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Welcome – Thanks for joining us.
ITRC's Internet-based Training Program

Performance-Based Environmental Management

Improving Environmental Site Remediation Through Performance-Based Environmental Management (RPO-7, 2007)

This training is co-sponsored by the US EPA Technology Innovation and Field Services Division (TIFSD)

Performance-based environmental management (PBEM) is a strategic, goal-oriented methodology that is implemented through effective planning and decision logic to reach a desired end state of site cleanup. The goal of PBEM is to be protective of human health and the environment while efficiently implementing appropriate streamlined cleanup processes. The major components of PBEM include: systematic planning; effective communications; agreement of a land use risk strategy; current conceptual site model; decision logic analysis; remediation process optimization (RPO); ARAR analysis; exit strategy development; and performance-based contracting including environmental insurance.

This ITRC training presents an overview of what PBEM is, explains how and when to implement it, and describes the issues that regulators are concerned about throughout PBEM's implementation. Case studies will be presented to illustrate successful PBEM projects. The course is valuable not only because PBEM is being proposed and implemented at many federal and private sites throughout the country, but also because PBEM provides an opportunity to enhance all site remediation.

This training is geared to those in the environmental remediation field including federal, state, and local government officials; owners or operators of sites; and consultants. The course will be most beneficial if the participant has taken one of ITRC's remediation process optimization courses. Online archives are available for *What is Remediation Process Optimization and How Can It Help Me Identify Opportunities for Enhanced and More Efficient Site Remediation?* (available from http://www.clu-in.org/conf/itrc/rpo_092804/) and for *Remediation Process Optimization - Advanced Training* (available from http://www.clu-in.org/conf/itrc/rpofs_081607/). These courses are recommended as pre-requisites, but are not required. The training materials are based on the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management (RPO-7, November 2007)*.

ITRC (Interstate Technology and Regulatory Council) www.itrcweb.org

Training Co-Sponsored by: US EPA Technology Innovation and Field Services Division (TIFSD) (www.clu-in.org)

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ITRC (www.itrcweb.org) – Shaping the Future of Regulatory Acceptance

- Host organization
- Network
  - State regulators
    - All 50 states and DC
  - Federal partners

    DOE DOD EPA
  - ITRC Industry Affiliates Program
  - Academia
  - Community stakeholders
- Wide variety of topics
  - Technologies
  - Approaches
  - Contaminants
  - Sites
- Products
  - Technical and regulatory guidance documents
  - Internet-based and classroom training

The Interstate Technology and Regulatory Council (ITRC) is a state-led coalition of regulators, industry experts, citizen stakeholders, academia and federal partners that work to achieve regulatory acceptance of environmental technologies and innovative approaches. ITRC consists of all 50 states (and the District of Columbia) that work to break down barriers and reduce compliance costs, making it easier to use new technologies and helping states maximize resources. ITRC brings together a diverse mix of environmental experts and stakeholders from both the public and private sectors to broaden and deepen technical knowledge and advance the regulatory acceptance of environmental technologies. Together, we're building the environmental community's ability to expedite quality decision making while protecting human health and the environment. With our network of organizations and individuals throughout the environmental community, ITRC is a unique catalyst for dialogue between regulators and the regulated community.

For a state to be a member of ITRC their environmental agency must designate a State Point of Contact. To find out who your State POC is check out the "contacts" section at www.itrcweb.org. Also, click on "membership" to learn how you can become a member of an ITRC Technical Team.

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ITRC Course Topics Planned for 2010 – More information at www.itrcweb.org

Popular courses from 2009

- Decontamination and Decommissioning of Radiologically-Contaminated Facilities
- Enhanced Attenuation of Chlorinated Organics
- In Situ Bioremediation of Chlorinated Ethene - DNAPL Source Zones
- LNAPL Part 1: An Improved Understanding of LNAPL Behavior in the Subsurface
- LNAPL Part 2: LNAPL Characterization and Recoverability
- Perchlorate Remediation Technologies
- Performance-based Environmental Management
- Phytotechnologies
- Protocol for Use of Five Passive Samplers
- Quality Consideration for Munitions Response
- Survey of Munitions Response Technologies
- Determination/Application of Risk-Based Values
- Use of Risk Assessment in Management of Contaminated Sites

New in 2010

- Decision Framework for Applying Attenuation Processes to Metals and Radionuclides
- LNAPL Part 3: Evaluating LNAPL Remedial Technologies for Achieving Project Goals
- Mining Waste
- Remediation Risk Management: An Approach to Effective Remedial Decisions and More Protective Cleanups

ITRC 2-day Classroom Training: Vapor Intrusion Pathway

More details and schedules are available from www.itrcweb.org under “Internet-based Training” and “Classroom Training.”

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Performance-Based Environmental Management (PBEM)

Logistical Reminders

- Phone line audience
  - ✓ Keep phone on mute
  - ✓ *6 to mute, *7 to un-mute to ask question during designated periods
  - ✓ Do NOT put call on hold
- Simulcast audience
  - ✓ Use  at the top of each slide to submit questions
- Course time = 2¼ hours

Presentation Overview

- Introduction
- PBEM components
- Questions & answers
- PBEM implementation
- Case studies
- Links to additional resources
- Your feedback
- Questions & answers

No associated notes.

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Meet the ITRC Instructors

Tom O'Neill
NJ Dept of Env. Protection
Trenton, New Jersey
609-292-2150
tom.o'neill@dep.state.nj.us

Pamela J. Baxter
US EPA Region 2
New York, New York
212-637-4416
baxter.pamela@epa.gov

Mike Rafferty
S.S. Papadopulos & Associates
San Francisco, California
415-896-9000 x202
mrafferty@sspa.com

Sriram Madabhushi
ITRC Program Advisor
San Antonio, Texas
803-446-0607
madabhushi_sriram@bah.com

Tom O'Neill is a Section Chief with the New Jersey Department of Environmental Protection's (NJDEP's) Site Remediation and Waste Management Program in Trenton, New Jersey. Tom joined the NJDEP in 1983 as an On Scene Coordinator overseeing a wide variety of publicly funded (State funds and Superfund) removal actions and planned site remediations including: drum and soil removals, laboratory clean-ups, landfill gas remediation, ground water investigations, and pump and treat systems. In 1994, Tom was responsible for the formation of the Operations and Maintenance Section that is currently responsible for the NJDEP's publicly funded long term remediation and monitoring sites, his Section is also responsible for the Deed Notice Inspection Program. His prior work includes design engineering with The Lummus Company, designing pollution control (air, water, and noise) systems for chemical and petrochemical facilities. Since 2002, Tom has been the co-leader of the ITRC Remediation Process Optimization (RPO) team and he is an instructor on the team's advanced RPO training course and Performance-Based Environmental Management course. He earned a bachelor's degree in environmental science from Rutgers University's Cook College in New Brunswick, New Jersey in 1981 and a master's degree in environmental science from the New Jersey Institute of Technology's- Newark College of Engineering in Newark, New Jersey in 1984.

Pamela J. Baxter, CHMM, has been with the U.S. Environmental Protection Agency, Region 2, since March 1990. She works in the Emergency and Remedial Response Division (Superfund), New Jersey Remediation Branch, as a Remedial Project Manager. She manages various hazardous waste sites in the state of New Jersey. Her duties include various activities related to implementing and managing EPA's selected remedy for her sites. She joined ITRC in 2005 and is a team member of the Remedial Process Optimization team. Pamela earned a bachelor's degree in mechanical engineering from the City College of the City University of New York in 1988, a master's degree in environmental and occupational health sciences from Hunter College of the City University of New York in 1991, a master's degree in environmental engineering from New Jersey Institute of Technology in Newark, New Jersey in 1996, a master's degree in construction management from Steven's Institute of Technology in Hoboken, New Jersey in 2002, and she is currently working on her doctorate degree in civil engineering at Steven's Institute of Technology. Pam is a Certified Hazardous Materials Manager.

Michael Rafferty, P.E., is a Principal Engineer with S.S. Papadopulos &Associates, Inc. (SSP&A), in San Francisco, California. Mike has worked for as a consultant since 1987, and has extensive experience in the design, construction, and operation of groundwater treatment, soil treatment, and oil and chemical process facilities. Mike worked for Aerojet, Bechtel and Geomatrix consultants prior to joining SSP&A. He has been responsible for the design of process systems (including equipment, piping and instrumentation); construction, startup, and operation of treatment plants; project material control; and various construction-related activities. He has managed site characterization and remediation programs in compliance with federal, state, and local regulatory guidelines for a wide variety of sites where the soil or groundwater were affected by metals, chlorinated organic compounds, petroleum hydrocarbons as well as non-aqueous phase liquids (NAPLs). Mike has been directly responsible for all phases of these projects, including soil and groundwater investigations; conceptual remedial design studies; development of design drawings and specifications; bid document preparation and evaluation; construction management; and field supervision and inspection. He has been an expert witness and has provided technical input for mediation, arbitration and litigation of environmental and construction claim cases. Mike joined the ITRC RPO team in 2005, and in 2006 was awarded an Industry Recognition award for his contribution to the team. He earned a bachelor's degree in chemical engineering from Cornell University in Ithaca, New York in 1979 and a master's degree in civil engineering from the University of California, Berkeley in 1987. Mike is a licensed professional engineer in California and seven other states.

Sriram Madabhushi became a consultant and the Program Advisor to the ITRC Remediation Risk Management team in June 2008. Previously, he was a hydrogeologist with the Underground Storage Tank (UST) Program in the Bureau of Land and Waste Management (BLWM), South Carolina Department of Health and Environmental Control (SCDHEC) in Columbia, South Carolina. He was a Project Manager directing technical and financial aspects of site remediation activities at contaminated UST sites. Sriram worked for three years in the Federal Facilities Agreement - Superfund Section reviewing the site rehabilitation activities at the Savannah River site and three years in the RCRA section providing technical review of project documents related to Shaw and Charleston Air Force Bases. Sriram worked the first eight years of his career with the SCDHEC in the UST Program. Between April 2004 – May 2008, Sriram has been the co-leader of the ITRC Remediation Process Optimization (RPO) team and he is an instructor on the team's advanced RPO training course and Performance-based Environmental Management course. He earned a bachelor's degree in physics from Andhra University, Waltair, India in 1981 and a master's degree in exploration geophysics from Indian Institute of Technology, Kharagpur in 1984. Currently he is working on his Ph.D. in geology at the University of South Carolina.

