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**PERFORMANCE ASSESSMENT ASSISTANCE ACTIVITIES
IN THE DOE COMPLEX - 12325**

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ABSTRACT

The United States Department of Energy Office of Environmental Management (DOE-EM) has established a Performance Assessment Community of Practice (PA CoP) to foster the sharing of information among performance assessment (PA) and risk assessment practitioners, regulators and oversight personnel. The general intent is to contribute to continuous improvement in the consistency, technical adequacy and quality of implementation of PAs and risk assessments around the DOE Complex. The PA CoP activities have involved commercial disposal facilities and international participants to provide a global perspective. The PA CoP has also sponsored annual technical exchanges as a means to foster improved communication and to share lessons learned from on-going modelling activities.

The PA CoP encourages activities to provide programmatic and technical assistance in the form of sharing experience and lessons learned with practitioners during the development of PAs and risk assessments. This assistance complements DOE-EM reviews through the Low-Level Waste Disposal Facility Federal Review Group (LFRG) that are conducted after modelling efforts are completed. Such up-front assistance is providing additional value in terms of improving consistency and sharing of information. There has been a substantial increase in the amount of assistance being provided. The assistance has been well received by practitioners and regulators that have been involved.

The paper highlights assistance and sharing of information that has been conducted in the last two years to support activities underway in support of proposed disposal facilities at Paducah, Portsmouth, and the Idaho National Laboratory and tank closure at Hanford.

BACKGROUND

The low-level waste (LLW) performance assessment (PA) process in the United States has been traditionally focused on LLW disposal facilities at a few locations. In recent years, there has been a significant increase in modeling activities to include many more disposal facilities and also for tank closures and site remediation activities.

The dramatic increase in the variety of activities involving modeling has resulted in a similar increase in the number of different groups of people involved in conducting assessments and the potential for inconsistency in approaches being applied. Improved consistency in approaches for assessments carried out under the same and different regulatory regimes is important for achieving broader public and regulatory confidence. Consistent is not intended to imply uniformity; however, there is a need to work towards: (1) consistency in approach and general framework, to improve transparency and (2) comparability to support identification of most appropriate practices for each application.

The recently issued report from the Government Accountability Office (GAO), “DOE Needs a Comprehensive Strategy and Guidance on Computer Models that Support Environmental Cleanup Decisions.” [1] included a number of recommendations related to DOE-EM modeling activities. The GAO report has served to reinforce the efforts of the PA CoP to improve the sharing of information and lessons learned.

Within DOE-EM, LFRG meetings and reviews of specific PAs have traditionally served as a means for sharing of information associated with LLW PAs. Although a substantial amount of information exchange occurs, the LFRG meetings tend to address policy or higher-level technical issues and detailed LFRG reviews occur after the PA has been prepared. The PA CoP was initiated to provide a forum for sharing information related to PAs about regulatory and policy updates, experiences and lessons learned early in the development of a PA to complement the sharing of information that occurs during the LFRG review at the end of the process. The PA CoP is also intended to reach out beyond the DOE LLW disposal community and include the broader community addressing PAs, risk assessments, and modeling to capture and share lessons learned and good practices from a more global perspective.

Since 2009, the PA CoP has been sponsoring annual technical exchanges to facilitate sharing of information related to key topical areas associated with the conduct of PAs. These technical exchanges have been a cornerstone of PA CoP activities. Previous technical exchanges have addressed the key topical areas of Engineered Barriers (2009 - <http://www.cresp.org/education/workshops/pacop/>), the Advanced Simulation Capability for Environmental Management and the Cementitious Barriers Partnership (2010 - <http://srnl.doe.gov/copexchange/links.htm>), and the use of models for decision-making and software quality assurance (2011 - <http://srnl.doe.gov/copexchange/2011/index.htm>). Each technical exchange has also included summary presentations to update participants regarding activities at DOE, the Nuclear Regulatory Commission (NRC) and other organizations (e.g., International Atomic Energy Agency (IAEA), United States Environmental Protection Agency (EPA)) in addition to a collection of specific presentations to provide insight and perspective from on-going modeling activities.

TECHNICAL ASSISTANCE TEAMS

More recently, there has been an increase in the number of activities to provide technical assistance to personnel actively involved in the development of PAs. The assistance teams get engaged during the development of the PA to provide technical advice and share experiences, noteworthy practices, and lessons learned from previous Low-Level Waste Disposal Facility Federal Review Group (LFRG) reviews. Support provided via assistance teams includes:

- strategic advice related to project planning and implementation,
- providing examples of approaches being used at other locations and sharing of lessons learned,
- support for specific technical topics and issues,
- guidance regarding expectations for reviews from the DOE-EM LFRG,
- reviews of draft documentation, and
- support at meetings with stakeholders and the public.

