SSAB Teleconference:
2. DOE EM Landfill Workshop & Path Forward

Office of Groundwater and
Soil Remediation
US Department of Energy

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Slides prepared by CRESP

DOE EM Landfill Workshop

Objective:

- Discuss findings & recommendations from ITR visits to DOE facilities
- Identify technology gaps and needs to advance EM disposal practice of the future.
- Obtain input from experts within and outside of DOE.

Panels:

Waste subsidence: prediction and impacts

Waste forecasting: predicting volumes and WACs

Final covers: long-term performance and monitoring

Liners: role and need

Workshop Approach and Structure

- Objective:
  - Discuss each issue
  - Evaluate the merits of each issue
  - Create a prioritized list of technologies needs for Office of Engineering and Technology (EM-20).
- Method:
  - Expert panelists to provide 8 min presentation on issues posed by ITR (see subsequent slides in panels)
  - Presentations followed by discussion facilitated by *discussion leader* and recorded by *scribe*.
  - Discussion leader provides wrap up of conclusions from discussion.

Panelists

- Practitioners and academics
- Individuals with and without DoE experience and paradigm
- Design experience (within and/or outside DoE) and research experience.
- Provide different perspectives.
- Prevent myopic thinking.

DOE EM Landfill Workshop

Participants:

DOE: 15

Other Federal Agencies: 4

Industry: 16

Academia: 6

Webcast: > 20 (nodes)

Panels:

Waste subsidence: prediction and impacts

Waste forecasting: predicting volumes and WACs

Final covers: long-term performance and monitoring

Liners: role and need

Near-Term Recommendations: State-of-the-Art Reviews

Conduct and publish state-of-the-art reviews on:

1. Transport properties of radionuclides in barrier materials

2. Hydrologic and transport performance of liners and drainage materials

3. Hydrologic performance of final covers

4. Life expectancy of liner and cover component materials (natural and geosynthetic) in LLRW environments

5. Criteria for acceptable differential settlement in covers and cover materials.

Long-Term Efforts: Waste Settlement & Liner Materials

- Develop techniques for reliably predicting settlement of soil-like and containerized waste forms, including parameters for design and performance prediction.

- Conduct studies to define the transport properties and life expectancy of barrier and drainage materials in LLRW environments.

- Develop probabilistic methods to address uncertainty in effectiveness of barrier materials that can be used in performance assessments.

Covers: Long-Term Recommendations

- Establish site-specific programs to develop improved methods for design of final covers.
- Develop strategies to design covers that are resistant to damage by differential settlement.
- Develop and/or refine models and modeling strategies for final covers using high-quality field data for validation.
- Develop ecological engineering strategies to design covers that mimic sustainable natural systems.

Covers: Long-Term Recommendations

- Characterize time-dependence of of cover system components, develop in situ methods to detect changes, develop & validate predictive methods for performance assessments that account for time-dependent engineering properties.

- Evaluate the reliability and utility of point-based and remote-monitoring methods for covers, and develop best practices regarding monitoring cover performance.

Forecasting: Long-Term Efforts

- Conduct field studies to support site-specific and/or complex-wide characterization and field screening methods for forecasting waste streams.

- Assess and improve methods to predict waste volumes for use in landfill sizing.

Recommendations: Guidance Documents

- Decision-making framework for settlement assessment and abatement that is tied to performance assessments.
- Guidance on implementing settlement analysis in design, operations, and performance assessments.
- Develop a decision-making framework that can be used on a site-specific basis to evaluate the efficacy of employing liners at DOE waste disposal facilities.
- Guidance on incorporating the contributions of liner systems, leachate collection systems, and final cover systems in performance assessments.

Recommendations: Guidance Documents

- Assessment of permanent cover system paradigm relative to evolutionary cover designs with periodic upgrading or replacement.

- Methodology for field screening of D&D materials, estimating waste types and volumes, and sequencing of waste streams.

- Summary report on waste types, soil-to-debris ratios, placement practices, and lessons learned from disposal operations in the DOE complex. Compare actual waste volumes and contamination levels to values anticipated during site characterization.

Path Forward: Processes

A: Waste Forecasting

Develop smart forecasting system that accounts for uncertainty and is calibrated based on data from completed DOE D&D projects (e.g., Fernald). This could be based on WACFACs and would be deployed over entire complex.

Use Bayesian updating method to permit revised forecasting during use.

Trial out at Oak Ridge.

B: Waste Sequencing & Scheduling

Develop Bayesian methodology to optimize scheduling of waste transport and landfill disposal that accounts for uncertainty in multiple objectives and constraints including cost, construction sequence, air space consumption, mechanical stability, and waste acceptance.

Validate using data from test sections at ERDF.

Path Forward: Processes

C: Landfill Settlement

Develop methodology to forecast waste deformation over time as a function of waste stream, filling strategy, and cover requirements.

Validate using data from test sections at ERDF.

D: Barrier Performance Prediction

Develop methods to predict the performance of liner and cover systems near term and over very long-term that account for uncertainty in meteorological conditions, contaminant source, and degradation mechanisms.

Path Forward: Systems

A: Liner Transport

- Define existing state-of-the-art on radioactive material transport in barrier materials.

- Conduct laboratory experiments to measure transport parameters and to validate transport processes.

- Conduct field experiments at Oak Ridge to evaluate lab-to-field scaling.

- Design and construct long-term monitoring/testing system for deployment at Portsmouth.

- Couple with models developed in *Processes*.

Path Forward: Systems

B: Waste Mechanics

- Conduct large-scale field experiments at Oak Ridge and Portsmouth to evaluate deformation of D&D wastes as a function of waste stream, placement method, and composition.

- Conduct prototype and bench-scale tests in lab and evaluate scaling issues from lab to field.

- Couple with models developed in *Processes*.

Path Forward: Systems

C: Long-Term Barrier Performance

- Develop accelerated testing technologies to assess life expectancy of geosynthetic barrier materials used in liners and covers.

- Develop sequential evolution cover design strategy.

- Construct field trials of cover systems to evaluate significance of degradation mechanisms for covers (differential settlement, geosynthetic deterioration, clogging).

- Construct field trials to evaluate evolution cover designs.