SRNL-STI-2011-00752

2011 Performance Assessment Community of Practice Technical Exchange – Summary

Roger R. Seitz, SRNL
Martin J. Letourneau, DOE-EM
Linda Suttora, DOE-EM

December 2011

Savannah River National Laboratory
Savannah River Nuclear Solutions
Aiken, SC 29808

Prepared for the U.S. Department of Energy under contract number DE-AC09-08SR22470.

DISCLAIMER

Printed in the United States of America

Prepared for
U.S. Department of Energy

Keywords:
Performance Assessment
Low-Level Waste Disposal

Retention: *Permanent*

2011 Performance Assessment Community of Practice Technical Exchange – Summary

Roger R. Seitz, SRNL
Martin J. Letourneau, DOE-EM
Linda Suttora, DOE-EM

December 2011

Savannah River National Laboratory
Savannah River Nuclear Solutions
Aiken, SC 29808

Prepared for the U.S. Department of Energy under contract number DE-AC09-08SR22470.

This page is left blank intentionally

EXECUTIVE SUMMARY

The Performance Assessment Community of Practice (PA CoP) was chartered to improve the consistency and quality of performance assessments (PAs) across the Department of Energy (DOE) Complex. Although there was an initial focus on DOE PA activities, the current intent is to open the PA CoP for anyone engaged in PA and PA-related activities (e.g., CERCLA, RCRA, NEPA, D&D) for United States DOE, United States commercial and international applications. The term PA is used to generically represent all of the modeling applications. The general approach for the PA CoP is to provide a forum to foster the exchange of information among PA practitioners and to share lessons learned from PAs conducted. Through the deployment of PA Assistance Teams, the PA CoP has also been engaged directly in the development of new PAs across the DOE Complex.

Technical exchanges and workshops are a cornerstone of PA CoP activities. Two previous technical exchanges have addressed Engineered Barriers (2009 - http://www.cresp.org/education/workshops/pacop/), and the Advanced Simulation Capability for Environmental Management and the Cementitious Barriers Partnership (2010 - http://srnl.doe.gov/copexchange/links.htm). Each technical exchange also includes summary presentations regarding activities at DOE, the Nuclear Regulatory Commission (NRC) and other organizations (e.g., International Atomic Energy Agency (IAEA)) as well as a number of presentations from selected sites to provide insight and perspective from on-going modeling activities. Two workshops on Sensitivity and Uncertainty Analysis were also held prior to the first formal technical exchange.

A PA CoP Steering Committee was formed and the first meeting was held on May 24, 2011 prior to the technical exchange. The steering committee discussed the charter and future directions for the PA CoP. The committee discussed approaches to expand participation in the PA CoP and improve the exchange of information. The group reached consensus on several suggestions aimed at engaging a broader audience. A number of high priority topics for the PA CoP were also identified, including a few topics that could be the focus of topical conference calls that are planned to be held multiple times per year.

The 2011 PA CoP Technical Exchange was held on May 25-26 in Atlanta, GA (http://srnl.doe.gov/copexchange/2011/). The exchange was attended by approximately 50 people and many others participated via a live video webcast. The 2011 PA Technical Exchange was focused around the topic of the role of modeling in decision making and an additional topic of software quality assurance to address the recent report on DOE Office of Environmental Management (DOE-EM) modeling from the Government Accountability Office (GAO). The GAO recommendations have further reinforced the benefits of efforts to share information and lessons learned through the PA CoP.

The Technical Exchange began with several introductory presentations to provide updates on activities in DOE, NRC, EPA and other organizations. A new feature at the 2011 technical exchange was the use of panel discussions. The exchange featured two panel discussions on considerations related to the use of models for decision making. The first panel comprised a variety of different PA practitioners and the second panel included EPA, State, and NRC regulators. The panels provided a variety of perspectives that helped to bridge the understanding between practitioners and regulators.

The second day began with a number of presentations of PA-related activities around the DOE Complex. The presentations included PA activities in the DOE Office of Nuclear Energy, tank closure PA efforts, the Landfills partnership, and modeling for a new disposal facility in Idaho. These presentations were followed by three presentations related to software quality assurance. A presentation from the DOE-EM Office of Quality Assurance provided an overview of the GAO report on DOE EM modeling activities

and provided perspective on the path forward to address the recommendations in the report. Two other presentations addressed good practices for documentation of models and modeling assumptions as part of software quality assurance.

The final presentations for the exchange included updates on the Advanced Simulation Capability for Environmental Management (ASCEM) project and the Cementitious Barriers Partnership (CBP). These efforts are developing next generation tools that can be used for PAs. ASCEM is a comprehensive modeling toolset and the CBP is developing specialized tools for modeling cementitious materials used for waste forms, containers and disposal facilities.

The technical exchange included many active discussions and exchanges among speakers, panelists and the audience. The closing discussion included a number of recommendations for consideration when planning future activities of the PA CoP.

TABLE OF CONTENTS

This page is left blank intentionally.

LIST OF ACRONYMS

ASCEM	Advanced Simulation Capability for Environmental Management
CA	Composite Analysis
CBP	Cementitious Barriers Partnership
CIEM	Community of Practice for Integrated Environmental Modeling
DOE	Department of Energy
DOE-EM	DOE Office of Environmental Management
DOE-HS	DOE Office of Health, Safety and Security
DOE-NE	DOE Office of Nuclear Energy
ELLWF	E-Area Low Level Waste Disposal Facility
EC	European Commission
EPA	Environmental Protection Agency
GAO	Government Accountability Office
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ISCMEM	Interagency Steering Committee on Multimedia Environmental Modeling
LFRG	Low Level Waste Disposal Facility Federal Review Group
LLW	Low-Level Waste
NDAA	Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005
NEAMS	DOE-NE Advanced Modeling and Simulation
PA	Performance Assessment
PA CoP	Performance Assessment Community of Practice
QA	Quality Assurance
SQA	Software Quality Assurance
SRNL	Savannah River National Laboratory
UCAQ	Unreviewed Composite Analysis Question
UFD GPAM	Used Fuel Disposition Generic PA Model

This page is left blank intentionally

1.0 INTRODUCTION

The Performance Assessment Community of Practice (PA CoP) was developed in 2008 to improve consistency and quality in the preparation of performance assessments (PAs) and risk assessments across the Department of Energy (DOE) Complex. The term, PA, is used to represent all of these modeling applications in this report. The PA CoP goals are to foster the exchange of information among PA practitioners and to share lessons learned from PAs conducted for DOE, commercial disposal facilities, and international entities.

