 264 and 265, Subparts F, G, and H, where a regulated unit and SWMU have contributed to the same release. Generally speaking, the goal is that closure and CA can be treated similarly.
- Ensure any other applicable obligations required in orders have been addressed.
- Document applicable RCRA performance measures, using appropriate RCRA Info Codes.

References

- EPA. 1998. Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities: Post-Closure Permit Requirement and Closure Process; Final Rule. Federal Register, Volume 63, Number 204. 63 FR 56710. October 22.
- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



RAU Documentation

- ❖ Ready for Anticipated Use (RAU)
- ❖ Reuse determinations complement cleanup decisions

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Notes:

Purpose of Slide

- Identify other types of Completion Determinations.

Key Points

- The Ready for Anticipated Use (RAU) Determination is a performance measure that enables EPA and States to track acres determined to be protective for current and reasonably anticipated uses. The criteria for a facility or areas of a facility to meet the Ready for Anticipated Use Measure outlined in the CPRM Guidance are as follows:
 - Criteria for Protective for People under Current Conditions has been met (this requires documentation);
 - Cleanup goals have been achieved for media that may affect current and reasonably anticipated future land uses of the facility so that there are no unacceptable risks; and
 - All institutional or other controls, identified as part of a response action or remedy as required to help ensure long-term protection, are in place.
- The RAU Determination can be accomplished for an entire facility or for a portion of a facility. States and Regions are not required to make area-specific RAU determinations, but may make these determinations as they deem appropriate.
- RAU determinations are intended to aid EPA in performance measurement--they complement cleanup decisions, but cannot be used to address matters of liability or enforcement. The RAU Determination does not replace or substitute for decision documents required by RCRA regulations.

References

- EPA. 2007. Guidance for Documenting and Reporting RCRA Subtitle C Land Revitalization Indicators and Performance Measures. February 21.
- EPA. 2007. RCRA Ready for Anticipated Use (RAU) Documentation Form.



CA Performance Standards Attained

- ❖ Event Code 900
 - All required remedies constructed and installed
 - Cleanup objectives have been met
 - May include long-term controls to maintain protection of human health and the environment
 - May remain under RCRA permit, order, or other mechanism

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Module 12 – Corrective Action Complete

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Notes:

Purpose of Slide

- Introduce the CA 900 performance measure.

Key Points

- CA 900 is a new RCRA Info event code established to describe remaining events beyond the selection and construction of remedies at facilities subject to CA. While the event code is not actually available in RCRAInfo, it will become available with an upcoming release of this system.
- When EPA issued its final CA Completion Guidance, the guidance described CA Complete with or without Controls. EPA will use this guidance in making Completion Determinations at facilities, and will want to track those determinations. However, the event code structure in RCRAInfo did not adequately distinguish between situations where a completed CA requires long-term controls, and a “walk-away” situation. Also, in a number of authorized states, CA is not considered “complete” when an implemented remedy requires long-term maintenance procedures, land use controls, or other controls to maintain performance criteria. These states view these controls as part of CA, and must continue to expend RCRA resources to ensure that the controls remain in place. An event code structured on the final guidance would present a potentially misleading picture in states that require a permit or order to remain in place until no controls are necessary.
- The CA 900 code was designed to record the event where a facility attains CA performance standards, either with or without controls. There are two status codes within the 900 event code: CN for long-term controls, and NC for no controls.

References

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Final Report. Win/Informed Executive Steering Committee. July 28.
- FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25.



CA Process Terminated

- ❖ Event Code CA 999
 - Cleanup objectives have been met
 - RCRA regulatory mechanisms terminated
 - CA complete

February 2009 Module 12 – Corrective Action Complete 18

Notes:

Purpose of Slide

- Review the RCRA Info Event Code for CA Termination: CA 999.

Key Points

- The CA 999 Event Code memorializes that the CA process has been terminated. All remediation and stabilization has been completed at the facility, and all requirements in permits and/or orders have been satisfied.
- All cleanup objectives have been met.
- The regulatory agency has determined that the RCRA CA process is no longer needed to maintain a protective remedy, regardless of whether the determination is completed with or without controls. For example, some states have an IC scheme that ensures LTS of the facility outside of the RCRA CA process.
- CA 900 without Controls (where RCRA CA in a permit or orders has been terminated), is equivalent to CA 999.