7

What We Will Talk About…

- Basic concepts of performance-based environmental management (PBEM)
  - What is PBEM?
  - How and when to use it?
  - Benefits of using PBEM
  - Case studies
- Regulators' concerns described in Association of State and Territorial Solid Waste Management Officials (ASTSWMO) white paper

Several issues were raised by ASTSWMO in a white paper and we tried to address those issues in the techreg document.

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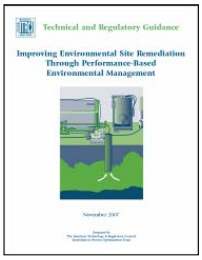
What We Will Talk About…

- Why should you care?
  - PBEM is being proposed and implemented at many sites
  - Considered a best management practice
- When to use and when not to use performance-based contracting (PBC)?
  - Limitations of PBCs
  - Caution: PBCs are not a panacea for all sites
- Tech Reg document on: Improving Environmental Site Remediation Through Performance-Based Environmental Management (RPO-7, 2007)



ITRC Technical and Regulatory Guidance Document: "*Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation.*" (RPO-1, September 2004) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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Performance-Based Environmental Management (PBEM)

Presentation Overview

- Introduction
- PBEM Components
- PBEM Implementation and Case Studies
- Q&A

In the next few slides we will be looking at these topics

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Performance-Based Environmental Management (PBEM)

Presentation Overview

Introduction

- Definition
- Goals and Benefits
- Regulatory Concerns
- Related Concepts
  - Systematic Planning
  - Effective Communication
  - Social Capital

PBEM Components

PBEM Implementation and Case Studies

Q&A

No associated notes.

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Definition

- What is performance-based environmental management (PBEM)
  - PBEM is a strategic, goal-oriented uncertainty management methodology that is implemented through effective planning and timely decision-logic that focuses on the desired end results
  - Promotes accelerated attainment of cleanup objective in an efficient process

No associated notes.

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From RPO Perspective

- Relationship of PBEM to
  - Remediation Process Optimization (RPO)
  - Performance-based contracting (PBC)
- RPO-1 document "*Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation"* and the associated Internet-based training available in the www.clu-in.org archive

Basic introduction to PBEM.

How PBEM is related to RPO and particular emphasis on PBC. Clarifying that PBEM is not PBC and PBC is a part of overall PBEM process.

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Benefits

- Everyone following the same ‘already agreed upon’ plan of action
- Promote cleanup efficiencies
- Expedite decision-making and minimizes risks
- Increase cleanup rates
- Reach site goals

We are introducing the concept of PBEM in this document, how it relates with RPO process, what it all constitutes and what we get out of doing a PBEM.

Make our goal of cleanup complete approach in a systematic and clear way.

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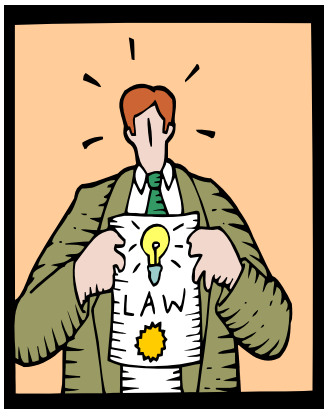
Regulatory Concerns with PBEM & PBC

- Unknown process with limited assurances
- Government staff shortages to provide rapid responses
- Loss of government oversight
- Lack of consensus on exit strategy
- Ineffective communications
- Need for PBEM Memorandum of Agreement (MOA) with regulators



There are regulatory issues to be kept in mind when implementing a PBEM. Success of PBEM depends on understanding these issues and making sure the regulator's are properly included in the process. These issues should be considered before and during planning and during PBEM implementation.

By clearly identifying these issues and putting options in place to open a dialogue as needed will result in successful PBEM implementation.

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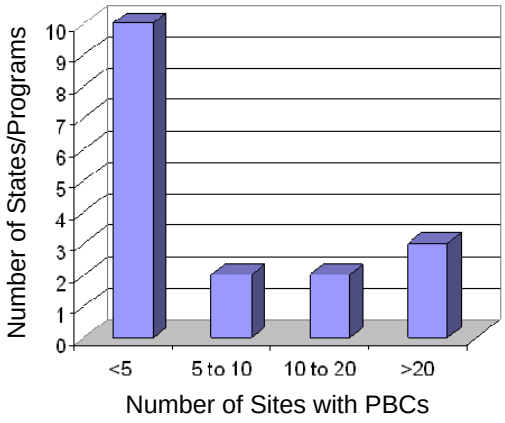
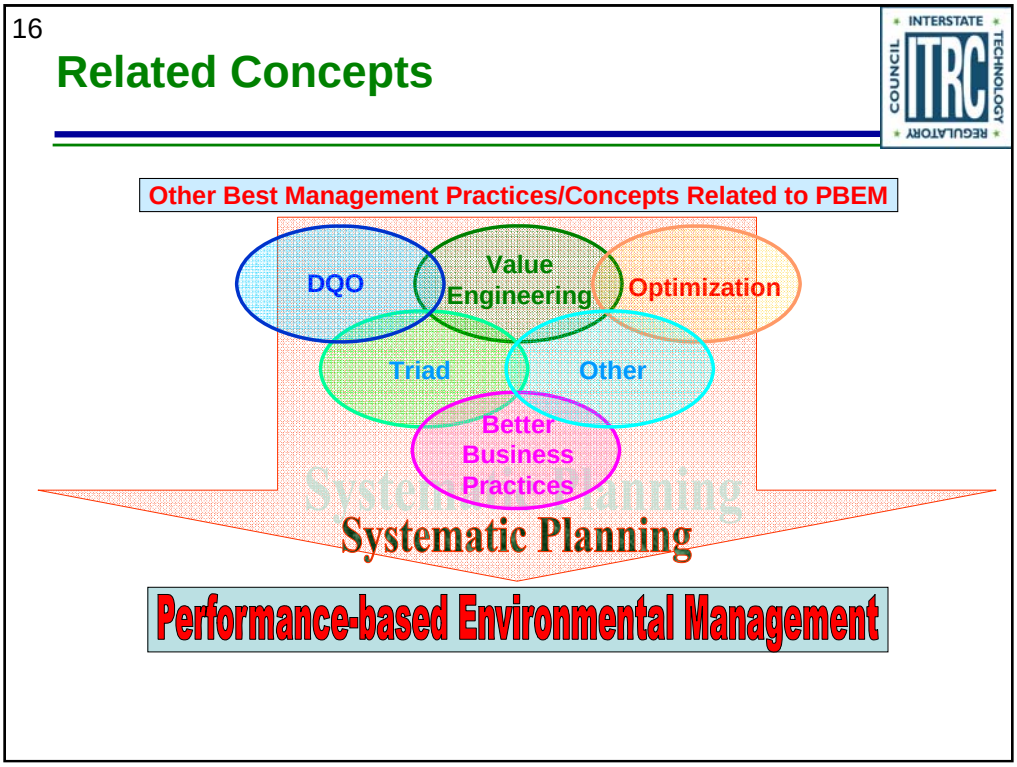
ITRC State Survey Results

- 21 states responded
  - Most states had limited knowledge with PBEM/PBCs
  - A variety of regulatory programs are involved
  - 72% of respondents stated most important PBEM concept is problem definition
- As shown on graph, as many as 17 states have participated in PBEM/PBCs, where as only three states have experience of >20 sites using PBEM/PBCs



Conducted a state survey of regulators in gauging their input on PBEM/PBCs in their states.

As you can see, most states are just getting started on with this process. Three or four states with lot more experience.



DQO = data quality objectives

ITRC Sampling, Characterization, and Monitoring team documents are available at www.itrcweb.org under “Guidance Documents” then “Sampling, Characterization, and Monitoring.” Documents include:

Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management (SCM-1, 2003)

Triad Implementation Guide (SCM-3, May 2007)

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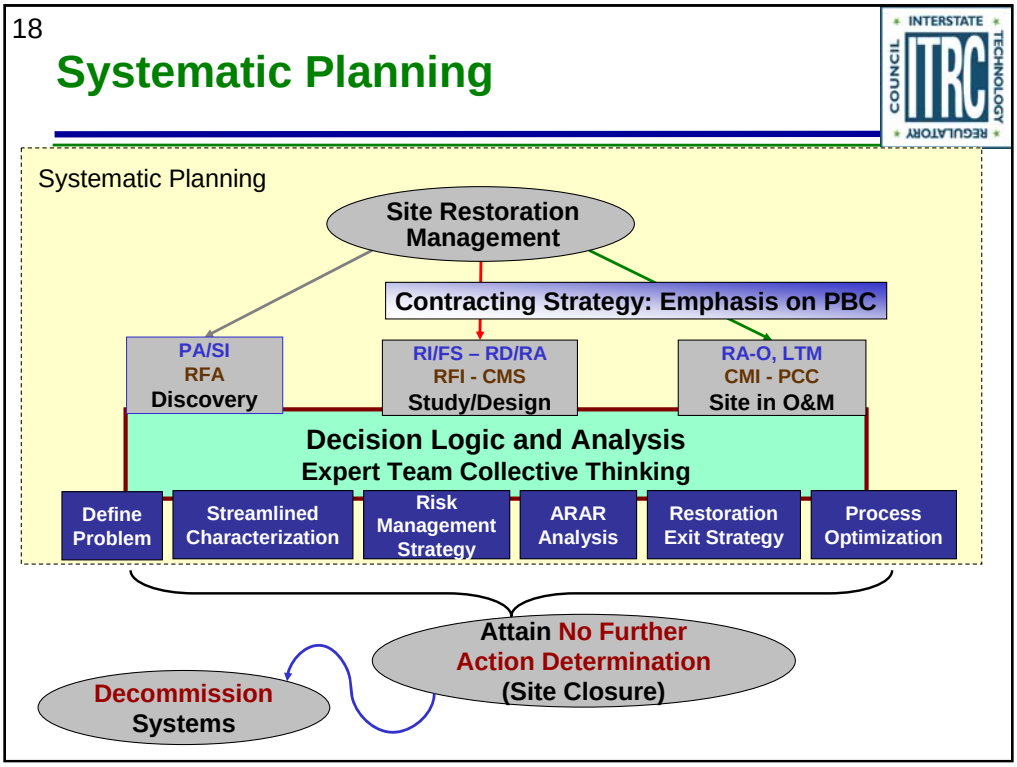
Concept Development Process

- ITRC RPO Team Perspective
  - Can we look at sites from a more comprehensive approach?
- Outgrowth of the RPO training
  - Project approved for 2005 effort
  - Fact Sheet series in 2006
- Team experience and expertise
  - AFCEE – State interaction
  - Army Corps of Engineers
  - Triad Community of Practice
  - Department of Energy

AFCEE = Air Force Center for Engineering and the Environment



PBEM is an interactive multilevel component process that is applicable to CERCLA and RCRA regulated sites. It is not necessarily linear. PBEM is founded on continuous feedback that is used to update the understanding of the process for the purpose of making the best decisions possible. Following the arrows, we can see that a site under LTM that is optimized would have a direct connection to updating the Exit Strategy, CSM, and potentially the risk and ARARs. The decision analysis and logic link optimization with the other activities. It is obvious that a modified CSM could change the risk management, and require ARAR re-analysis.