Technical exchanges and workshops are a cornerstone of PA CoP activities. Previous technical exchanges have addressed 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). Each technical exchange also includes summary presentations regarding activities at DOE, the Nuclear Regulatory Commission (NRC) and other organizations (e.g., International Atomic Energy Agency (IAEA)) as well as a number of presentations from selected sites to provide insight and perspective from on-going modeling activities.

Through the deployment of PA Assistance Teams, the PA CoP has also been engaged in the development of new PAs across the DOE Complex. As a way of improving consistency in the preparation of new PAs, the teams provide technical advice and share experiences, noteworthy practices, and lessons learned from previous Low-Level Waste Disposal Facility Federal Review Group (LFRG) reviews. Teams have provided support for PAs at Hanford, Idaho, Paducah and Portsmouth.

The third annual PA CoP Technical Exchange was held on May 25-26, 2011 in Atlanta, GA. The PA CoP Steering Committee Meeting held its first meeting on May 24 prior to the Technical Exchange. Decision making using models and software quality assurance were the topical emphasis for the exchange. A new feature at the 2011 technical exchange was the use of panel discussions to solicit feedback from regulators and practitioners.

This report summarizes discussions and recommendations from the steering committee meeting and presentations and feedback obtained at the technical exchange. Appendix I includes the steering committee meeting agenda and Appendix II includes the agenda for the technical exchange and a screenshot of the presentations and video files that are available online.

2.0 PA COP STEERING COMMITTEE MEETING

The PA CoP Steering Committee met for the first time on the afternoon of May 24, 2011 (see Agenda in Appendix I). Representatives from regulators, DOE HQ and field offices, DOE contractors, National Laboratories, and academia participated in the meeting (Table 1). The purpose of the meeting was to discuss activities of the PA CoP to date and to recommend a path forward for the PA CoP based on previous technical exchanges and ideas from the group.

Marty Letourneau, who is the LFRG co-chair and serving as the initial Chair for the Steering Committee opened the meeting by summarizing the history of the PA CoP. Formed in 2008 to address concerns regarding the consistency of PAs being conducted in the DOE Complex, the PA CoP was originally chartered under the Tank Waste Corporate Board and jointly chaired by representatives from EM-30 and EM-40. The initial emphasis was on DOE activities. Technical exchanges were sponsored in 2009 and 2010 and a number of PA assistance activities have been conducted since the formation of the PA CoP.

Table 1. Steering Committee Meeting Participants

Name	Organization
Alaa Aly	Intera, CHPRC
Martha Berry	US EPA, Region IV
Jim Clarke	CRESP, Vanderbilt University
Ginger Dickert	Savannah River Remediation
Frank DiSanza	DOE-NNSS
Michael Graham	Los Alamos National Laboratory
Matt Kozak	Intera
Marty Letourneau, Chair	DOE-EM-41
Chris McKenney	US NRC
John Morse	DOE-RL
Rob Pope	US EPA, Region IV
Roger Seitz	Savannah River National Laboratory
Ed Winner	Commonwealth of Kentucky

The PA CoP is now being led out of the DOE-EM Office of Environmental Compliance. There is a need to update the PA CoP charter to reflect this change and also to reflect a broader and more self-sustaining approach. The committee was challenged to identify effective approaches in sharing information and moving the PA CoP toward its goals.

Following the introductory presentation, participants discussed the current version of the Charter and recommended several revisions:

- Simplify the Charter to be more concise and to more accurately reflect a more self-managing structure for the PA CoP.
- Update the organizational references in the Charter.
- Emphasize that the membership is open to all interested parties; clarify that although the PA CoP is US centric, membership is not reserved solely for US affiliations.
- Rotate the chairmanship of the Steering Committee.
- Provide for more frequent (e.g., monthly or bimonthly) and focused (topical) interactions via conference call, video link, etc.
- Hold an annual face-to-face technical exchange, perhaps optimizing attendance by scheduling jointly with an LFRG meeting or other related activities.

The discussion of the Charter was followed by an open discussion of expanding participation in the PA CoP and improving the exchange of information. The group identified several suggestions aimed at engaging a broader audience:

- Consider online chat, blogs and other mechanisms as ways to share information; with appropriate controls and moderation, these forums could also provide technical support or guidance.
- Leverage or piggy-back with DOE online resources; set up links with professional societies.
- Establish presence on Facebook, Linked-In, Twitter, etc. as a means to make people aware of new information. (Participants acknowledged the challenge of doing this at DOE sites that limit access to these resources.)
- Develop a central information repository.
- Share information from maintenance and R&D plans to identify opportunities for cost sharing on common needs.
- Produce, as an alternative to detailed guidance, fact sheets, lists of best practices, etc.
- Encourage open access to information, but establish different levels of controlled access to specific information.
- Involve a Public Affairs subject matter expert.

Committee members also developed a list of high priority subjects for consideration by the PA CoP:

- Interpretation of performance objectives, including how to interpret “what-if” scenarios and output distributions that may exceed performance objectives.
- Effective implementation of performance confirmation programs as part of the PA maintenance process.
- What to include in an information repository.
- How to address features, events and processes (identifying and screening for a specific application).
- Modeling to take credit for waste forms and containers.

Several specific topics were identified for near-term consideration during regular conference calls:

- Nuclear Regulatory Commission (NRC) activities associated with unique waste streams and the 10 CFR Part 61 update.
- Updates on activities of the Cementitious Barriers Partnership and the Advanced Simulation Capability for Environmental Management Project.
- Specific issues arising from PAs for CERCLA facilities underway in Kentucky and Ohio.

- Lessons learned from the most recent PAs.

At the end of the meeting, the group developed a list of key messages that were presented at the PA CoP technical exchange:

- The PA CoP is not owned by one agency or group.
- The PA CoP should be self-sustaining and self-directing.
- Activities and output from the PA CoP will not supersede regulatory obligations.
- Key opportunities for the PA CoP are sharing lessons learned, enhancing PA consistency, and sharing data, methods and science related to PAs.
- The PA CoP should strive for recognition as a "go-to" group (like INPO, NCRP, etc).

3.0 SUMMARY OF THE TECHNICAL EXCHANGE

The PA CoP Technical Exchange took place on May 25-26, 2011. Following the approach adopted for previous technical exchanges, the program included introductory presentations about PA-related topics in DOE and other organizations, topical presentations, and some presentations regarding on-going PA modeling activities. Appendix II includes the agenda and a screenshot of the webpage with links to the presentations and videos for this technical exchange.