References

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



Summary

CA Completion Determinations signal everyone that CA activities are no longer necessary (though controls to ensure remedies remain protective may be necessary).

February 2009 Module 12 – Corrective Action Complete 19

Notes:

Purpose of Slide

- Summarize the key messages in this module.

Key Points

- CA Completion Determinations signal that no further CA activities are necessary (though controls may remain in place).
- The end goal is a remedy that is sustainable, complete, and protective of human health and the environment, based on current and reasonably anticipated uses.

References

FR. 2003. Final Guidance on Completion of CA Activities at RCRA Facilities. 68 FR 8757. February 25

Appendix A: Enforcement Authorities by IC Type

IC Type	Authorities	Possible Enforcing Organizations and Actions
Governmental Controls	Zoning Groundwater Restrictions	Local jurisdiction; enforcement through administrative process or legal action Typically a State agency; enforcement through administrative process or legal action
Proprietary Controls	Easement or Covenant Third Party Beneficiary Agreements CERCLA/RCRA CD, Order, or Permit	The grantee of a proprietary control may take legal action against any party that engages in activities prohibited by its proprietary control EPA or the State may enforce the proprietary control under State property law if they are a third party beneficiary to the easement or covenant If a responsible party or a liable party is the grantor or grantee of the proprietary control, EPA may utilize these tools to enforce maintenance of the proprietary control
Information Devices	CERCLA/RCRA CD, Order, or Permit	EPA may use these instruments to order a responsible party or liable party to record a notice in the land records
Enforcement and Permit Tools with IC Components	CERCLA/RCRA CD, Order, or Permit	EPA may use a variety of legal instruments to require a responsible party or liable party to control the use of land or resources

Appendix B: Glossary of Terms

Module 13
Challenge Exercise



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



This training and training documents do not create any legally binding requirements on the U.S. Environmental Protection Agency (EPA), states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



February 2009 Module 13 – Challenge Exercise 1

Notes:

Purpose of Slide

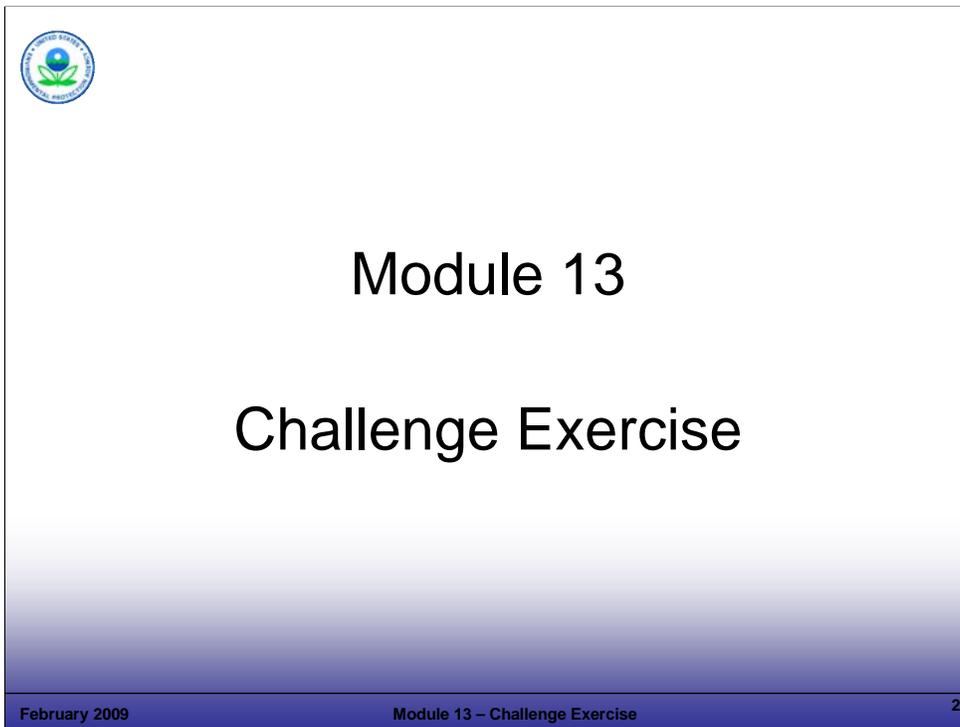
- Holder slide for Module 13, Challenge Exercise.

Key Points

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

References

- None.



Notes:

Purpose of Slide

- Holder slide for Module 13, Challenge Exercise.

Key Points

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

References

- None.