ARAR – Applicable or Relevant and Appropriate Requirements
CSM – Conceptual Site Model
LTM – Long-term Monitoring
LUC/IC – Land Use Controls/Institutional Controls
O&M – Operations & Maintenance
PBC – Performance-based Contracting
PA/SI – Preliminary Assessment/Site Investigation
RA O – Remedial Action Operation
RCRA – Resource Conservation and Recovery Act
RD/RA – Remedial Design/Remedial Action
RFA – RCRA Facility Assessment
RFI – RCRA Facility Investigation
RI/FS – Remedial Investigation/Feasibility Study
RPO – Remediation Process Optimization

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Expert Team

- Essential team qualities
  - Interdisciplinary team
  - Support from senior management, regulators, and potential stakeholders
  - Trust
  - Common interest and goals
  - Communication flows freely

Having a good expert team is critical to PBEM.

Get regulators involved early and keep the communication flowing.

Buy in by the upper management is critical.

This team should be of regulators, regulated community and consultants.

Purpose of function of the team is develop an exit strategy.

In order to do this, the team should be a pool of interested experts in appropriate fields. They should compliment one another.

Free flow of communication and well defined roles – who make what decision, etc.

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Effective Communications

- Ensure timeliness and accuracy
- Promote trust between management, team, and stakeholders
- Use best available communications technologies
- Interact with community
- Explain risk





No associated notes

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Social Capital

- Social Capital
  - Ensure all parties understand each others concerns
  - Win-win solutions
- Stakeholder
  - Include all stakeholders at appropriate decision points
  - Utilize communication tools

No associated notes.

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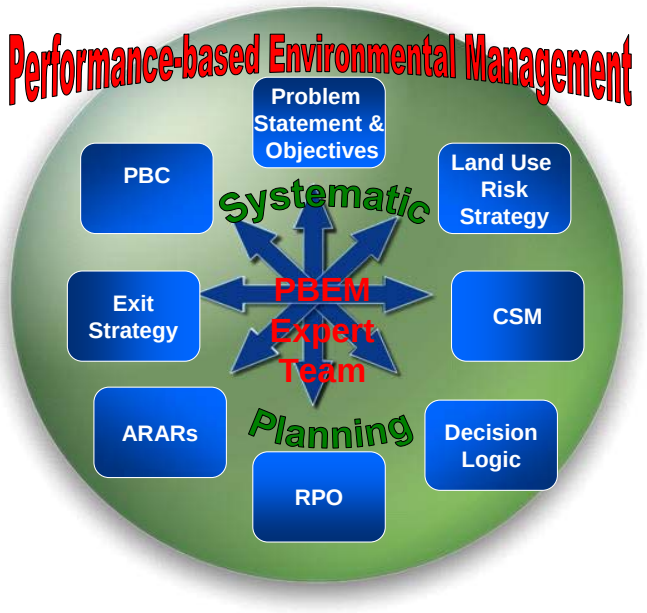
Components of PBEM



Components – although all are important, some are considered more important the others.

Some of these are repeated from what Tom has already presented, so those will not get much time as we need to spend more time on the ones that are considered more critical.

ARAR – Applicable or Relevant and Appropriate Requirements

CSM – Conceptual Site Model

PBC – Performance-based Contracting

RPO – Remediation Process Optimization

Expert Team and Systematic Planning

Arrows represent communication. Between the team members, in between components,

Problem Statement and Objectives

Land-use risk strategy

Conceptual Site model (CSM)

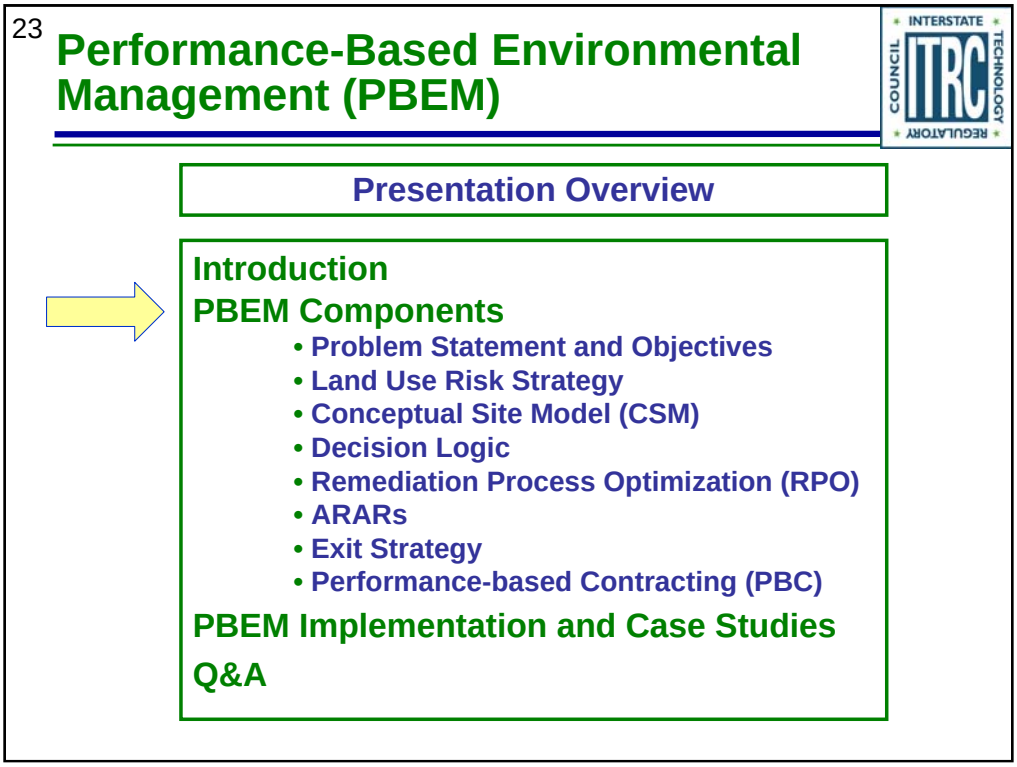
Decision logic

RPO

Applicable or relevant and appropriate requirements (ARAR) analysis

Exit Strategy

PBC



No associated notes.

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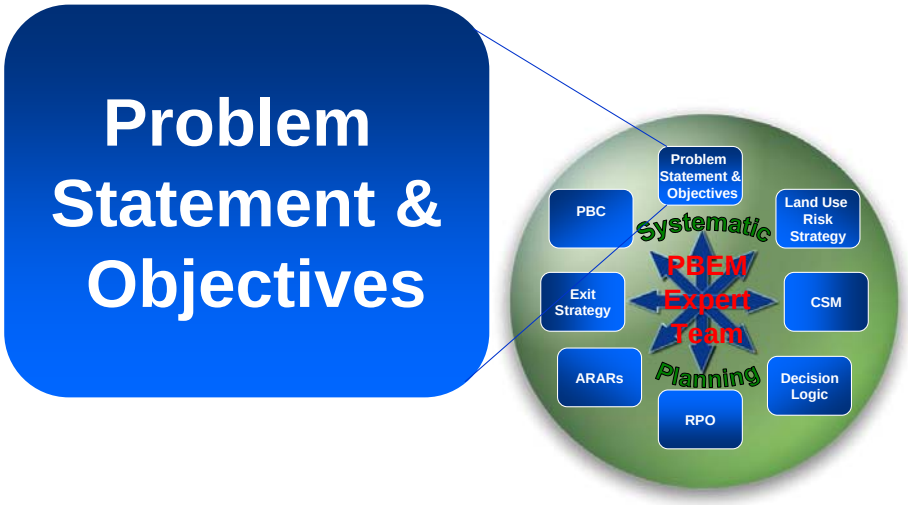
PBEM – Problem Statement and Objectives



Additional information is available in section 3.1 of the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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PBEM – Problem Statement and Objectives (continued)

- Develop performance objectives
- Define conditions at the site
- Explain reasons for remediation
- Understand regulatory and political issues
- Establish a site timeline
- Identify uncertainties
- Develop a detailed schedule of the project
- Verify and update goals as needed

No associated notes.

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PBEM – Land Use Risk Strategy

Additional information is available in section 3.2 of the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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Land Use Impact on Site Remediation

- Current and future land uses considered
- Identification of risks
- Remedial action objectives determined

No associated notes.

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Land Use Risk – Information for Future Land Use Determination

- Decide on future land usage
- Determine land use risk strategy
- Purpose of land use risk strategy

No associated notes.