Topical themes for this exchange included software quality assurance and the role of models for decision making. The use of models for decision making had been consistently identified as an area of interest at previous technical exchanges. Decision making has broad interest because it is relevant for practitioners, oversight personnel and project managers as well as regulators. Likewise, software quality assurance has become a topic of significant interest within DOE-EM as a result of publication of the recent Government Accountability Office (GAO) report entitled "DOE Needs a Comprehensive Strategy and Guidance on Computer Models that Support Environmental Cleanup Decisions." (GAO 2011: http://www.gao.gov/new.items/d11143.pdf).

3.1 Introductory Session

The introductory session included a summary of the PA CoP steering committee meeting (see Section 2), presentations on PA and modeling activities in DOE, NRC, and EPA, and a summary of activities in other national and international organizations. Presentation files and videos of the presentations are provided on the website for the meeting. Only brief descriptions are provided here with along with any key questions or comments from the discussion.

3.1.1 Overview of Global PA Related Activities

Roger Seitz, Savannah River National Laboratory (SRNL), provided an overview of PA related activities not covered in the DOE, NRC and EPA presentations. This overview served as an introduction to other, more focused presentations. The presentation introduced examples of work and recent publications from the International Atomic Energy Agency (IAEA), European Commission (EC), DOE Office of Health, Safety and Security (DOE-HS), and the International Commission on Radiological Protection (ICRP).

The status of IAEA safety standards for waste disposal was summarized including the recent publication (May 5 2011) of the Specific Safety Requirements for Disposal of Radioactive Waste (IAEA 2011). The Safety Guide on Geological Disposal of Radioactive Waste was accepted for publication earlier in the year. Other documents in this series are being prepared: Safety Guide on Near-Surface Disposal (draft form, meeting held in May 2011), Safety Guide on Safety Case & Assessment for Disposal (in review by IAEA Commission on Safety Standards prior to publication), and the Safety Guide on Monitoring and Surveillance (draft for Member State review, comments due August 1, 2011). The IAEA Basic Safety Standards are also being revised and were nearing approval for publication at the time of the Technical Exchange. Further information on the Safety Standards can be obtained at http://www.ns-iaea.org/standards/.

Two on-going IAEA waste safety projects – PRISM and EMRAS II – were also discussed. PRISM is addressing the practical application of the safety case concept and EMRAS II involves nine different working groups considering different aspects of environmental modeling related to radiation safety. Activities of the IAEA's Waste Technology Section were also summarized. DISPONET, ENVIRONET, and the International Decommissioning Network are collaborative networks for sharing information about waste disposal, environmental remediation, and decommissioning, respectively. Internet links for these activities were included in the presentation available on the website for the technical exchange.

The PAMINA project (Performance Assessment Methodologies IN Application) from the European Commission has resulted in a number of publications related to performance assessment. This project assessed the state-of-the-art and examined lessons learned from European experiences in using the PA and safety case concept for deep geologic disposal. The final summary report, published this year, is a comprehensive collection of information related to European PA approaches. There are a suite of reports available at http://www.ip-pamina.eu.

DOE-HS recently completed the new directive on Radiation Protection of the Public and the Environment (DOE Order 458.1). An accompanying technical standard (DOE-STD-1196-2011, DOE 2011) was also produced that includes derived concentration standards based on updated ICRP dose factors. Recent publications from the ICRP were also discussed. ICRP 101 addresses the representative person concept and ICRP 107 addresses the latest radionuclide decay data.

3.1.2 Activities in the DOE-EM Office of Environmental Compliance

Marty Letourneau, DOE-EM-41, presented the status of EM-41 activities related to performance assessment. The presentation addressed DOE Order 435.1, the LFRG, implementation of tank closures, PA Assistance Teams, and PA Scoping and Educational Forums.

As part of the update to DOE Order 435.1, Radioactive Waste Management, several activities have been completed during the past year, including: update of the Complex-Wide Review, two internal workshops and a public workshop held in conjunction with WM 2011, and engagement of the Senior Technical Advisors for reviews. The current schedule aims to complete drafting of the DOE Order by the end of September 2011. The package would then be submitted to the review process with a target for completion of the review process in August 2012.

Several key changes to DOE Order 435.1 could affect PA activities. Examples include proposed updates to address concentration averaging and blending; more detailed information related to maintenance of institutional controls; considerations regarding interpretation of probabilistic results and more information on sensitivity and uncertainty analysis expectations; requirements for protection of biota; and the concept of a systems evaluation for new facilities to address recent concerns about the need for liners in near-surface disposal facilities.

The LFRG will continue to review PAs and related documentation and will serve as one vehicle for promoting consistency in PAs and sharing of experiences and lessons learned. All of the LFRG manuals and guides are being incorporated into DOE Order 435.1 and an accompanying technical standard. The LFRG has also sponsored PA Assistance Team visits to Paducah, Idaho and Hanford to share experiences and lessons learned during the planning and conduct of PAs.

With the implementation of the National Defense Authorization Act (NDAA) Section 3116, there has been a significant increase in the interactions and dialogue with NRC technical staff. This has promoted sharing of ideas and is helping to enhance consistency of PA applications across regulatory regimes. DOE is also engaged in public comment and reviews for on-going rulemaking and regulatory activities at the NRC. There have also been significant efforts to engage NRC and other stakeholders using the PA scoping process. Public education forums, timed to support the release of PAs for public review, have been held at the Savannah River Site and at Los Alamos.

3.1.3 NRC Part 61 Update and PA Implications

David Esh, US NRC, summarized NRC's activities related to the update of 10 CFR Part 61. The NRC has prepared papers that outline the proposed update and provide the technical basis for the proposed changes. The primary driver for the update has been the need to address disposal of large quantities of depleted uranium, but the proposed update also addresses generally applicable requirements for site-specific performance assessments. The proposed changes will address performance assessment, intruder assessment, long-term analysis, and maintenance of analyses at facility closure.

Specific changes proposed for performance objectives include an update to the use of total effective dose equivalent, a staff proposal to specify a period of performance to be used for compliance, and an intruder dose assessment requirement. Some other changes include references to uncertainty and features, events and processes.

The second half of the presentation focused on development of NRC recommendations for period of performance; this has been a controversial topic owing to the divergence of opinion as to an appropriate time frame. As outlined in the presentation, the process used to arrive at the recommendation analyzed five different options, including no change to the existing approach. The options ranged from an assessment to peak dose, a two-tier system, a three-tier system, and an approach similar to that for industrial metals (e.g., RCRA design standard). A two-tier system was proposed by NRC staff.