Module Overview

- ❖ Review concepts covered in Modules 1 through 12
- ❖ Groups work to evaluate CA challenges and identify solutions
- ❖ Group present findings and discusses options with class
- ❖ Class provides input to future Challenge Exercises



February 2009

Module 13 – Challenge Exercise

3

Notes:

Purpose of Slide

- Provide overview of Module 13, which includes a Challenge Exercise.

Key Points

- In this module we will review the concepts addressed in this course using a Challenge Exercise.

References

- None.



Challenge Exercise

- ❖ Divide into groups.
- ❖ Take time to review and discuss your group's challenges.
- ❖ As a group, identify solutions to the challenges (as possible).
- ❖ Designate a representative to report to the class.
- ❖ Participate in a facilitated discussion.

February 2009

Module 13 – Challenge Exercise

4

Notes:

Purpose of Slide

- Provide overview of Challenge Exercise process.

Key Points

- The participants will divide into groups, review the handout materials, and work as a group to discuss corrective action (CA) challenges, experiences, and options for future progress.
- The participants can refer to the course material, share their knowledge, and refer to the menu of CA optimization tools considered earlier.
- After the exercise, the instructor will facilitate group presentations and lead a review a debrief of the exercise.

References

- None.



Summary

- ❖ Course concepts can be applied across a range of sites and challenges.
- ❖ Tools and resources are available to support implementation of the concepts presented in this training course.
- ❖ To GET TO YES, focus on progress rather than process.

February 2009

Module 13 – Challenge Exercise

5

Notes:

Purpose of Slide

- Summarize the module.

Key Points

- Summarize key concepts reviewed in this module.

References

- None.

Module 14
Wrap Up



UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

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



HSW

This training and training documents do not create any legally binding requirements on of U.S. Environmental Protection Agency (EPA) , states, or the regulated community, and do not create any right or benefit, substantive or procedural. The training and documentation are not a complete representation of the Resource Conservation and Recovery Act or of EPA's regulations and views.



Tt

February 2009 Module 14 – Course Wrap-Up 1

Notes:

Purpose of Slide

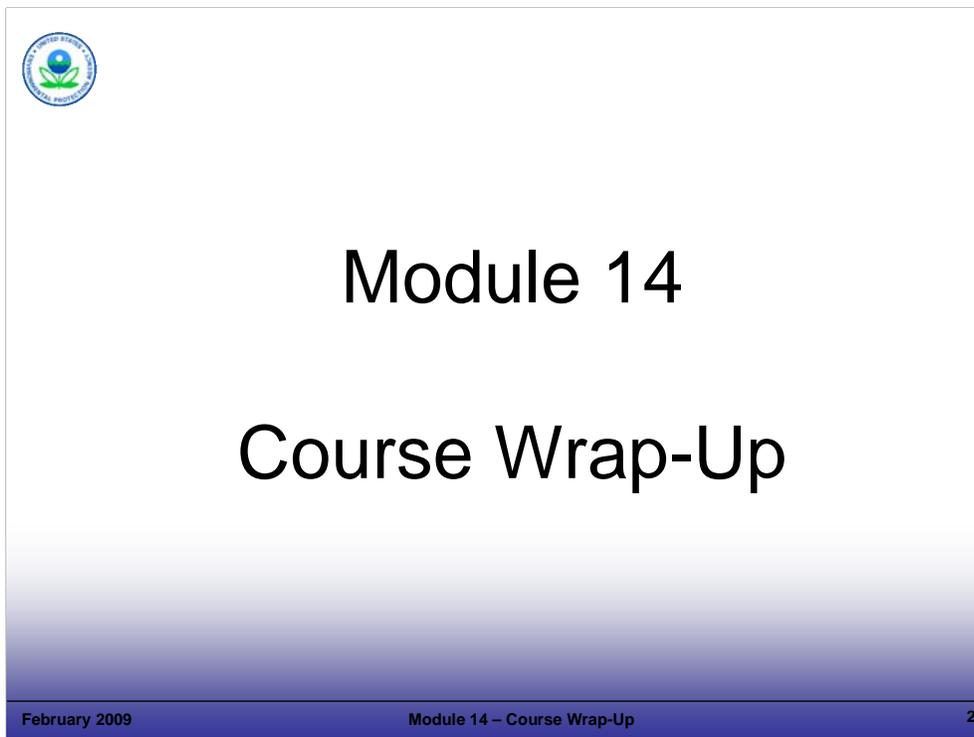
- Holder slide for Module 14, Course Wrap-Up.