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Land Use – Remedial Action Objectives (RAOs)

- Specific goals to protect human health and the environment
- Usually developed in the remediation investigation (RI) and feasibility (FS) phase of a project
- Foundation upon which remedial action cleanup alternatives are developed
- Developed considering
  - Exposure routes
  - Human, ecological, and environmental receptors
  - Protection of groundwater resources
  - Potential future land use

Remedial action objectives (RAO) are specific goals to protect human health and the environment

They are usually developed in the remediation investigation (RI) and feasibility (FS) phase of a project

They provide the foundation upon which remedial action cleanup alternatives are developed

These objectives are developed considering exposure routes; human, ecological, and environmental receptors; protection of groundwater resources; and potential future land use

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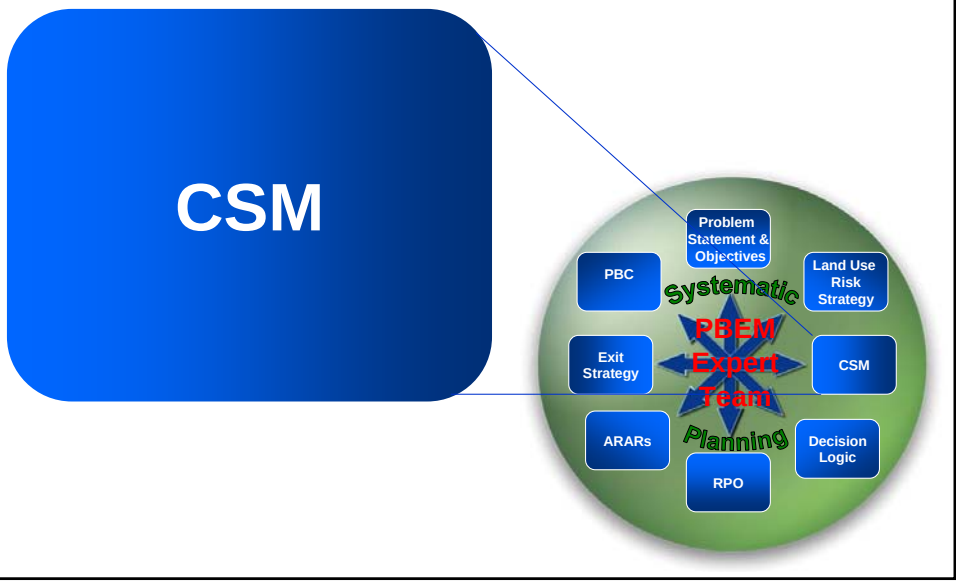
PBEM – Conceptual Site Model (CSM)



CSM – sources of contamination, receptors and pathways connecting sources to receptors. Human and ecological receptors, present and future receptors

Additional information is available in section 3.3 of the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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PBEM – Conceptual Site Model (CSM) (continued)

- Develop conceptual site model (CSM)
  - Focus on data collection from site investigation phases, bench/pilot studies, monitoring events and confirmatory sampling
  - Compile and interpret data for CSM
  - Periodically update the CSM
- Use CSM for site decision making
  - Information from CSM can be used throughout the project life cycle

CSM is fundamental to the entire process.

Need for updating continuously and with data gathered from the field operations.

More information in the Exit Strategy section

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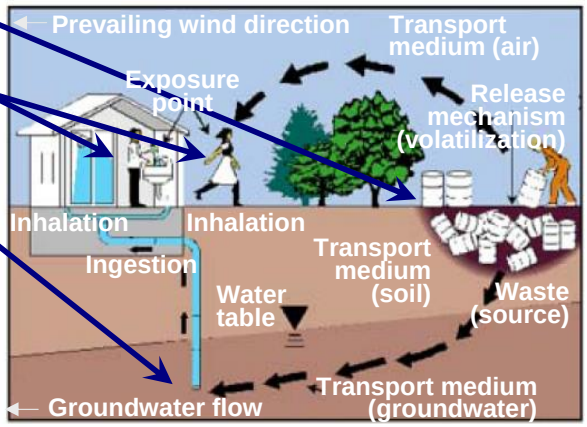
PBEM – Conceptual Site Model (CSM) (continued)

- Site contaminants
- Possible receptors including future land use
- Contaminant
  - Fate
  - Transport
  - Paths to receptors
- Incorporate recently collected data
- Consistent with potential land use



Nature and sources of site contaminants

Nature and location of possible receptors including future land use

Contaminant fate, transport, and paths to receptors

The CSM must incorporate recently collected data and be consistent with potential land use

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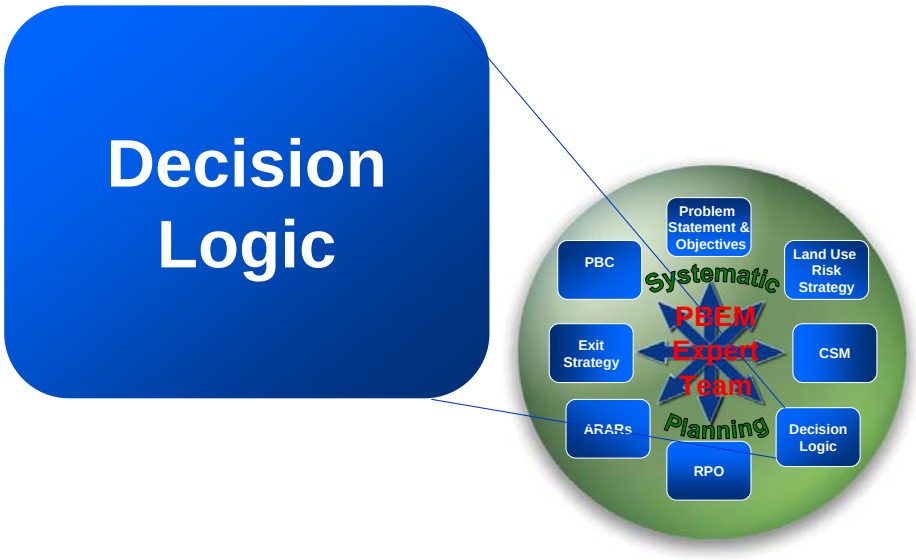
PBEM – Decision Logic



Additional information is available in section 3.4 of the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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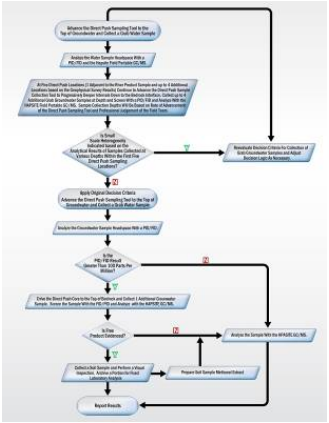
Using Decision Logic in PBEM

- Decision logic levels include
  - Program
  - Project
  - Field
- Decision logic development
- Decision logic documenting
  - Decision trees
  - Flow charts
  - Other tools



Example decision logic for site characterization using direct push sampling techniques. Available in Appendix B of RPO-7 document.

Conditions changed that make it in appropriate for the original assumptions – need to go back and look at them.

Additional information is available in Appendix B of the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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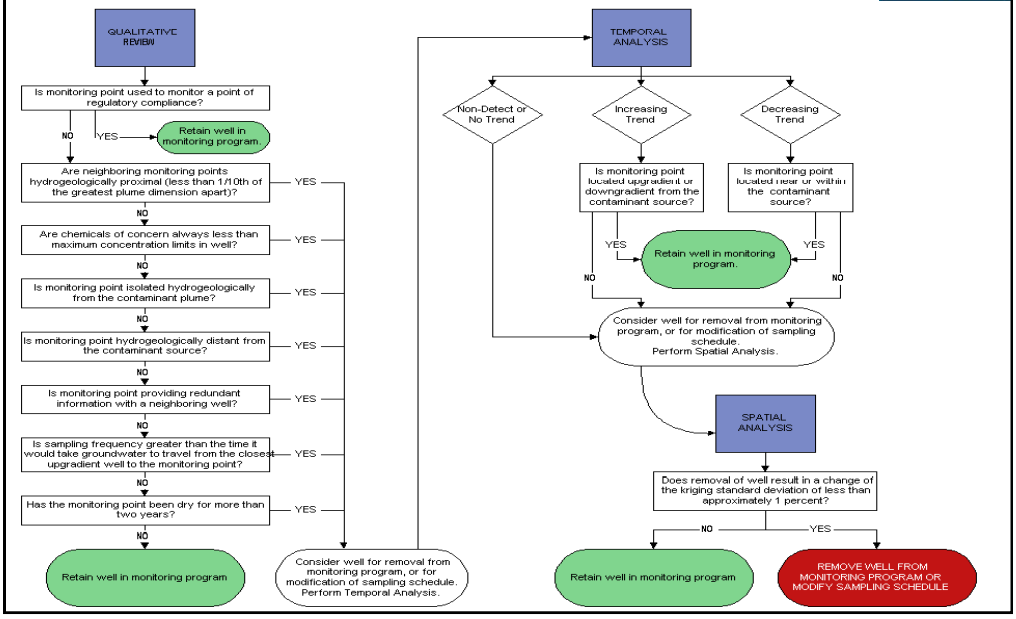
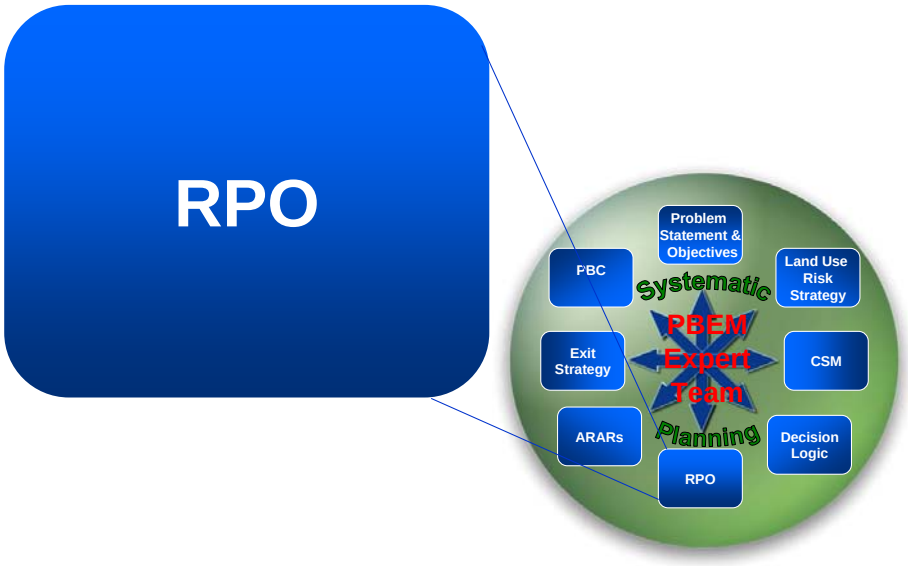
Example Decision Tree Showing the Process of Monitoring Optimization



No associated notes.