3.1.4 EPA's Modeling Community of Practice

Gene Whelan, US Environmental Protection Agency, provided an overview of the Community of Practice for Integrated Environmental Modeling (CIEM) and the Interagency Steering Committee on Multimedia Environmental Modeling (ISCMEM). The presentation included examples of collaboration for environmental modeling applications and the modeling platforms and organizations involved in those collaborations. The scope is often broader than that of a PA, but many of the activities are relevant to issues of model development and application for performance assessment.

The CIEM has established a modeling hub (iemHUB.org) where information is shared and modeling tools can be accessed. CIEM recently sponsored an international summit in Washington, DC, involving 25 national and international organizations interested in integrated environmental modeling. The meeting resulted in 15 proposals for collaborative projects.

The iemHUB also hosts information for ISCMEM, a collaborative effort involving nine federal agencies (e.g., NRC, EPA, DOE, USACE), universities and international participants. ISCMEM coordinates integrated environmental modeling across Federal agencies and considers specific aspects of modeling with an emphasis on integrated frameworks. ISCMEM has sponsored workshops on modeling topics and has six working groups focused on specific modeling topics, including software systems design and implementation, uncertainty analysis, subsurface reactive solute transport modeling, and integrated monitoring and modeling. There are specific efforts on standardization of data formats to provide a common framework for integration and sharing of data between different modeling tools.

3.2 Session on Role of Models for Decision Making

The session on the role of models for decision making included both presentations and panel sessions. The presentations addressed stakeholder engagement during the PA process as a way to gain acceptance for PA conclusions and how a composite analysis can be used to guide clean-up decisions sites with multiple contaminated areas and facilities. The presentations were followed by two panel discussions involving practitioners and regulators, respectively.

3.2.1 PA Scoping and Monitoring Experiences

Mark Layton, Savannah River Remediation (SRR), reviewed lessons learned during development of PAs for waste tank closure at SRS, including the scoping process involving NRC, EPA, State regulators, and the public. He also summarized the experience of working with the NRC in their monitoring role associated with on-going tank closure activities. The scoping process aimed to gain early input from regulators during development of the PA, to enhance understanding of the process of preparing a PA, and to yield better decision making at the end of the process.

The scoping meetings addressed specific details regarding conceptual models and assumptions used in the PA modeling. Minutes from each meeting were made available to the general public to document the assumptions being adopted. The meetings specifically targeted some of the more difficult issues early in the process, such as point of assessment, exposure assumptions, etc. Lessons learned from the scoping process included the importance of working with new players over time, the likelihood that new reviewers may question items that were addressed in earlier meetings, and the imperative to strive for clear agreements where possible to minimize potential changes later in the process.

The PA maintenance and monitoring processes also contribute to improved decision making. The maintenance process supports additional studies and provides further confidence in assumptions made for the PA. This allows a decision to be made with some uncertainty, but provides the assurance that follow-up work will help reduce the uncertainty. One of the key lessons learned from maintenance and monitoring is to view the PA as a continuously improving process. New methods may be applied as each new PA is conducted. The use of new approaches does not imply that previous work is inadequate, but it is important to ensure that the assumptions from earlier PAs remain valid. The DOE process includes a requirement for annual reviews to address this need.

3.2.2 Use of Composite Analysis as a Decision Tool

Mark Phifer, SRNL, presented the new SRS site-wide composite analysis (CA) as a tool for making clean-up decisions. DOE Order 435.1 requires that an analysis of all potential contributing sources be conducted to complement a PA for a disposal facility. This is to ensure that the cumulative dose from all potential sources, including the disposal facility, does not exceed the 100 mrem/yr dose standard in DOE

Order 458.1. A dose constraint of 30 mrem/yr is used in DOE Order 435.1 to provide some margin between the composite analysis and the 100 mrem/yr limit identified in DOE Order 458.1.

The SRS CA was developed to include the entire SRS site. Previous versions had focused on facilities and contamination in the general vicinity of the disposal facility (the General Separations Area). By expanding the CA, it can now be used to explore the impacts of different clean-up decisions on cumulative dose to a member of the public on a site wide basis. An important aspect was to ensure that it is possible to trace back to the cause of a specific dose at a given location (i.e., which source leads to a concentration at a given receptor location). This allows the contributions from individual facilities to be managed.

To improve the use of the CA as a decision tool, a configuration management process has been developed for assumptions made in the CA. Given that hundreds of sources are addressed and some of them had not been remediated at the time of the CA, it is important to track the assumptions regarding those sources relative to the final disposition. An Unreviewed Composite Analysis Question (UCAQ) procedure was developed to formalize this process. It is modeled after the concept of an Unreviewed Safety Question process, which has also been adopted for Unreviewed Disposal Questions in the context of a disposal facility. The UCAQ approach provides a formal process to track key inputs and assumptions from the CA (e.g., land use, end-state closure configuration or inventory, model inputs, new SRS missions) and evaluate changes to those assumptions that may affect the CA conclusions.

The ability to identify the specific sources that are driving the primary dose contributions allows decision makers to focus on those sources and to identify potential options to reduce dose contributions as necessary. The CA also includes a number of what-if and uncertainty analyses that address potential changes in assumptions and provide an envelope of acceptable conditions. The current assumptions and the what-if analyses identified no doses that approached the 30 mrem/yr target, but the tools are now in place to identify and assess the impacts of any changes to the current assumptions.

The presentation also summarized how the CA is being integrated with on-going environmental monitoring activities across SRS. This allows the CA modeling results to be compared with monitoring data as another means to build confidence in the validity of the modeling assumptions.

3.2.3 Panel Discussion – Regulators

The first panel discussion emphasized the regulator perspective regarding models and decision-making. The panel featured State regulators and representatives from EPA and NRC. There were panel members from NRC, EPA and State regulatory perspectives.

Regulators are often engaged with stakeholders and the general public, who appreciate effective graphical representations of results. Visualization of results is very important in explaining the basis for decisions, and movies and plume maps are especially useful in this regard. The public also tends to focus on scenario oriented questions rather than modeling details. So, it is important to use models and graphics to show how members of the public are protected and to link exposure scenarios to activities they are familiar with. Members of the public are sensitive to real impacts to themselves and the community and also sensitive to any remarks about protection of children.