Key Points

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

References

- None.



Notes:

Purpose of Slide

- Holder slide for Module 14, Course Wrap-Up.

Key Points

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

References

- None.



Module Overview

- ❖ Review materials covered and resources provided/available
- ❖ Review training purpose, objectives and course expectations
- ❖ Revisit learning objectives (....test)
- ❖ Provide evaluation input for future course improvements

February 2009

Module 14 – Course Wrap-Up

3

Notes:

Purpose of Slide

- Provide overview of wrap-up module.

Key Points

- Review the points covered in this module.

References

- None.



Day 1 – The Blueprint for Success

- ❖ Module 1 – Introduction and Course Overview
- ❖ Module 2 – How to Meet the 2020 Vision
- ❖ Module 3 – CA Authorities and Guidance
- ❖ Module 4 – Starting with the End in Mind: Building an Exit Strategy
- ❖ Module 5 – Achieving Success: Practical Solutions to CA Challenges
- ❖ Module 6 – CA and Facilitating Land Revitalization

February 2009

Module 14 – Course Wrap-Up

4

Notes:

Purpose of Slide

- Review content of Day 1.

Key Points

- Review the content of Day 1; this first day of the course focused on (1) the RCRA CA Goals and Vision that must be achieved; (2) the regulations, guidance, and polices that provide the framework for CA; (3) reforms and results-oriented guidance; (4) how focusing on the end goals early in the process can support CA results; (5) EPA programs and resources to support revitalization; and (6) how CA and revitalization can support each other.
- Day 1 presented the basic framework of CA and overviewed where the program has come from and where the program is headed.
- The course emphasis is on concepts and tools to achieve rapid CA progress.

References

- None.



Day 2 – Concepts and Strategies

- ❖ Module 7 – Selecting and Approving a Protective Remedy
- ❖ Module 8 – Remediation Technologies
- ❖ Module 9 – Managing Remediation Waste
- ❖ Module 10 – CA Optimization Tools and Challenge Exercise

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Module 14 – Course Wrap-Up

5

Notes:

Purpose of Slide

- Review content of Day 2.

Key Points

- Review the content of Day 2; the second day built on the first.
- The second day addressed elements that are common to each CA site and are important in implementing the CA process successfully.
- Module 7, Selecting a Protective Remedy, reviewed factors that support the selection of a remedy (Module 8, Achieving a Remedy Decision). The modules included two parts, policy and field considerations, including: consideration of current and anticipated uses, establishment of cleanup objectives, integration of engineering and institutional controls, and integration of special challenges (non-aqueous phase liquids).
- Module 8, Remediation Technologies, provided information on a range of remediation technologies that can support cleanup.
- Module 9, Managing Remediation Waste, reviewed common issues and practical solutions related to the management of soil and groundwater materials at RCRA CA sites.
- Module 10, CA Optimization Tools and Challenge Exercise, provided a discussion-based review of ideas that can support rapid CA progress.

References

- None.



Day 3 – Completing the Process

- ❖ Module 11 – Maintaining Effective Remedy Performance
- ❖ Module 12 – CA Complete
- ❖ Module 13 – Challenge Exercise
- ❖ Module 14 – Wrap Up

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Module 14 – Course Wrap-Up

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Notes:

Purpose of Slide

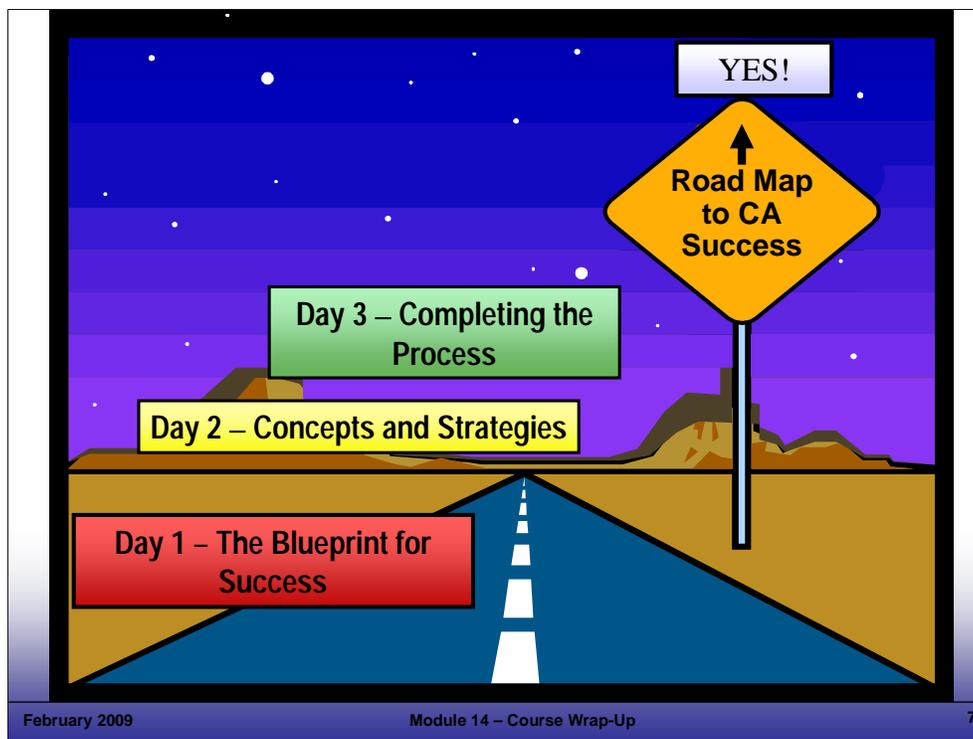
- Review content of Day 3.

Key Points

- Module 11, Maintaining Effective Remedy Performance, reviewed what happens after a remedy is implemented; after implementation, monitoring, optimization and operation and maintenance become important.
- Module 12, CA Complete, reviewed the CA completion determinations.
- Module 13, Challenges Exercise, allowed time for participants to work in groups to review a case study where groups of participants were able to work through an example facility undergoing RCRA CA. This will allow participants to share their knowledge and brainstorm regarding how some of the tools and principles can be applied at sites in the future.

References

- None.



Notes:

Purpose of Slide

- Revisit the road-map approach to the course.

Key Points

- As stated previously, we thought carefully about how to cover the wide range of materials required for this training program in a manner that is logical and manageable.
- In thinking through the material, EPA and the development team identified that the RCRA CA process can be thought of as a process with logical decision points, sign posts, and directions. This helped us develop a road map for the course.
- Within this framework, each day had a theme and covered certain topics related to that theme. As we progressed, we built on the lessons from one day as we moved into the next.
- The road we are on is to an end point of RCRA CA Success. As you can see on this slide, we are moving to a YES for key decision milestones associated with the 2008 and 2020 RCRA Goals and Vision.
- This course is designed to assist those working on RCRA CA to build on the strong foundation of knowledge and experience that has been developed to achieve further, rapid progress.
- The course materials have focused on opportunities for streamlining and maximizing the flexibility allowed within the RCRA CA program to achieve rapid CA progress, support land revitalization, and ensure remedies that are protective of human health and the environment.
- We have included a range of examples that show how these approaches can be applied. As we move forward with this course, additional examples are being sought.

References

- None.



Course Mission Statement

- ❖ *To develop and enhance the skills of qualified personnel who will implement corrective actions for their sites by the year 2020 that are protective of human health and the environment while encouraging revitalization.*

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Module 14 – Course Wrap-Up

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Notes:

Purpose of Slide

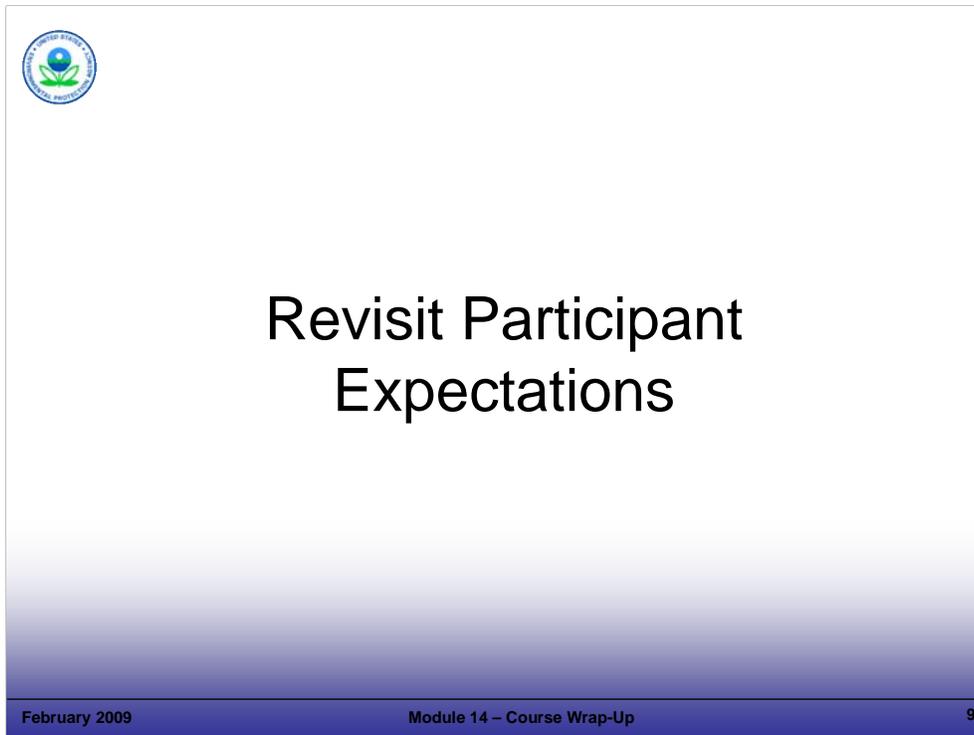
- Review the course mission.

Key Points

- Review materials covered in light of the course mission.

References

- None.

**Notes:**Purpose of Slide

- Review the participant expectations and compare what was covered to expectations.

Key Points

- Review the participant expectations list from Day 1 of the course and discuss which were met and which were not addressed, if any.
- Remind students that their input is important to course improvements.

References

- None.



Summary

- ❖ EPA goals and vision for the CA program are ambitious.
- ❖ Practical and demonstrated approaches can support rapid progress towards EPA Goals and 2020 Vision – Get to Yes!
- ❖ Resources are available to support your efforts.
- ❖ Your input to this course will improve it over time.

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Module 14 – Course Wrap-Up

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Notes:

Purpose of Slide

- Summarize the module and course.

Key Points

- Summarize the module and course.
- Participants should complete evaluation forms; this input will be used to improve the course over time.
- Thanks for your time and good luck with your future RCRA CA efforts!

References

- None.

RCRA Corrective Action (CA) Training: Getting to YES! Strategies for Meeting the 2020 Vision
Chicago, IL – February 10-12, 2009

Evaluation Form							
Your RCRA CA Experience		Low	Medium	High			
Your Affiliation		EPA	State	Consulting/Industry			
Day 1 – The Blueprint for Success		Day 2 – Achieving Success		Day 3 – Completing the Process			
1. Introduction and Overview 2. How to Achieve the 2020 Vision 3. CA Authorities and Guidance 4. Starting with the End in Mind: Building an Exit Strategy 5. Achieving Success: Practical Solutions to CA Challenges 6. CA and Facilitating Land Revitalization		7. Selecting and Approving a Protective Remedy 8. Remediation Technologies 9. Managing Remediation Waste 10. CA Optimization and Challenges Exercise 11. Maintaining Effective Remedy Performance		12. CA Complete 13. Challenge Exercise 14. Wrap Up			
Please rate the following from Strongly Disagree (1) to Neutral (3) to Strongly Agree (5) by circling the appropriate number.							
The topics presented and discussed are relevant to my job.			1	2	3	4	5
The speakers were knowledgeable and communicated well.			1	2	3	4	5
The length of the course was appropriate for the material addressed.			1	2	3	4	5
The venue was conducive to productive learning.			1	2	3	4	5
The manual and references were appropriate and relevant.			1	2	3	4	5
What topics were of the most use to you?							
What topics should have been discussed (and were not) or should be discussed further?							
What suggestions do you have to improve the course and its value in supporting those working to achieve the 2020 Vision and Goals?							

RCRA Corrective Action (CA) Training: Getting to YES! Strategies for Meeting the 2020 Vision
Chicago, IL – February 10-12, 2009

Evaluation Form

What speaker topics did you find particularly helpful and can you apply back at your office?

Please provide any other specific comments or input on the modules, specific slides, contents, and speakers.

List four challenges you feel should be addressed in this course (to support you in getting sites through the cleanup progress (focusing on RCRA CA or other programs you work under).

Thank you for your input – we value your suggestions and will use them to improve the course!