36

PBEM – Remediation Process Optimization (RPO)



The next component of PBEM is Remediation Process Optimization

Additional information is available in section 3.5 of the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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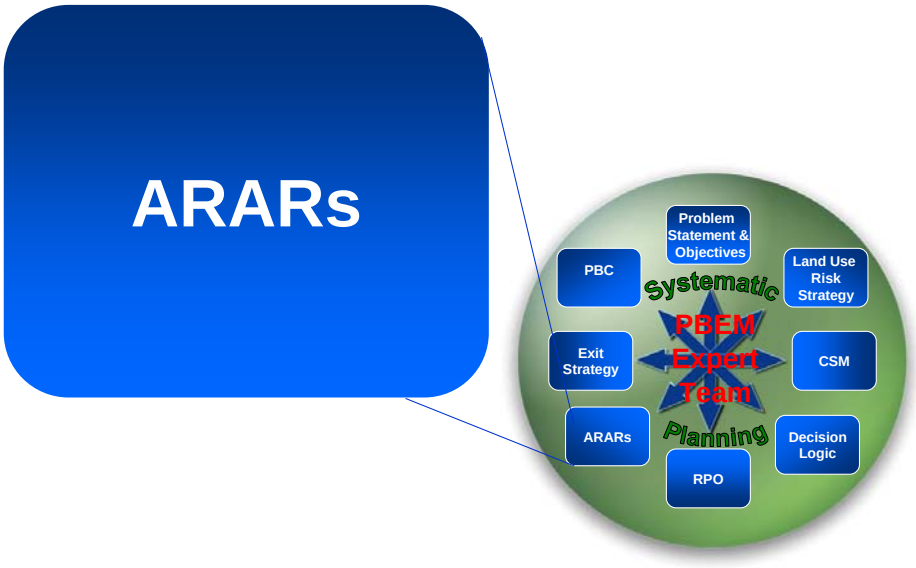
PBEM – Remediation Process Optimization (RPO)

- External look at optimizing current remediation
- Goal to save time and resources
- Enhance protection
- More common in practice
- RPO-1 document "*Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation"* and the associated Internet-based training

The detailed Remedial Process Optimization strategy is provided in the ITRC Technical/Regulatory Guideline titled "Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation" (RPO-1, 2004) available at www.itrcweb.org under "Guidance Documents" and "Remediation Process Optimization."

38 PBEM – Applicable, or Relevant and Appropriate Federal and State Requirements (ARARs)



ARARs are the next component of PBEM.

Additional information is available in section 3.6 of the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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PBEM – ARARs

- Regulatory requirements assessment
  - Applicable, or relevant and appropriate federal and state requirements (ARARs) must be considered initially during remedy selection and periodically revised

New Jersey's N.J.A.C. 7:26E Technical Requirements for Site Remediation ("Tech Rule")

California's Code of Regulations (CCR), Title 22, Division 4.5

South Carolina's Hazardous Waste Regulations, Reg. 61-79 (RCRA)

The regulations listed below the definition are examples of state regulations that may be considered as ARARs.

40

What are ARARs

- Soil screening levels
- Maximum contaminant levels
- Risk-based cleanup levels
- Site-specific target levels

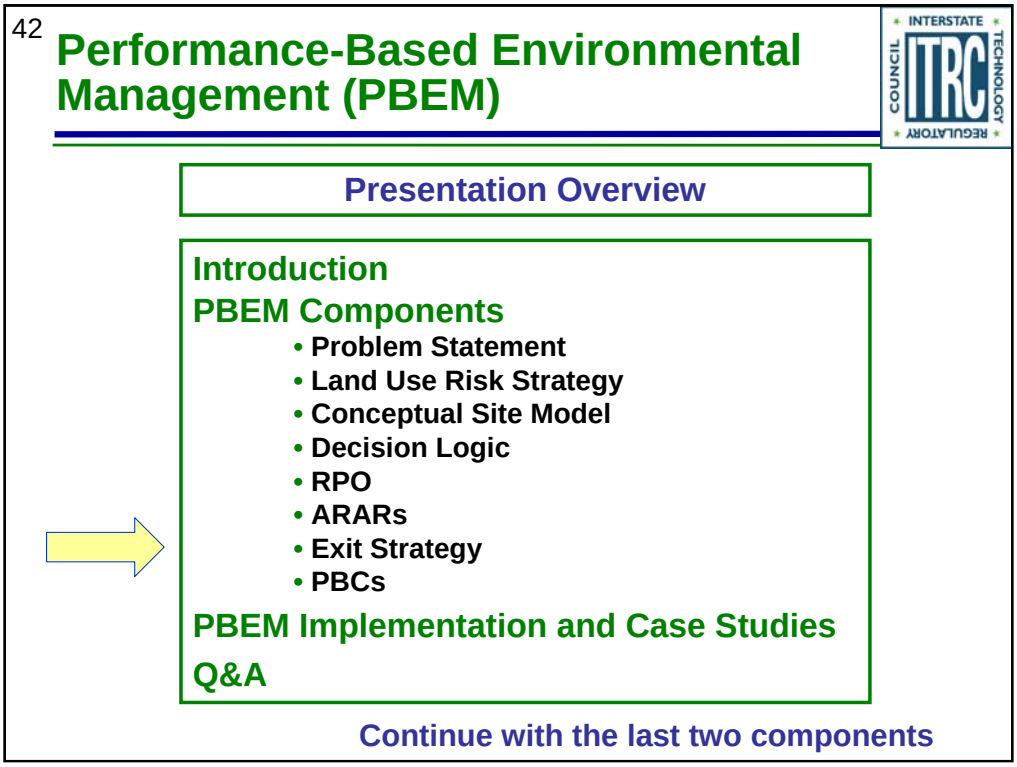
The photos stress that when working on sites we frequently focus on the hardware and technology needs but the consideration of the standards or regulatory environment is just as important.

41

Performance-Based Environmental Management (PBEM)

Questions and Answers

No associated notes.

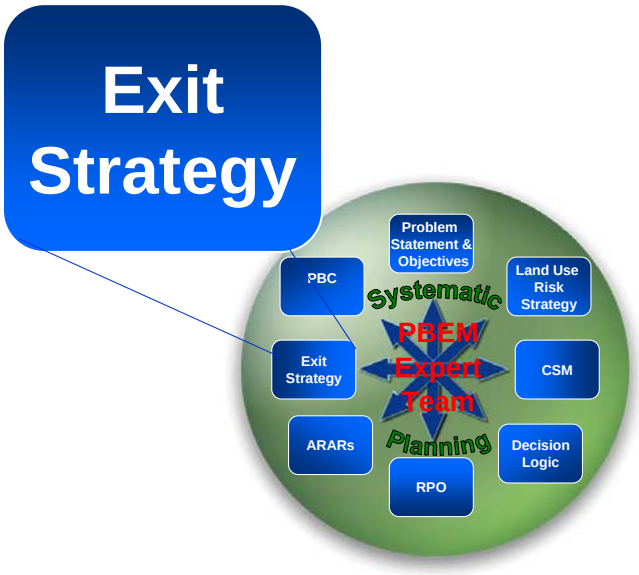


Continuing with the last two components of PBEM

43

PBEM – Exit Strategy

- Definition
- Overview
- Benefits
- Components
- Obstacles
- Example



Additional information is available in section 3.7 of the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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Exit Strategy: Definition

- Detailed plan of why actions will be taken
- Specifies goals, schedules and metrics
- Documents the pathway leading to no further action status
- Identifies milestones and alternative actions

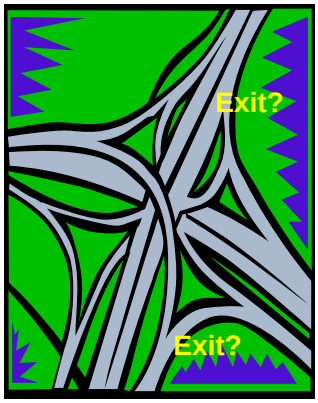
A multi-site facility should develop an exit strategy for each site and a comprehensive exit strategy for the facility

No associated notes.

45

Exit Strategy: Overview

- Focus on performance to continuously optimize remedy and close site
- Documents
  - Logic
  - Metrics
  - Contingency measures
- Preparation of a written exit strategy is an important component of PBEM practices



"… and if you don't know where you're going; any road will take you there"

Clearly document pathway leading to closure/response-complete status

Contingency measures to implement if progress varies from plan

Preparation of a written exit strategy is an important component of PBEM practices

Based on sound scientific and technical understanding

Site conditions

Remediation technologies

Iteratively validated and updated through routine review

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Exit Strategy: Benefits

- Allows understanding of the site and goals by all stakeholders
- Provides basis for effective decisions
- Accelerates risk reduction while maximizing restoration resources
- Promotes dynamic system optimization through performance tracking
- Part of good management planning for facility

Planning and documenting the exit strategy provides an opportunity to obtain buy-in to future actions and contingency measures from all stakeholders. An exit strategy is a necessary part of an installation's Management Action Plan or Base Closure Plan.