When asked about links between models and data/monitoring, the panelists emphasized that changing assumptions are a credibility problem. That is a challenge when comparing data and models given all of the uncertainty associated with PAs. It is important to explain uncertainty up-front and to show that there are ranges of expected values. Also important is the ability to explain any differences between models and data. It is beneficial to illustrate the role of continuous improvement starting with initial data as the basis for a first model, comparing the model and data, seeking more data and improving models as necessary, updating assumptions, etc. The public appreciates a thoughtful process that involves a combination of modeling and data collection working together to support a decision.

When asked about the importance of being able to independently set up and run simulations, panelists recognized that, it is beneficial for regulators or their contractors to be able to work with the models, especially for the more complex decisions and modeling. The NRC considers this essential for the tank closure activities. The cost of proprietary models can be an impediment to reviews in these cases. The use of a “player” version of a model can be helpful to see what was done, but in order to do a complete review for complex systems, the ability to look at and manipulate the full model is necessary.

The regulators were then asked about preferences for deterministic, probabilistic or hybrid models. There is a general preference for simple approaches that are easily understood and explained, where possible. Although there are benefits to using probabilistic approaches, there was a view that they can be difficult to explain and understand in a public forum. Others suggested that it is important to use probabilistic approaches to capture the full range of possible results and to better explain decisions. A significant challenge for probabilistic models or hybrid approaches is defending the abstractions and simplifications needed to extend the model period for thousands or tens of thousands of years.

There was a suggestion from the audience to have simulation tools available online. The panel cautioned against promoting a specific agenda with simulation results, and urged participants to provide the full story, not just the best parts. Online access can be difficult for many members of the public, so there needs to be an effort to contact people directly as well. It was also suggested that, in addition to expressing model results using numbers, it is effective to explain the safety of a concept with words.

3.2.4 Panel Discussion – Practitioners

The second panel focused on views related to models and decision-making from a practitioner perspective. The panel comprised representatives from consultants, DOE contractors, commercial LLW disposal, and National Laboratories.

Practitioners often focus on modeling numbers and output rather than the underlying meaning. Yet a key goal for visualization is presenting complex models and results in an understandable and relatively simple form. It is important to develop trust, and an ability to explain complex concepts in an understandable manner is critical to developing trust. The use of words and graphics (rather than numbers) to explain the "safety functions" of different elements of a disposal system can be very effective. Simple views showing how different radionuclides peak at different times and linking the graphics with explanations of what causes and can affect those peaks is important.

There were a number of views related to transparency and documentation of assumptions, both of which are also important for gaining trust. Having a process for documenting assumptions and the basis for assumptions helps build confidence with reviewers and also leads to more trust because it can be easier to understand why modeling was conducted a certain way. Linking assumptions to safety functions and expectations for different barriers can focus attention on those assumptions that are most critical to performance. Participants deemed critical an ability to demonstrate an understanding of system behavior and which assumptions are most important in terms of potentially affecting the decision to be made.

There was a lot of discussion about the role of data and models. Practitioners and panelists understood the importance of basing models on real site data, and expressed a desire to be able to compare model projections with sampling data. Participants also noted, however, the importance of keeping the input data in the proper context, especially as related to long-range projections (for example, evolution of barriers or global changes over thousands of years). Although, data to support the model are important, uncertainties associated with the data and the model must be explained. For PA applications, uncertainty about evolution of the system often outweighs traditional uncertainty due to variability in parameter values. Panelists recommended a graded approach in which priorities for data collection are driven by what is demonstrated to be important in the modeling rather than simply collecting data to populate a model.

To build confidence, it is desirable to compare model projections with sampling data from the field. However, caution is needed to maintain proper perspective regarding temporal and spatial scales over which comparisons are made and also to not build unrealistic expectations about the level of "validation" that can be achieved. In general, PA modeling and decision making is about capturing larger scale trends and averages rather than point results. Thus, when comparing models and sampling data, larger spatial scales and trends tend to be more representative than point measurements. Point measurements can be used to indicate potential concerns, but need to be placed in proper perspective relative to the scales associated with the decision to be made.

3.3 Current PA Related Activities

Each PA CoP technical exchange has included presentations to provide perspective related to on-going activities around the DOE Complex. This session included examples of PA activities underway at Idaho and Savannah River Site and overviews of the Landfills Partnership and PA related activities being conducted in the DOE Office of Nuclear Energy (DOE-NE). A presentation on approaches used in current PAs for building transparency into models was also provided as a lead-in to the discussions on software QA that followed this session.

3.3.1 DOE Office of Nuclear Energy PA Activities

Geoff Freeze, Sandia National Laboratories, provided a presentation on PA related activities in DOE-NE. Modeling activities in DOE-NE are occurring primarily in two organizations: the Office of Used Nuclear Fuel Disposition Research & Development (e.g., Used Fuel Disposition (UFD) generic PA model

(GPAM)) and the Office of Advanced Modeling and Simulation (NE Advanced Modeling and Simulation (NEAMS) Waste Integrated Performance and Safety Codes).

In the short term (two to three years), the UFD GPAM is working with simplified generic system models based on current capabilities to evaluate options for future disposal. In the future, the effort will incorporate tools generated through the NEAMS model development activities and will eventually fully adopt these advanced models. The NEAMS effort is viewing a longer time frame (~10 years) and considering fully coupled multi-physics models that can be used to inform system level models or be applied directly for detailed analyses.

DOE-NE activities are addressing multiple disposal options for LLW and used nuclear fuel/high-level waste, from the waste form and engineered barriers to migration through the natural environment to the biosphere and receptors. Parallel efforts are underway to develop fully three-dimensional (3-D) tools (NEAMS) and quasi 3-D representations (UFD GPAM) that can be used in a modular structure. These efforts are also being integrated with the ASCEM tools being developed for DOE-EM.

3.3.2 SRS Liquid Waste PA Modeling

Mark Layton, SRR, summarized the status of PA modeling for F Tank Farm, H Tank Farm, and the Saltstone disposal facility at SRS, and shared several lessons learned. These three PAs are in different stages of NRC review and have evolved as a result of the on-going review process.

Significant experience has been gained in the application of hybrid modeling; this approach involves a combination of: 1. deterministic “base case” plus “what-if” sensitivity modeling; and 2. probabilistic uncertainty plus sensitivity analysis modeling. The hybrid approach provides a means to improve overall system understanding and the ability to capture possible but less probable assumptions in an efficient manner. Selection of and agreement on the base case has proven to be a challenge, but it has forced consideration of what is important in the simulations, including the relative importance of different simplifications and what level of simplification is reasonable for different aspects of the modeling.

