

Performance Monitoring – State of the Practice:

Highlights

Goals:

- **Exchange and compile information on current requirements, strategies, tools, and practices for performance monitoring.**
- **Identify technology needs and opportunities for improvement arising from that experience.**
- **Distribute information to help guide future performance monitoring activities and future DOE technology development**



Categories of Sites

Current DOE Legacy Management Sites

Sites in Transition to Legacy Management

Ongoing Cleanup Sites

Other sites and agencies

Topics and Speakers

Current Legacy Management Sites:	Speaker
Ground Water Monitoring	Dave Peterson, SM. Stoller
Weldon Spring Case Study	Dave Peterson, SM. Stoller
Cover Performance Monitoring	Jody Waugh, SM. Stoller
Sites in Transition to Legacy Management:	
Rocky Flats	Sam Marutzky, SM. Stoller
Fernald	Jyh-Dong Chiou, Flour Fernald Craig Benson, Univ. of Wisc.
Ongoing Clean Up Sites:	
INL Subsurface Disposal Area	Joel Hubbell
Hanford	Tom Fogwell, Flour Hanford Andy Ward, PNNL
Savannah River Site	John Gladden, SRNL
Nevada Test Site	Ron Warren, Bechtel Nevada
Other Agencies and Sites:	
EPA Alternative Cover Assess. Program	Craig Benson, Univ. of Wisc.
Gilt Edge Mine	Roelof Versteeg, INL
Butte Reclamation Evaluation System	Sara Sparks, EPA Region 8

Categories/Phases of Performance Monitoring

Remedy Verification Monitoring

Baseline Performance Monitoring

Long-Term Performance Monitoring

Optimization Monitoring

Model Development Monitoring

Long-Term Performance Projections

Compile Performance Monitoring Information

1. Regulations and requirements
2. Current strategies, tools, and practices
3. Lessons learned: What's working, not working?
4. Plans for near-future applications
5. Emerging strategies, methods and tools that could address challenges and deficiencies
6. Science and technology needs and opportunities
7. Priorities

1. Regulations and Requirements

Regulations: UMTRCA, FUSRAP, CERCLA, RCRA, NPDES, NWPA

- Site specific (see the presentations on the web)

Regulators: EPA, NRC, States, Tribes

Requirements: (see the presentations on the web)

- Existing LM Sites
 - No disposal cell monitoring requirements
 - Ground water:
 - MCLs, background, supplemental standards, ACLs
 - Detect disposal cell performance
 - Verify clean up
 - Follow Long-Term Surveillance Plan: Annual inspections

2. Current strategies, tools, practices

Highlights (see the presentations on the web)

- Off-site laboratory analysis is commonly used, but auto-sampling used at some sites, for GW compliance monitoring.
- Rocky Flats is using Integrated Monitoring Plan & Decision Flow process to decide when to quit monitoring a well.
 - The regulator has bought into the practice.
 - It will become part of the Long Term Surveillance and Maintenance Plan, even for Point of Compliance measurements.
 - They are observing significant number of measures less than the Maximum Concentration Limits for various periods of time.

2. Current strategies, tools, practices (continued)

- At Fernald, they are using Integrated Environmental Monitoring Plan; they are planning to reduce number of wells and number of Contaminants of Concern by ~1/2 through GW Certification Plan being developed now.
- At Fernald, moisture accumulated during filling of OSDF cells must be appropriately accounted for in leachate collection, management and measurement.
(44 inch rain/year)

2. Current strategies, tools, practices (continued)

- At INL Subsurface Disposal Area, regulator supports vadose zone monitoring
 - To provide early detection of potential problems
 - Has allowed reduction of groundwater monitoring in recognition of the value of VZ monitoring
- Aerial remote sensing (sometimes with change detection) is beginning to be used at some sites because it covers large areas a relatively low cost.
 - E.g., detect changes and spatial patterns of vegetation health.

3. Lessons Learned:

What is working, not working?

- A fair amount of commercially available equipment available for monitoring
- At Rocky Flats, reliability of sensors was a problem (drift, accuracy)
- At Rocky Flats, telemetry of data is working well now, but will need upgraded when closure contractor moves off-site.
- At Rocky Flats, telemetry data is too coarse temporally.
- Solar panels are targets for vandalism.
- Integration of data management is not complete, but is proceeding (e.g. Geospatial Environmental Management System (GEMS))

3. Lessons Learned: What is working, not working? (cont.)

- At Fernald, cover performance monitoring system for OSDF is in place but management is not convinced of its value – no funding for operation.
- Depending on the site, GW sometimes does not need to be monitored.
- Vegetation (ET) is a critical measure of cap performance
- Vegetation on ET covers sometimes not establishing well - need to involve biologist/microbiologist early to improve success
- Public perception will force monitoring at many sites.

3. Lessons Learned: What is working, not working? (cont.)

- Vadose zone monitoring may pick up indications of problems so engineered controls can be implemented prior to impacting GW (early warning to reduce LT cost)
- Frequent monitoring provides useful/invaluable insight regarding system behavior (e.g. barometric responses and diurnal variations)
- Switch from cleanup standards to risk-based performance evaluations can limit cost in some cases
- Our understanding of systems evolves over time (e.g. UMTRCA caps and design standards); change will continue

3. Lessons Learned: What is working, not working? (cont.)

- Need to consider consequences of ecological change (e.g. succession, fire, invasive species)
- Performance Monitoring systems focus limited to regulatory standards; are not supporting model development, testing or long term projections
- We're not using monitoring data to refine and test predictions (e.g., model that handles water level fluctuation at Fernald)
- Funds to support performance monitoring are not adequate to accomplish objectives

4. Plans for Near-Future Applications

- LM is planning to link PM data systems to “Enterprise” data systems including accounting, personnel, procurement (e.g. Fernald IEMP and GW Certification)
- Fernald is planning to prepare Groundwater Certification Plan, through which they expect to decrease monitoring requirements and costs

5. Emerging Strategies, Methods and Tools that Could Address Deficiencies

- Include use of tracers as leading indicators & include in design/build phases.
- Expert system or equivalent to provide go/no-go indicators of performance.
- Direct measures of vapor and other fluxes are needed, e. g., Glendon Gee moisture fluxmeter.
- Have stakeholders take significant responsibility for performance monitoring activities.
 - Could potentially reduce PM requirements and costs over the long term.