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Exit Strategy: Components

- Description of the planned remedial components and actions that are planned
- Remediation and monitoring schedule
- List of metrics to be used to measure progress
- Description of potential contingency measures
- Description of conditions required for site closure
- Written or graphical summary of the decision logic

As conceptual site models (CSMs) and remedial action objectives (RAOs) are refined by the dynamic decision process, the exit strategy should be reviewed

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Exit Strategy: Examples for Site with Groundwater Affected by VOCs

- Protect human receptors
  - Drinking water
  - Indoor air
- Remedial action in place
  - Groundwater extraction with air stripping
- Flexibility
  - Monitoring and extraction wells
  - Potential treatment system changes
- Regulator buy-in to shut down pump and treat
  - When MCLs reached
  - Provisions if MCLs not reached

MCLs = Maximum Contaminant Levels

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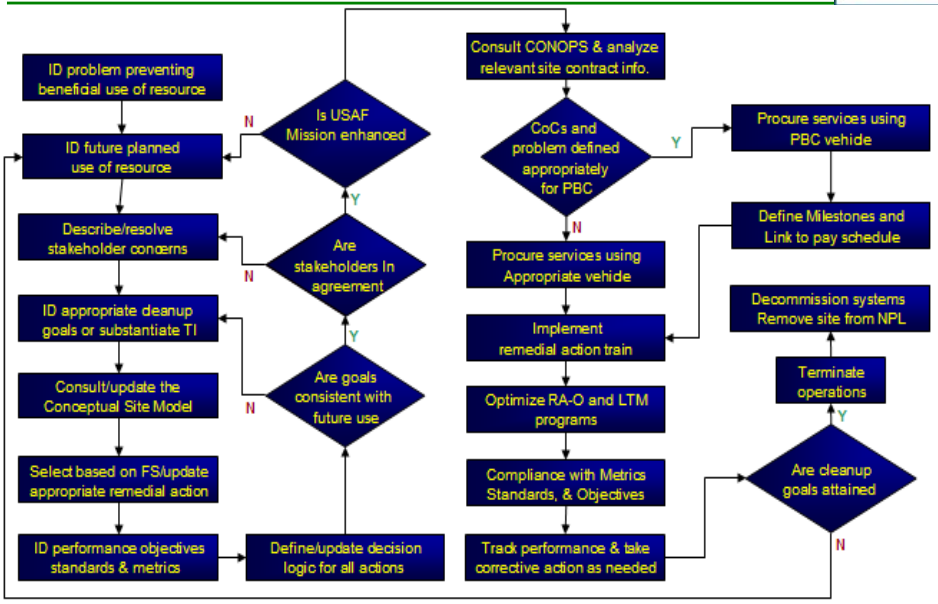
Example Site-specific Exit Strategy



No associated notes.

50

Exit Strategy: Obstacles

- Inadequate conceptual site models (CSMs)
  - May require modification of exit strategy as additional data become available
- Improper remedial action objectives (RAOs)
  - Not necessary to protect human health and the environment
  - Not achievable
  - If the remedy is impracticable or infeasible

Obstacles to executing an exit strategy generally can be traced to deficiencies in the strategy elements.

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Exit Strategy: Obstacles (continued)

- Performance metrics unclear
- Performance monitoring plan inadequate
- Decision logic not well defined

If performance metrics are unclear or the performance monitoring plan is inadequate, effectiveness of the exit strategy cannot be assessed.

If decision logic is not well-defined, stakeholders may be disappointed.

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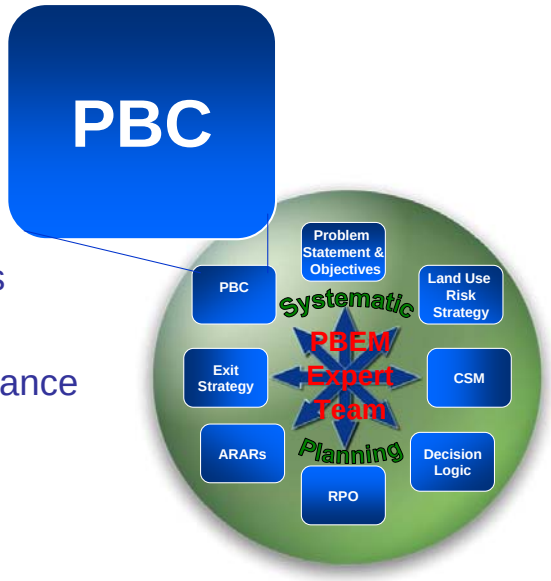
PBEM – Performance-Based Contracting (PBC)

- Overview
- Contracting vehicles
- Development steps
- Environmental insurance
- Pros and cons



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PBC: Overview

- Clearly defined cleanup goals and milestones
- Incentives for performance
- Allowances for flexibility

Caution: PBCs do not fit all cases

- A typical PBC involves
  - Definition of the scope
  - Selection criteria for the PBC contractor
  - Implementation schedule

Caution: PBCs do not fit all cases

A typical PBC involves

Definition of the scope of the work to be done under PBC – must have well defined:

Conceptual site model

Exit strategy

Selection criteria for the PBC contractor

Qualifications (company and individuals)

Capabilities

Financial ability, etc.

PBC implementation schedule

Must anticipate regulator approval and stakeholder acceptance process

54

PBC: Contracting Vehicles

- Fixed-price
  - Includes **lump-sum contracts** and **fixed unit-price contracts**
  - For services that can be reasonably defined in the solicitation
  - Risk of performance is manageable
- Cost-plus
  - Also known as **cost-reimbursement contracts**
  - Used where costs cannot be determined due to uncertainties in the extent or duration of work
  - Different variations include **cost-plus-fixed fee** and **cost-reimbursement incentive** contracts.

Fixed-price

The contractor is fully responsible for performance costs. The contractor is motivated to find improved methods to increase its profits.

Cost-reimbursement

Should include specific incentive provisions to insure that contractors are rewarded for good performance.

55

Fixed-price Contracts

- Lump-sum contract
  - Contractor performs work for a predetermined price, not subject to adjustment for contractor's actual costs
- Unit-price contract
  - Prices of specified units of work are fixed and the cost will vary with actual quantities of units put in place

No associated notes.

56

Fixed-price Contracts (continued)

- Places more cost responsibility on contractor
  - Profit is function of contractor's ability to control costs and perform effectively
- Minimum administrative and risk burden on owner
- May have incentive for contractor to reduce quality of labor or materials to increase profit
- Places owner-contractor in adversarial roles
- Difficult to make adjustments due to unforeseen difficulties
- Permits overall cost to be predetermined

No associated notes.

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Cost-plus Contracts

- Contract allows for payment of incurred direct expenses at actual costs with a fixed or variable amount covering profit and home-office costs
- Cost-plus-fixed fee
  - Fixed fee to cover profit and general and administrative costs with direct costs reimbursable
- Cost-reimbursement guaranteed maximum
  - Reimbursable up to a not-to-exceed maximum price
- Cost-reimbursement incentive fee
  - Some or all of the fee dependent upon achieving certain goals

No associated notes.

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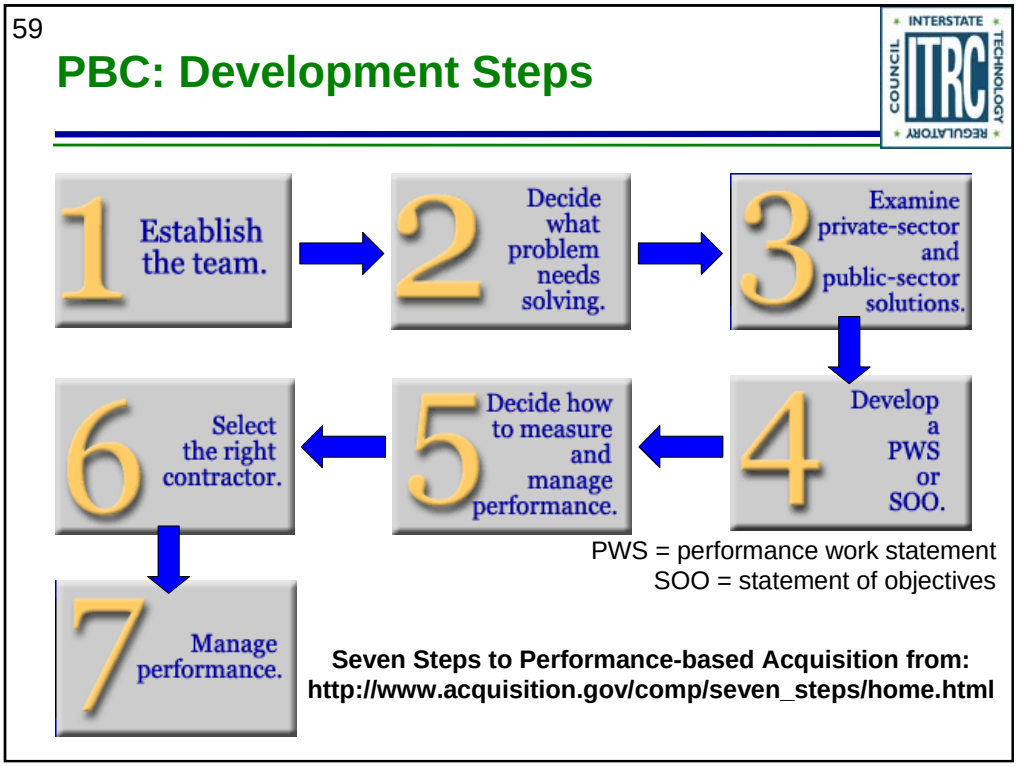
Cost-plus Contracts (continued)

- Requires more oversight by owner to provide assurance that efficient methods and effective cost controls are used
- Contractors profit is fixed but price of contract is not
- Allows contractor to adjust quickly to unforeseen changes
- Minimizes adversarial relationship between owner-contractor
- Costs not known until work almost complete

No associated notes.



Seven Steps to Performance-based Acquisition from:
http://www.acquisition.gov/comp/seven_steps/home.html

60

PBC: Development Steps (continued)

- Establish an integrated project team
- Describe problem
- Establish contractor selection solutions
- Get Regulator input
- Develop performance work statements

- Decide how to measure and manage performance
- Select the right contractor(s)
- Manage performance

No associated notes.

61

PBC: Environmental Insurance

- Dozens of types of environmental insurance available
- Often cost cap insurance used
- Also Pollution Liability and Lender Pollution Liability Insurance
- Expensive

No associated notes.

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PBC: Pros and Cons

From the Regulator's view point:

- Pros
  - Schedule set up front
  - Better managed, faster and cost effective cleanups
- Cons
  - Perceived loss of control by regulators
  - Significant up front time on the part of the regulator
- Key is how well the problem is defined
- Need to learn from successes and failures

PBC's can provide reduced, or pre-established, reporting points with pre-established turn around times agreed to up front. PBCs can result in better managed, faster executed and more cost effective cleanups.

Disadvantages are a potential for a perceived loss of control by regulators.