Multiple assumptions regarding mechanisms of failure were considered for the F and H Tank Farm steel tank liners, including simultaneous and patch failure models. When considering any model simplification, it is important to assess the relative conservatism of different assumptions and how much pessimism is appropriate for a base case used to determine compliance. The general approach has been to include some pessimism, but to attempt to reflect more of the best available information in the base case and to deal with uncertainty in those assumptions through the sensitivity and uncertainty analyses. An established maintenance process provides for on-going assessments of the validity of model assumptions and incorporation of new information as it becomes available.

3.3.3 Landfills Partnership

Craig Benson, University of Wisconsin and CRESP, provided a summary of activities being conducted under the Landfills Partnership. The partnership resulted from a review of issues identified at the Hanford Environmental Remediation Disposal Facility. The partnership provides a forum for independent applied research, discussion of regulatory conflicts and shortcomings, resolution of technological challenges, and participation in independent technical reviews related to DOE technologies or sites.

The partnership’s kick-off meeting, in August 2010, involved 23 participants from DOE, NRC, EPA, State agencies, the private sector, and academia. DOE representation includes participants from SRS,

DOE-RL, Portsmouth, Paducah, Fernald, and UMTRA. The meeting included review and discussion of regulatory paradigms, summaries of projects underway, and a follow-up survey.

The survey responses identified five technical issues, most of which involve improving the confidence of a system component or modeling prediction:

- long-term performance of lined disposal systems;
- degradation mechanisms affecting containment systems;
- performance and evolution of final cover;
- performance monitoring for disposal facilities; and
- PA models for disposal facilities.

The survey responses also highlighted four regulatory issues for consideration by the partnership; most of these issues identify a need or historical problem:

- consistent design approach that includes prescriptive and performance-based concepts and considers the need for liners depending on conditions;
- consistent definition of performance requirements;
- logical time frame for performance expectations consistent with waste characteristics and performance requirements; and
- performance requirements that explicitly acknowledge uncertainty and the degradation of containment systems.

The presentation also summarized activities underway to assess degradation rates of liner materials, characteristics of leachate from different facilities, evolution of covers, and transport characteristics for different barrier materials.

3.3.4 Idaho PA Modeling

Art Rood, Idaho National Laboratory, reviewed recent modeling performed to support a proposed new LLW disposal facility at the Idaho site. The presentation covered the facility siting efforts, preliminary design, waste inventories and forms, modeling assumptions and preliminary results. The current design for the new facility consists of multiple cylindrical concrete vaults for remote handled LLW. The waste will be placed in stainless or carbon steel containers, which will in turn be placed directly in the vaults. The waste forms primarily include ion exchange resins, activated metals and miscellaneous debris.

The modeling was conducted in a graded manner starting with a three-phase screening approach that limited the number of radionuclides for further consideration. The more detailed modeling considered different release mechanisms depending on the waste form. Releases from activated metals were assumed to depend on the corrosion rate of the metal; for resins and other waste forms, release was assumed to occur during surface wash following container failure.

The modeling approach used a simplified 1-D flow model that was informed by the results of 3-D (TOUGH-REACT) modeling that had been conducted independently to evaluate design alternatives for the facility. Some key conceptual assumptions included: cement-altered geochemistry in the materials beneath the vaults but not in the deeper vadose zone; no water flow through intact containers; free flow of water through containers immediately upon initial failure; and a 500-year life for the cover before degradation occurs. There was no sorption assumed in the waste containers or in the fractured basalt. Sorption was assumed to occur in the interbeds and alluvium, and cement was assumed to alter the chemistry in the alluvium beneath the facility.

The calculated doses from the preliminary models were all well below the performance objective of 25 mrem/yr with a peak slightly above 1 mrem/yr. The primary contributors to dose were Tc-99, C-14, I-129 and U-238, each peaking at different times. A one-factor-at-a-time sensitivity analysis evaluated the model's sensitivity to assumptions of corrosion rates, infiltration rates through the cover, iodine Kd, thickness of the interbeds, subsidence, and container type. All of the peak doses from these cases were less than 2 mrem/yr individually. A Monte Carlo uncertainty analysis was also conducted to demonstrate the potential variability in the results. The doses for atmospheric and intruder scenarios were also well within the acceptable standards.

3.3.5 Transparency in Model Documentation

Recent reviews have emphasized the importance of transparency in documentation. In response to a request from the PA CoP, John Tauxe, from Neptune and Company, presented examples illustrating good and bad cases for transparency in coding, user interface, communication, documentation and decision making. This presentation was used as a lead-in to the software quality assurance discussions.

The presentation highlighted the use of modern tools to improve others' use and understanding of computer code. Extensive commenting when developing code should be a standard practice; added efforts – like including ASCII art to illustrate grid space interpretation – can help avoid confusion.

User interfaces have advanced significantly and visual representations of input data, especially for uncertainty analyses, are becoming commonplace. Visual representations provide a sanity check to make sure the shape and values in the distribution are consistent with data (or assumptions) on which they are based.

As models and results are subjected to independent execution and scrutiny, it will be important to document assumptions and linkages. Models should be readable, traceable, supported and informative. Examples using GoldSim were provided to illustrate good practices for traceability and documentation inside the models as well as linkages to documentation outside the model.

3.4 Software Quality Assurance

A report issued recently by the GAO is self-explanatory in its title: "DOE Needs a Comprehensive Strategy and Guidance on Computer Models that Support Environmental Cleanup Decisions." It is important that the PA community understand the recommendations and DOE's requirements for software QA. Two presentations were provided, one addressing DOE's response to the GAO recommendations and providing a detailed description of EM's software quality assurance requirements and a second presentation including lessons learned from LFRG reviews of PA software QA.

3.4.1 DOE-EM Policies for Software QA

Bob Murray, Director of the DOE-EM Office of Standards and Quality Assurance, summarized the DOE-EM response to the GAO recommendations. The presentation included detailed discussion of DOE requirements related to software QA.

The GAO report identified several issues to which DOE-EM took exception. The report implied shortcomings in guidance, oversight, and central coordination for quality of models used for EM cleanup decisions. The presentation included a detailed discussion of EM policies and guidance that address these areas. EM's position is that these policies and guidance ensure full compliance with DOE directives related to software QA.

DOE concurred, with significant clarifying discussion, with three specific recommendations from the GAO report; these recommendations urged clarification of specific quality assurance requirements for computer models, assurance that models are assessed for compliance, and development of a comprehensive strategy and guidance for the management of computer models DOE has developed a path forward to address each of these recommendations. The response involves coordination with the DOE Office of Corporate Information Technology and DOE-HS, which are responsible for software quality assurance policy; one action involves processing all computer models through the EM IT Governance process.