5. Emerging Strategies, Methods and Tools that Could Address Deficiencies (continued)

- Monitor vadose zone to obtain leading indication of problems; provide early warning of need for preventive maintenance/repair, which can be completed at lower cost than remediation of a failure.
- Need protocol for reducing monitoring requirements, # of wells/monitoring points, # of contaminants of concern, frequency of measurement,
 - ITRC involvement would be good.

6. Science and Technology Needs and Opportunities (continued)

- Transfer technology regarding operation of unattended sites and equipment/facilities (e.g., wells, pumps, sensors, data loggers, solar panels/telemetry).
 - Potentially involving stakeholders.
- Construction materials for 100 years for wells and access paths. (Army Corp is researching materials for Cone Penetrometer wells.)
- Long-term sensor reliability; design testing and standards are needed. (e.g. moisture monitors.)
- Solar panels disguised as sagebrush (West) and kudzu (East)

6. Science and Technology Needs and Opportunities (continued)

- Aerial remote sensing
 - cap vegetation and ET,
 - treatment and mitigation wetlands
 - soil moisture content and storage
- Coupled model of ecosystem dynamics and unsaturated flow (e.g. link models using FRAMES)
- Detection of large-scale preferential flow in covers
- Protocol for design of performance monitoring systems
 - Identify potential failure modes/mechanisms and design performance system accordingly to meet performance monitoring objectives

6. Science and Technology Needs and Opportunities (continued)

- Protocol for reducing monitoring volume, number of wells, frequency, and number of contaminants (potential ITRC participation)
- Means to reduce uncertainty of measurements (geostatistical, volumetric measures)
- Better information and understanding of deep vadose zone
- IT Issue: Protocols for managing data and information, technology portability
- Background GW contaminant concentrations to understand effects of water table fluctuations

6. Science and Technology Needs and Opportunities (continued)

- Capture information on already developed technology and practices (e.g. OTD) and make readily accessible
- Shift from short-lived point sensors to long-term, large-scale monitoring
- For LT waste isolation, we need to know how waste forms change over time (may vary spatially within individual disposal facilities). Needed to update risk assessments.
- Use lessons learned (UMTRA sites, natural analogs, long-term engineered structures) to project very long-term behavior and performance of capping systems and components

7. Priorities

1. IT Issue: Protocols for managing data and information, technology portability
2. Protocol for reducing monitoring volume, number of wells, frequency, and number of contaminants (potential ITRC participation). Reduce/limit costs.
3. Use lessons learned (UMTRA sites, natural analogs, long-term engineered structures) to project very long-term behavior and performance of capping systems and components
4. Capture information on already developed technology and practices (e.g. OTD) and make readily accessible

Sandra's Challenges

- 1- *Identify new monitoring and modeling tools and systems that can improve the state of the art in performance monitoring-- what's available now, in the near-term future (3 years) and in the long term.*
 - Advances/Integration of data/information systems (e.g. Stoller LM work)
- 2- *Tell the Department how performance monitoring needs to change according to site closure status.*
 - Put more focus now on Long Term monitoring objectives, tools,
 - EM & LM need to integrate long term performance monitoring efforts, i.e., include necessary tools, strategies, methods before closure, while you are building the performance monitoring system

Sandra's Challenges (cont.)

3- *Are there better ways to indicate that containment measures are effective? Identify those measures? Is the remediation successful?*

- Involve regulators and stakeholders in design.
- Involve stakeholders in surveillance & maintenance activities
- Report contaminant fluxes/surrogates
- Report lumped and holistic indicators (tracers)
- Do good job in reporting surveillance & maintenance operations
- Do vadose zone monitoring and report results (early indicator)
- Make the monitoring plan part of the remedy design

Sandra's Challenges (cont.)

4- *How can monitoring and modeling tools or concepts improve communication with regulators and stakeholders?*

- Include regulators and stakeholders in design
- Involve in Performance Monitoring activities
- Internet access to model synopses, Performance Monitoring synopses & data summaries
- Geospatial environmental (data) management system (GEMS) at LM (GIS on top of data management; several other sites moving in same direction)
- Public outreach and education re: clean-up activities and LTS/PM activities (e.g. documentaries on sites and clean-up activities; involve young producers)

Overarching Observation/Recommendation

- EPA multi-year investment in Alternative Cover Assessment Program (ACAP) has yielded a wealth of knowledge and understanding based on studies at real sites across the nation that has been valuable for application of caps.
 - Regulators were deeply involved.
 - Established many new strategies, methods, & tools.
- DOE EM, LM, and SC should invest in similar way at real remediation and waste isolation sites that are being implemented now and in the near future because additional knowledge and understanding is needed to limit long term performance monitoring costs.
 - EPA and ITRC participation are desired, too.
 - Closure contractors may need incentives to support this.