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Performance-Based Environmental Management (PBEM)

Presentation Overview

- Introduction
- PBEM Components
- PBEM Implementation and Case Studies
- Q&A

Now let us look at some examples and case studies

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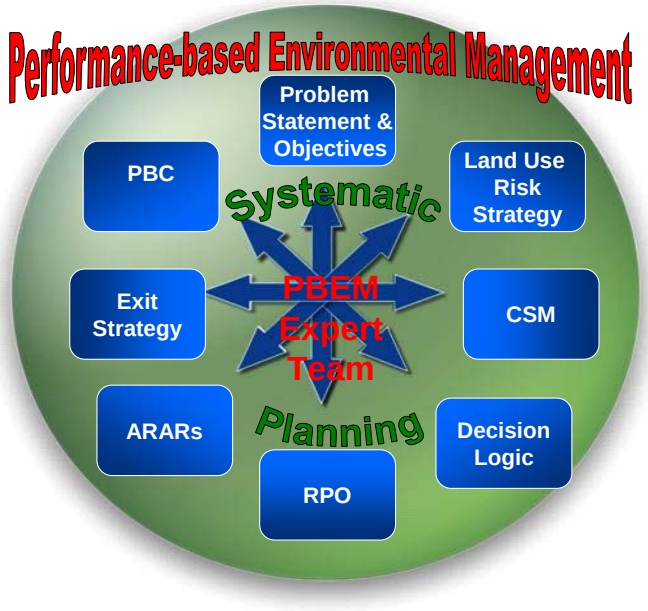
PBEM – When to use it?



PBEM – 8 components

Systematic planning, expert team and communication

Not all components needed at all sites.

PBEM process can be used at all stages and projects can benefit from this better management technique.

65

Federal Agency Implementation

- Department of Defense (DoD) mandated clean up performance goals
- Also implementing PBEM process
  - Department of Energy (DOE)
  - Environmental Protection Agency (EPA)
  - Other federal agencies
- Federal Acquisition Regulations provide implementing guidance
  - http://www.acquisition.gov/comp/seven_steps/home.html

For more information, see section 1.6 “Federal Acquisition Regulations Performance-based Concept” of the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

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PBEM – When to use it?

- Only during the beginning of a new project?
  - No, all phases
- Only at huge – superfund like sites?
  - No, all sites
- Sites where we know that we will be successful?
  - No, but …
- Do we have to do all components?
  - No
- Sites with no controversies and limited public interest?
  - Not always

Let us look at when we can use PBEM.

Different cases and scenarios

Can pretty much use at any stage – may need to 'fit' situation

67

PBEM – Case Studies

- Programmatic
  - Federal programs
  - State programs
- Project-specific
  - Sites within a complex
- Lessons learned
  - Early completion incentives

Still building the database

Overall a success story that resulted in a faster, better, and cheaper cleanup.

Examples from federal, state, industry partners.

Lot more information in the RPO-7 document appendix C.

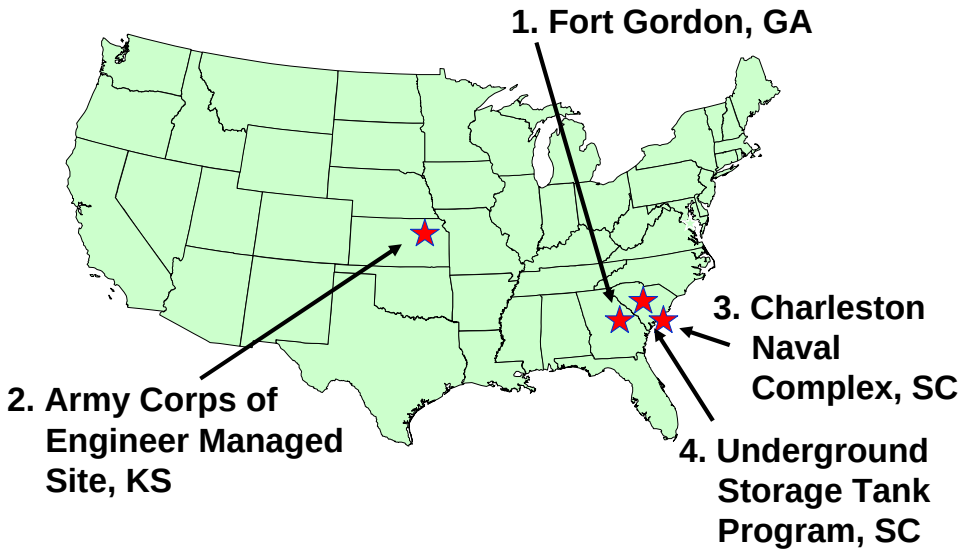
Not many examples – but building the database. Will add to the RPO website as we get more. Send if you have good or not so good examples

Need to look into the process from programmatic as well as project-specific perspectives

Let us also look at some lessons learned

68

PBEM – Case Studies



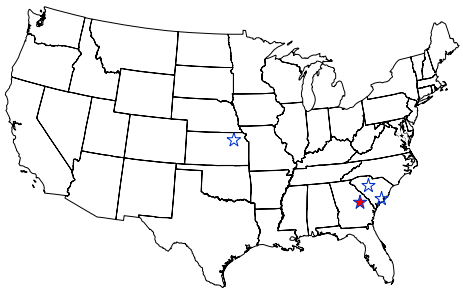
Locations of three sites and the fourth state program

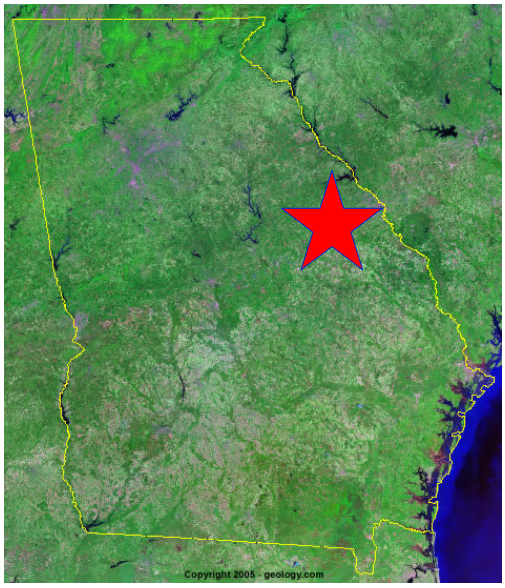
All examples submitted by the ITRC RPO team members/contacts, etc.

Examples that indicate different stages of the process, with emphasis on different components of PBEM Process

69

Fort Gordon, Georgia





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This is a site in the initial stages – mostly Problem Statement, LU Risk, CSM development are the components emphasized

70

PBEM – Case Studies Ft. Gordon

- Guaranteed fixed price with insurance
- Award period: about $20M awarded in 2002
- Site information
  - 26 of 35 active solid waste management units (SWMUs)
  - Most of the units were in site investigation phase
  - Groundwater and soil impacted
- What went right
  - Single contractor to interact with all sites
  - 20 of 26 received no further action by 2006
- What went wrong
  - Contractor's expectations of expedited regulatory response beyond the capabilities of agency

Summary of the site conditions.

71

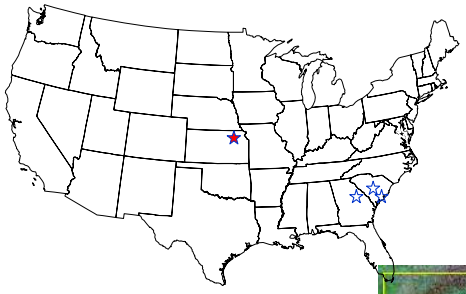
PBEM – Case Studies Ft. Gordon

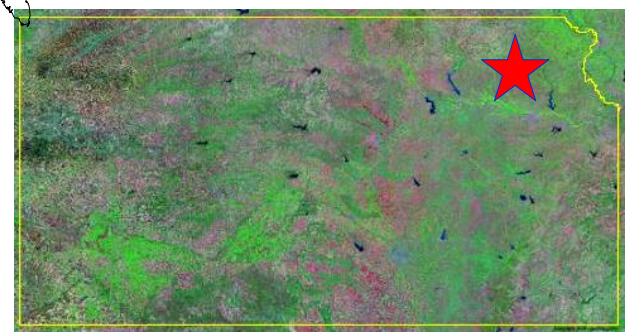
- Advantages of PBC
  - Contractor was motivated to meet performance goals
- Disadvantage of PBC
  - Contractor had a dedicated group for PBC and expected the state to have similar group
  - State regulators were burdened with increased expectations
- Lessons learned
  - Define clearly expectations for DoD, contractor, and state agency well in advance
  - Build the PBC process around the state agency limitations

What did we get out of doing a full-fledged PBC

72

Army Corps of Engineers (ACE) Managed Site, Kansas





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More ‘matured’ example – with emphasis on

73

PBEM – Case Studies KS ACE

- Guaranteed fixed price with insurance
- Award period: 5 years from 2004
- Site information
  - TCE plume
  - Fine-grained glacial till with limited sands
  - Groundwater and soil impacted
- What went right
  - Expedited progress
  - Time-critical removal
- What went wrong
  - Presumptive remedy – a potential for proposed remedy not acceptable for the stakeholders – but it was accepted
  - Pilot testing not conclusive

Photo credit: Kansas Geological Survey

Site details.

PBC details.

74

PBEM – Case Studies KS ACE

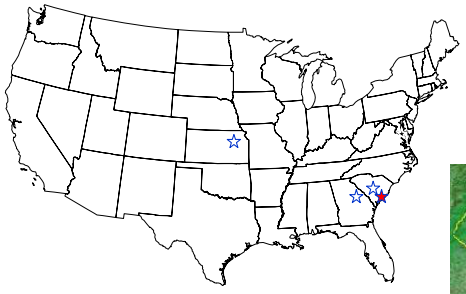
- Advantages of PBC
  - Strong motivation to make progress at the site
- Disadvantage of PBC
  - Potential to circumvent public participation required by CERCLA
  - Contractor pursuing a technology that was not quite unequivocal in producing results
  - Potential for residual risk for responsible parties
- Lessons learned
  - Consider time-frame for complete cleanup – including potential rebound
  - Include pilot testing in the process and for bid
  - Include room for public participation

PBC process certainly speeded up the cleanup.

Took some chances but turned out to be OK at the end.