3.4.2 LFRG Lessons Learned on Software QA

Susan Krenzien, Navarro-Intera, presented lessons learned from LFRG reviews of PA software QA. Susan cited three examples that highlight the attention being placed on software QA: the PAMINA summary report (PAMINA 2011, see Section 3.1.2 of this report), the GAO report discussed above, and a recent letter from the DNFSB to DOE regarding a lack of control of a safety related computer program.

The LFRG review has four criteria related to software QA: sufficient documentation and verification, traceability of input data, justification and defensibility of assumptions, and clear description of computational steps. The presentation included practical examples of good and bad practices for these four criteria.

Common LFRG review comments concern inadequate documentation of data sources and assumptions, inconsistent use of data in different aspects of a model, and a lack of documentation for assumptions. Configuration control is necessary for models, input and output files, and linkages between different codes, spreadsheets, etc.

Another frequent LFRG comment concerns documenting the flow of information and linkages between models. The presentation illustrated the level of detail required to clearly illustrate the computational steps, data files, and flow of information associated with modeling activities.

3.5 ASCEM and Cementitious Barriers Partnership Updates

DOE-EM is supporting two major model development activities: ASCEM and the Cementitious Barriers Partnership (CBP). Last year's technical exchange focused on providing input for these activities. This year ASCEM and the CBP were asked to provide status updates on the model development work.

3.5.1 ASCEM

Paul Dixon, ASCEM Multi-Laboratory Program Manager, reported on progress and plans for the ASCEM program. ASCEM is being designed as an open source and modular state-of-the-art toolset to support decision making for waste disposal and cleanup activities. Eight different National Laboratories are engaged in the project. The project is divided into three thrust areas: the Platform, the High Performance Computing (HPC) core, and Site Applications. The Platform Thrust is developing the user interface and integrating tools, and the HPC Thrust is developing the simulators. The Site Applications

thrust is conducting the ASCEM demonstrations and engaging the user community to identify needs and participate in site-oriented demonstrations as the tools are developed.

The presentation summarized the tools being developed, ASCEM interactions with the user community, and relationships with other modeling activities, including NEAMS, Advanced Field Research Initiatives (AFRIs), and coordination with other DOE offices. The progress summary included completion of the Phase I demonstration in December 2010.

The presentation described a graded approach to development of ASCEM, including the transition from a research and development code to a community code and finally to a regulatory code. Version 1 of the integrated toolset was released in June 2011 as an alpha product for internal ASCEM use. A beta release is planned for September, with a candidate Version 1 release date expected in FY 2012. There are plans to engage a broader set of users (beyond the ASCEM team) in limited demonstrations in FY 2013.

Plans for FY 2011 focused on developing a first version of the integrated toolset with limited functionality and on initiating the Phase II demonstration of the integrated toolset. A technical peer review was also completed in August 2011. ASCEM working groups for the SRS F Area, Hanford Deep Vadose Zone and Waste Tank Performance Assessment are continuing their activities for the Phase II demonstrations. Interactions with the user community – including this technical exchange – are continuing. There is also increasing emphasis on interactions with DOE-EM small sites to identify opportunities for demonstrations of the toolsets.

3.5.2 Cementitious Barriers Partnership

Greg Flach, SRNL, provided an update on the CBP model development efforts. The partnership brings together subject matter expertise in the many different uses of cementitious materials for waste management, and emphasizes the importance of “taking credit” for long-term performance of those materials as part of PA calculations. The CBP includes participants from National Laboratories, the NRC, NIST, private industry and academia. The CBP is also working on integration with ASCEM as part of the ASCEM Phase II demonstration.

The CBP tools focus on near-field (source term) processes that serve as inputs to a site model for predicting migration through the vadose zone and into an aquifer. Laboratory and model development activities are being conducted in parallel. The model development activities include extension/enhancement of existing tools into an integrated framework. The CBP has established a set of reference cases and reference materials that are being used to demonstrate capabilities of the models.

The presentation included examples of calculations that have been compared with experimental data for contaminant retention, chemical and mechanical changes, and ingress of CO_2 and O_2. The emphasis is currently on integration of the codes into a common interface being developed with the GoldSim model. The integrated model will also include a sensitivity and uncertainty analysis driver.

3.6 Close Out

Participants held an open discussion and, to provide additional input to the Steering Committee, completed survey forms to suggest future activities. Suggestions for future activities and topics included:

- Leveraging experience from Yucca Mountain (consider including a representative from DOE-NE on the Steering Committee and establishing ties with NEAMS and other NE modeling efforts.)
- Development of an information repository and website for information sharing – perhaps a PA wiki site with example data, experiments, modeling projects, links to existing PAs, scoping meetings, CAs, DAS related documentation, IAEA, ITRC, etc.
- Confidence building and performance confirmation (integration of monitoring and modeling); examples of retrospective studies to demonstrate effectiveness of modeling
- Features, events and processes (and how to efficiently apply in practice)
- Modeling of different waste forms (cementitious, activated metals, glass, etc.)
- A standardized view of specific elements of performance assessment (to illustrate similarities between PAs and PA-like analyses)
- Effective communication of technical topics to the public
- PA topical presentations to describe the process to the general public (currently viewed as a black box)
- Interpretation of results and accounting for biases in conceptual models (such as excluding processes)
- Appropriate use of generic data and upscaling of data for use in models
- Visualization tools and approaches
- Case histories to illustrate evolution of conceptual models as new information is obtained (graded approach, iterative process)
- Examples of QA experiences and approaches from Yucca Mountain
- Survey of computer codes (list of codes being used and a standard set of questions that a new user can refer to understand code capabilities, limitations, etc.)
- Conference calls or short seminars on specific technical topics
- Guidance for a common reporting structure for PAs and supporting documents used for input data or assumptions
- Evaluating compliance vs. a deterministic standard when using probabilistic modeling approaches and communicating this to decision makers and stakeholders
- Waste characterization and waste package confirmation as inputs for modeling

4.0 REFERENCES

DOE, "Derived Concentration Technical Standard," DOE-STD-1196-2011, Department of Energy Office of Environmental Policy and Assistance, Washington, DC (2011). (http://www.hss.doe.gov/nuclearsafety/ns/techstds/standard/standard.html)

GAO, "DOE Needs a Comprehensive Strategy and Guidance on Computer Models that Support Environmental Cleanup Decisions," GAO-11-143, US Government Accountability Office, Washington, DC (2011). (http://www.gao.gov/new.items/d11143.pdf)

IAEA, "Disposal of Radioactive Waste," Specific Safety Requirements No. SSR-5, IAEA, Vienna, Austria (2011). (http://www-ns.iaea.org/standards/)

PAMINA, "PAMINA: Performance Assessment Methodologies in Application to Guide to the Development of the Safety Case – Project Summary Report," D5.1, Version 1, European Commission, Brussels, Belgium (2011). (http://www.ip-pamina.eu)

This page is left blank intentionally.