The scope and budget for assistance teams is limited, thus reviews and support tend to be targeted at areas deemed to be of the most concern. DOE-EM provided some initial funding to support technical assistance activities, but the trend is for individual sites to cover the costs of assistance moving forward. The Consortium for Risk Evaluation with Stakeholder Participation (CRESP) has also been involved in providing support through their funding.

Guidance and suggestions are generally in the form of updates on regulatory and policy developments, providing reference material or examples, sharing lessons learned, and highlighting areas that have been concerns in previous LFRG reviews. A goal for this assistance is to improve awareness of approaches being used in other assessments to help promote consistency prior to a PA being submitted to the LFRG for a formal review. The assistance does not include development of input for the PAs, although separate activities involving development work have been initiated in some cases.

The following sections provide some perspective regarding the types of assistance being provided and some examples of key areas of interest at the different sites.

IDAHO NATIONAL LABORATORY

The Idaho National Laboratory (INL) is developing a PA for a proposed LLW disposal facility to provide future capacity for wastes currently being disposed at the Radioactive Waste Management Complex (RWMC). The RWMC is in the process of being closed and disposal operations are planned to end in 2017. The new facility is being developed to provide capacity for 20-50 years of continued on-site disposal of LLW from on-going operations at the Idaho Site. The disposal concept includes a system of barriers including the use of metal containers, below grade concrete vaults, and an engineered cover to provide long-term protection of human health and the environment. The proposed design of the facility was selected after consideration of a variety of different design concepts, including: different materials for the vault and containers, geochemical barriers, and liners and leachate collection systems.

PA assistance in Idaho has included support on the siting study, systems evaluation, review of draft PAs and other documentation and technical support during the LFRG review of the PA. The assistance team has included personnel from DOE-EM Office of Environmental Compliance and Savannah River National Laboratory (SRNL). Technical support has included sharing experience and lessons learned to help support assumptions related to the performance of engineered features (e.g., vaults, geomembranes, liners, covers), geochemistry of engineered features and the natural system, and modeling. General assistance is also being provided to share

experience from other LFRG reviews and considerations associated with expected changes in the update to DOE Order 435.1 [2].

The proposed update for DOE Order 435.1 includes a draft requirement for a systems evaluation for new disposal facilities. The systems evaluation is intended to provide a means for the facility developer to illustrate the roles of natural and engineered barriers associated with the disposal system in the long-term protection of human health and the environment. In Idaho, the assistance team provided input during the development of the systems evaluation to help address questions about the need for liners and leachate collection systems for the proposed disposal facility. The evaluation also provided insights that helped to refine the design of specific components of the system.

PADUCAH

The Paducah Site is in the process of considering alternatives for disposition of wastes associated with site restoration activities. One of the alternatives is an On Site Disposal Cell (OSDC) designed to meet EPA standards for Subtitle C disposal facilities for hazardous wastes. The risks associated with an OSDC are being considered as part of a remedial investigation/feasibility study (RI/FS) that is being conducted. The modeling approaches used to assess the risks have evolved over the past few years. Discussions with the State and EPA Region IV have addressed modeling approaches and key assumptions for the risk assessment and its supporting modeling. Communications were also encouraged between the project team involved in the risk assessment and modeling work at Paducah and similar work being completed at Portsmouth (see next section).

Assistance at Paducah by staff members from the DOE-EM Office of Environmental Compliance, SRNL, and CRESO has included participating and leading workshops for regulators and technical support staff, where release and transport modeling approaches and assumptions and risk assessment methods were discussed, and reviewing the draft RI/FS. The workshops have provided a forum to discuss key assumptions and build successfully consensus on the possible approaches available for modeling and risk assessment. Since the regulators and technical staff conducting the modeling and risk assessment had not been involved in LFRG reviews previously, DOE and SRNL provided presentations to share experiences and lessons learned from implementation of DOE Order 435.1 [2] and interactions with LFRG review teams.

Assumptions related to the long-term performance of geomembranes (in covers and liner systems) and other engineered barriers were a key area of interest at the workshops. Other areas of interest for which experience and lessons learned are being shared include technical topics, such as: use of deterministic or probabilistic simulations, selection of distribution coefficients, geochemical interactions, agreement on model selection and implementation, consideration of source depletion through leachate generation, and methods to determine sensitive modeling parameters. The ultimate goal of the technical information interchange was to gain a clear understanding of the conditions that could lead to changes in the Preliminary Waste Acceptance Criteria. Policy issues were also discussed, such as: potential locations to be modeled, time frames (i.e., period of compliance) to be considered, methods to address potential long term impacts associated with disposal of depleted Uranium, risk criteria and points of assessment (or exposure), and general definition of exposure scenarios.

PORTSMOUTH

The Portsmouth site is considering development of an OSDC for waste associated with decommissioning and demolition of process and support buildings and other cleanup activities at the site. Portsmouth is actively pursuing siting, characterization and modeling activities to support development of the facility under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Systems evaluations are also being conducted to consider hydrological water balances for the potential sites and disposal concepts.