75

Charleston Naval Complex, South Carolina



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Sites with all components.

Many at initial stages, and some at final stages and remaining in between.

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PBEM – Case Studies SC DoD

- Charleston Naval Complex
  - Closed in 1996 – Base Realignment and closure (BRAC) site
  - 1500 acres prime real estate
  - Fixed-price remediation with insurance contract in April 2000
  - Over 400 soil samples and 1500 wells
  - >170 RCRA and >70 UST sites
  - Variety of chemicals – solvents, metals, PCBs, lead-acid, fuel/petroleum oils and lubricants (POL) sites, landfills, etc.
- Goals
  - Divest property quickly
  - Cap environmental liabilities
  - Fund liabilities within current budgets – BRAC, ER (Environmental Restoration)

Overall a success story that resulted in a faster, better, and cheaper cleanup.

BRAC = Base Realignment and Closure

POL= petroleum oils and lubricants

77

PBEM – Case Studies SC DoD

- Challenges
  - Sites not fully characterized
  - Extensive documents to be reviewed
  - Remedies not selected or approved
  - Long-term liabilities > 20 years
- Keys to expediting process
  - High performance team concept
  - Use of organizational tools to expedite decision-making process
  - Implemented public relations plan
  - Geographical Information System (GIS) and Environmental Visualization Software (EVS) system to manage and visualize massive data
  - Developed decision-making flow charts with stakeholders input

Site conditions – varied

Communication with the state.

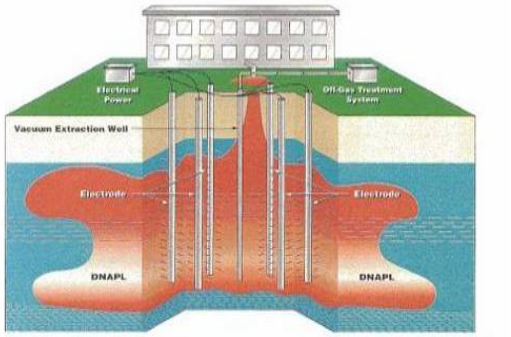
Agreement with the state to conduct the expedited reviews.

Innovative technologies/tools

78

PBEM – Case Studies SC DoD

- Use of innovative technologies
  - Vertical profiling in characterization
  - Membrane interface probe for site screening
  - Electrical resistive heating
  - Hydrogen release compound to enhance in situ bioremediation of solvents



Schematic Diagram for Electrical Resistive Heating (ERH)

Innovative technologies – educating the regulators.

Special meetings – discussions & trainings.

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PBEM – Case Studies SC DoD

- Lessons learned
  - Involve regulators early
  - Plan enough time for regulatory processes
  - Engage in open discussions with contractors and insurers
  - Flexible solicitations for bids
  - Allow sufficient time for data transfer to new management system

Communicate well in advance

80

Underground Storage Tank Program, South Carolina

- Program-wide
  - All South Carolina Underground Storage Tank (UST) program sites follow this process
- Overview
  - Over 9,000 releases
  - > 3,300 active
  - Over 400 in pay for performance
  - Fund: $12-15 Million/year
  - Risk-based corrective action

Program wide example.

UST is one of several programs in the Bureau of Land and Waste Management.

81

PBEM – Case Studies SC UST

- Tiered approach to remedial investigations
  - Tier I (standard plan)
  - Tier II (site specific)
  - Tier III (detailed, if needed)
  - Complete vertical and horizontal characterization
- Risk-based corrective action
  - Vapor, soil, groundwater
  - Risk is based on the receptors
  - Modeling
  - Verification
  - Conditional no further action (CNFA)

PBEM process – SC version

Assessment is done using efficient FS/Optimal well installation.

Objective is to define the contamination completely.

Follow a systematic approach to cleanup.

Goals based on RBCA process.

Concept of conditional NFA

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PBEM – Case Studies SC UST

- Pay for performance
  - Award is low bid (in most cases)
  - Award price – firm fixed price

- Contract final unless the department agrees
  - A new petroleum release has occurred
  - The assessment had major errors or omissions
  - Initial concentrations have dramatically increased
- Highlights
  - Pay contractors in a timely manner
  - Avoid cost change orders
  - Assist environmental consultants/contractors
    - With streamlined permitting process
    - Offsite access issues, etc.

PBEM process – SC version.

PBC are called PfPs (pay for performance) in SC.

Contract is final unless we agree that something went wrong in the initial assessment or a second release took place.

83

PBEM – Case Studies SC UST

Year	Number of Cleanups	Average Bid Cost
1997	16	$128,396
1998	68	$154,880
1999	43	$112,404
2000	25	$103,411
2001	47	$138,758
2002	62	$84,187
2003	48	$102,208
2004	52	$102,520
2005	44	$169,050
2006	23	$229,607

Remediation Bids Awarded at SC UST Sites

No associated notes.

84

PBEM – Case Studies SC UST

	Average Bid Cost
From 1997-2006	$127,808.94

Prior to 1997	Time & Material Costs
System Installation	$150,000
O&M for 5 years @ $35,000 per year	$175,000
Total costs	$325,000

On an average, SC is saving over $197,000 per UST release

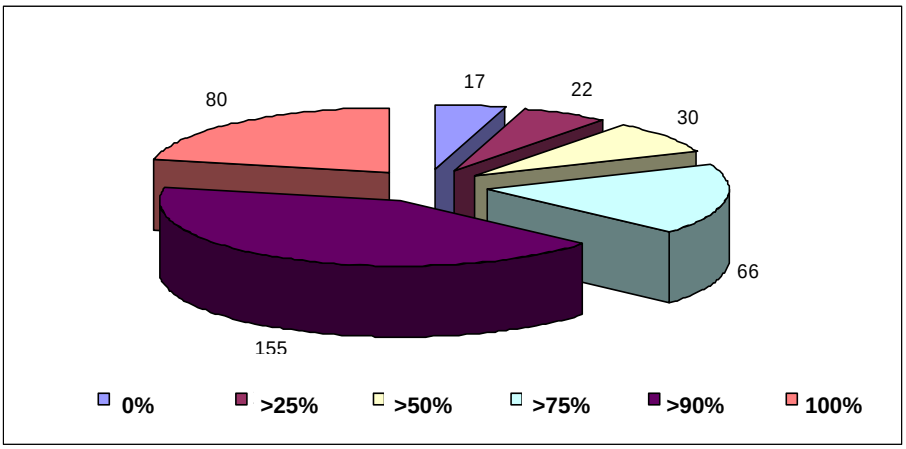
Most cleanups are completed in 2-3 yrs

No associated notes.

85

PBEM – Case Studies SC UST

UST Remediation Sites – Progress



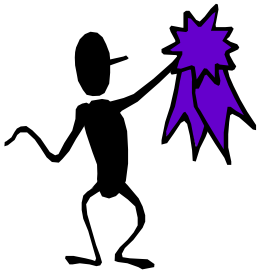
Progress towards cleanup.

Most sites are 75 or 90 or 100 complete

86

PBEM – Case Studies SC UST

- Early completion incentive
  - A bonus of 10% of the contract money if they finish cleanup within an established time period
  - Based on the risk priority ranking of the release, a site incentive period is set by the Department and is included in the bid solicitation



Overall a success story that resulted in a faster, better, and cheaper cleanup.

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Case Studies – Lessons Learned
SC UST

- **Success of a PBC depends on how well the contract is written**
- **A well defined contract requires complete site assessment**
- **Other important issues**
  - **Be flexible**
  - **Provide incentives**
  - **Insurance**
  - **Contingencies**
    - **What if…**
    - **How to pay for failure**

SC UST Program learned important lessons through 10 years of experience.

What are important issues in the

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Performance-Based Environmental Management Summary and Conclusions

- Regulators will receive proposals with some form of PBEM
- Concepts of PBEM – systematic planning, exit strategy, CSM, RPO, PBC, etc.
- Other businesses/industries outside the environmental world
- Examples from federal programs
- State programs – South Carolina
- CERCLA, RCRA, UST Programs, Brownfields, etc.
- A better management practice
- RPO Team as a resource

1. All the information you heard and saw today is available in the ITRC RPO Team's *Technical Regulatory Guidance Document: Improving Environmental Site Remediation Through Performance-Based Environmental Management* (RPO-7, 2007) available at www.itrcweb.org under “Guidance Documents” and “Remediation Process Optimization.”

2. All of the concepts presented today are "tools in the toolbox," available for all practitioners of site remediation. They are intended as an aide to your work and are to be used and modified, as needed, to suit the needs of your particular projects. While we encourage their use we realize that not all tools or applications are appropriate for all situations.

3. Performance-based management is an upcoming issue. Federal agencies are mandated to implement performance-based management as part of their business practices. State regulators can expect to see some variant of performance-based management and or performance-based contracting proposed for all federal lead cleanup projects.

4. If you have any questions please do not hesitate to contact the instructors or any member of the ITRC RPO Team. Look for our contact information on the “Meet the ITRC Instructors” provided near the beginning of this presentation and www.itrcweb.org.

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Thank You for Participating

- **Links to additional resources at:**
  - http://www.clu-in.org/conf/itrc/pbem/resource.cfm
- **2nd question and answer session**

Links to additional resources:
http://www.clu-in.org/conf/itrc/pbem/resource.cfm

Your feedback is important – please fill out the form at:
http://www.clu-in.org/conf/itrc/pbem

The benefits that ITRC offers to state regulators and technology developers, vendors, and consultants include:

✓Helping regulators build their knowledge base and raise their confidence about new environmental technologies

✓Helping regulators save time and money when evaluating environmental technologies

✓Guiding technology developers in the collection of performance data to satisfy the requirements of multiple states

✓Helping technology vendors avoid the time and expense of conducting duplicative and costly demonstrations

✓Providing a reliable network among members of the environmental community to focus on innovative environmental technologies

How you can get involved with ITRC:

✓Join an ITRC Team – with just 10% of your time you can have a positive impact on the regulatory process and acceptance of innovative technologies and approaches

✓Sponsor ITRC's technical team and other activities

✓Be an official state member by appointing a POC (State Point of Contact) to the State Engagement Team

✓Use ITRC products and attend training courses

✓Submit proposals for new technical teams and projects