APPENDIX I. AGENDA FOR STEERING COMMITTEE MEETING

AGENDA

PERFORMANCE ASSESSMENT COMMUNITY OF PRACTICE STEERING COMMITTEE

May 24, 2011 - Downtown Hyatt Hotel, Atlanta, GA

Call-In Number: (803) 725-1403, Access code: 6858190

1:00 – 1:15 – **Welcome and Introductions – Martin Letourneau**

1:15 – 2:00 – **Original Concept for PA CoP and Proposed Activities – Letourneau**
Reference Materials
- SRNL-STI-2009-00062 – Waste Management Paper
- Recommendations of 27 Aug 09 (PA CoP Exchange #1)
- 2010 PACoP Meeting Summary (PA CoP Exchange #2)

2:00 – 2:45 – **Discussion of Charter and Future Approach for PA CoP – All**
Reference Material
- PA CoP EM-41 Rev 1 rs markup

2:45 – 3:15 – Break

3:15 – 3:45 – **Suggested Revisions to Charter – All**

3:45 – 4:30 – **Sharing of Information Related to PA CoP, ASCEM Links – All**

4:30 – 5:00 – **Steering Committee Recommendations to be Presented to PA CoP Technical Exchange - All**

This page is left blank intentionally

APPENDIX II. TECHNICAL EXCHANGE AGENDA

Table II-1. Website version of the agenda for the Technical Exchange (The agenda and links to presentation files and video are available at http://srnl.doe.gov/copexchange/2011/).

U.S. DEPARTMENT OF ENERGY

Performance Assessment Community of Practice Technical Exchange

May 25-26, 2011 Atlanta, Georgia

SRNL

AGENDA | HOTEL INFO | REGISTER | CONTACTS | EVENT MEDIA | PRESENTERS | PREVIOUS EXCHANGES | HOME

Preliminary Agenda

Day 1 Tuesday, May 24th

TIME EDT	TITLE/EVENT	PRESENTER
1:00 - 5:00 pm	Steering Committee Meeting	

Day 2 Wednesday, May 25th — Click here to view the live Webcast. — Click here to ask the presenter a question.

TIME EDT	TITLE/EVENT	PRESENTER
7:30 - 8:00 am	Registration	
8:00 - 9:00 am	Welcome and Introductory Presentations	
	PA CoP Status and Plans	Martin Letourneau (US DOE EM-41)
	Status of Other PA-Related Activities	Roger Seitz (SRNL)
9:00 – 9:45 am	DOE, NRC and EPA Developments	
	EM-41 Activities and PA Implications	Martin Letourneau
	Discussion	
9:45 - 10:00 am	*Break*	
10:00 – 11:15 am	DOE, NRC and EPA Developments (Continued)	
	NRC Part 61 Update and PA Implications	David Esh (NRC)
	EPA Modeling Community of Practice/ISCMEM	Gene Whelan (EPA)
11:15 am– Noon	Discussion	
Noon - 1:00 pm	*Lunch*	
1:00 - 2:30 pm	Models and Regulatory Decision Making	
	SRS NRC Scoping and Monitoring Experiences	Mark Layton (SRR)
	Use of Composite Analyses as a Decision Tool at DOE Sites	Mark Phifer (SRNL)
2:30 - 2:45 pm	*Break*	
2:45 – 4:45 pm	Models and Regulatory Decision Making (Continued)	
	Panel Discussion: Regulator Views of Models and Decision Making	Martin Letourneau, Moderator
	Panel Discussion: PA Practitioner Views of Models and Decision Making	Roger Seitz, Moderator
4:45 – 5:30 pm	Open Discussion – PA CoP Plans for the Future	

RETURN TO TOP

Day 3	Thursday, May 26th	Click here to view the live Webcast.	Click here to ask the presenter a question.

TIME EDT	TITLE/EVENT	PRESENTER
8:00– 10:00 am	**Current PA Related Activities**	
	DOE-NE Performance Assessment-Related Activities	Geoff Freeze (Sandia)
	SRS Tank Farm Modeling	Mark Layton (SRR)
	Landfills Partnership	Craig Benson (CRESP/ University of Wisconsin)
10:00 - 10:15 am	*Break*	
10:15 – 11:45 am	**Current PA Related Activities (Cont.)**	
	Idaho PA Activities	Art Rood (INL)
	Transparency: The Lighter Side of Modeling	John Tauxe (Neptune & Co.)
11:45 am - 1:00 pm	*Lunch*	
1:00 - 2:30 pm	**Quality Assurance For Assessment Software**	
	DOE Software QA Directives	Robert Murray (EM-23)
	LFRG Lessons Learned on QA	Susan Krenzien (Navarro-Intera)
2:30 - 2:45 pm	*Break*	
2:45 – 4:00 pm	**ASCEM and CBP Updates**	
	ASCEM Progress and Plans, Including QA	Paul Dixon (ASCEM Project Lead)
	CBP Progress and Plans	Greg Flach (SRNL)
4:00 – 5:00 pm	**Close out – Summary of Exchange, CoP Plans for the Future**	
5:00 – 6:00 pm	**GoldSim Modeling Roundtable**	

RETURN TO TOP

AGENDA | HOTEL | REGISTER | CONTACTS | MEDIA | PRESENTERS | PREVIOUS EXCHANGES | HOME

SRNS

FLUOR DANIEL • NORTHROP GRUMMAN • HONEYWELL

SRNL is managed and operated for the U.S. Department of Energy by Savannah River Nuclear Solutions, LLC

Distribution:

R. S. Aylward, 773-42A
B. T. Butcher, 773-43A
D. A. Crowley, 773-43A
G. P. Flach, 773-42A
G. K. Humphries, 705-3C
M. A. Phifer, 773-42A
R. R. Seitz, 773-43A
C. Wilson (1 file copy & 1 electronic copy), 773-43A - Rm. 213