Assistance at Portsmouth has focused more on technical considerations associated with siting and characterization activities to support model inputs. Staff members from the DOE-EM Office of Environmental Compliance and Office of Large Site Support, and SRNL/Savannah River Nuclear Solutions have provided assistance. Staff members from Pacific Northwest National Laboratory and the NRC have also provided input on specific needs. The support has included feedback on the models and modeling approaches being used, reviews and feedback on documents/presentations related to the modeling, feedback on field and laboratory characterization activities used to develop the basis for inputs for the models, and participation on weekly modeling teleconferences. Since technical staff conducting the modeling have not been involved in LFRG reviews, presentations were provided to share experiences and lessons learned from implementation of DOE Order 435.1 and interactions with LFRG review teams.

Experience and lessons learned have been shared on topics such as: decisions regarding selection of models, general geochemistry and laboratory testing to develop distribution coefficients (K_{ds}) and leachability of contaminants from process equipment, deterministic and probabilistic modeling, prioritization of activities to collect data for model support, assumptions regarding durability of geomembranes in liner and cover systems, and site-wide water balance considering the natural and engineered systems.

HANFORD

The Hanford site is conducting activities to support PA efforts associated with closure of the C Tank Farm. Extensive field characterization activities (soil sampling and resistivity geophysical methods) have been conducted along with a number of geochemical characterization studies on the small amounts of residual waste that will remain after the tanks following retrieval. The current plan is that a cementitious material will be used to fill and stabilize the tanks prior to final closure. The PA will be used to estimate if the closed tanks are sufficiently isolated to provide reasonable assurance that performance objectives for disposal of LLW can be met.

A series of scoping meetings were conducted involving regulators and key stakeholders in order to work towards consensus on the assumptions and modeling approaches to be used for the new PA. The scoping meetings included presentations from Hanford technical staff and stakeholders, DOE, NRC and other experts to share experiences and lessons learned and help to build the

necessary consensus. Independent discussions and briefings on specific topics have also been provided by DOE and SRNL for Hanford technical staff and regulators.

Experiences and lessons learned have been shared on numerous technical and policy related topics via the scoping meetings and independent discussions. Areas of specific interest have included, for example: long-term performance of covers and other engineered features, development and screening of lists of Features, Events and Processes (FEPs), inventories of past releases (from both tanks and pipelines), ancillary equipment residuals, and tank residuals, characteristics associated with release mechanisms for tank residuals, exposure scenarios, and potential for enhanced migration from past operations in the natural system.

SUMMARY

DOE-EM established the PA CoP to help improve the consistency and quality of implementation of modelling activities around the DOE Complex. The PA CoP has sponsored annual technical exchanges as a means to foster improved communication and to share lessons learned from on-going modelling activities. Practitioners; project managers; oversight personnel; and regulators from United States and international facilities have participated in the three technical exchanges that have been held to date.

At the working level, the PA CoP has sponsored technical assistance in support of modelling activities that are currently underway. The assistance concept provides a means to share specific experience, good practices, and lessons learned on topics of interest at a given site while the modelling is being conducted. Such up-front assistance complements the sharing of information that occurs via regular LFRG meetings and independent LFRG reviews that are conducted when the modelling effort is completed.

Examples from assistance activities that have been conducted at Idaho, Paducah, Portsmouth and Hanford were highlighted in this paper. There were differences in the types of assistance provided at each site. In some cases the assistance was focused on technical support for the practitioners and management responsible for the development of the PAs. At other sites, the assistance included working with the developers and regulators/stakeholders involved in the process to help with reaching consensus on critical assumptions. Such interactions have proven to be very effective to help all parties get a chance to discuss their perspectives and better understand the different points of view. In all cases, the assistance was used as a means to share broader perspectives, experiences and lessons learned with personnel engaged in modelling activities at a given site.

The combination of technical exchanges and targeted technical assistance has provided additional means to encourage the sharing of information around the DOE Complex and globally. Feedback from practitioners, oversight personnel, regulators and stakeholders that have been involved has been overwhelmingly positive. It is believed that such sharing of information and experiences is contributing to continuous improvement in the consistency, technical adequacy, and quality of modelling activities. Although different approaches are still being used, there is an improvement in the awareness of lessons learned and implementation of practices that have proven to be effective.

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REFERENCES

1. United States Government Accountability Office, “DOE Needs a Comprehensive Strategy and Guidance on Computer Models that Support Environmental Cleanup Decisions,” GAO-11-143, Washington, DC (2011) - <http://www.gao.gov/new.items/d11143.pdf>.
2. United States Department of Energy, “Radioactive Waste Management,” DOE Order 435.1, Chg 1, Washington, DC (2001).