

Performance Assessment to Support Closure of Single-Shell Tank Waste Management Area C at the Hanford Site

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management
Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800



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Date Published
January 2010

To Be Presented at
Waste Management Symposia 2010

WMS
Phoenix, Arizona

March 7-11, 2010

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**Performance Assessment to Support Closure of Single-Shell Tank
Waste Management Area C at the Hanford Site – 10402**

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ABSTRACT

Current proposed regulatory agreements (Consent Decree) at the Hanford Site call for closure of the Single-Shell Tank (SST) Waste Management Area (WMA) C in the year 2019. WMA C is part of the SST system in 200 East area of the Hanford Site and is one of the first tank farm areas built in mid-1940s. In order to close WMA C, both tank and facility closure activities and corrective actions associated with existing soil and groundwater contamination must be performed. Remedial activities for WMA C and corrective actions for soils and groundwater within that system will be supported by various types of risk assessments and interim performance assessments (PA). The U.S. Department of Energy, Office of River Protection (DOE-ORP) and the State of Washington Department of Ecology (Ecology) are sponsoring a series of working sessions with regulators and stakeholders to solicit input and to obtain a common understanding concerning the scope, methods, and data to be used in the planned risk assessments and PAs to support closure of WMA C. In addition to DOE-ORP and Ecology staff and contractors, working session members include representatives from the U.S. Environmental Protection Agency, the U.S. Nuclear Regulatory Commission (NRC), interested tribal nations, other stakeholders groups, and members of the interested public. NRC staff involvement in the working sessions is as a technical resource to assess whether required waste determinations by DOE for waste incidental to reprocessing are based on sound technical assumptions, analyses, and conclusions relative to applicable incidental waste criteria.

INTRODUCTION

The U.S. Department of Energy, Office of River Protection (DOE-ORP) is pursuing closure on the Single-Shell Tank (SST) Waste Management Area (WMA) C under the requirements of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)[1] timeline and in accordance with federal requirements and State-approved closure plans and permits. Current baseline plans at the Hanford Site (Fig. 1) call for closure of the WMA C in the year 2019. WMA C is part of the SST system in 200 East area of Hanford (Fig. 2) and is one of the first tank farm areas built in mid-1940s.

Environmental releases from SSTs and related facilities have occurred in the past to the underlying vadose zone in vicinity of the WMA C. Notable facilities to be addressed in the closure of WMA C include 12 large SSTs each with a capacity of $2 \times 10^{+6}$ L (530,000 gal), 4 smaller SSTs each with a capacity of $2 \times 10^{+5}$ L (55,000 gal), a catch tank, a vault with 4 tanks, 7 diversion boxes, and about 16 km (10 miles) of pipelines (Fig. 2). In addition, 14 unplanned releases to the soil have been recorded, but documentation on these releases is limited and other undocumented losses might also exist.

In order to close WMA C, tank and related facility remedial activities and corrective actions associated with existing soil and groundwater contamination must be performed. Some of the needed activities are

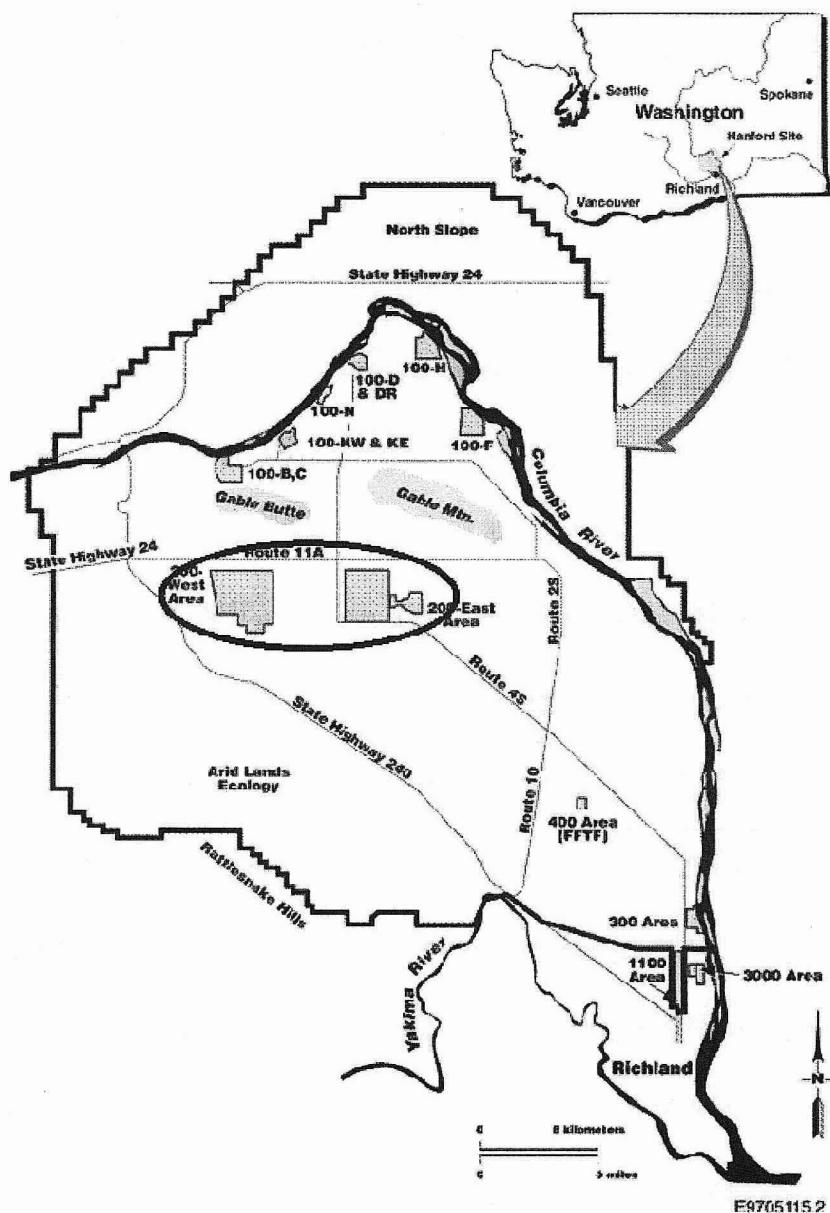


Fig. 1. Hanford Site and its location in Washington State.

now underway for WMA C. Remedial activities underway now include retrieval of wastes stored in SSTs and the second phase of corrective measure investigations to characterize past spills and leaks using available data and various conceptualizations for potential source, fate and transport. Additional investigations are planned for assessing and determining disposition of ancillary equipment within the tank farm through actual demonstrations and technical evaluations. These actions will provide necessary information to ensure compliance with applicable laws and regulations including DOE Orders and *Resource Conservation and Recovery Act of 1976* (RCRA)[2] permit conditions. Remedial activities for WMA C and corrective actions for soils and groundwater within that system will be supported by various types of risk assessments and interim performance assessments (PA). These risk assessments and PAs will provide information necessary for the remedial decision process and the baseline assessments of soils and groundwater.

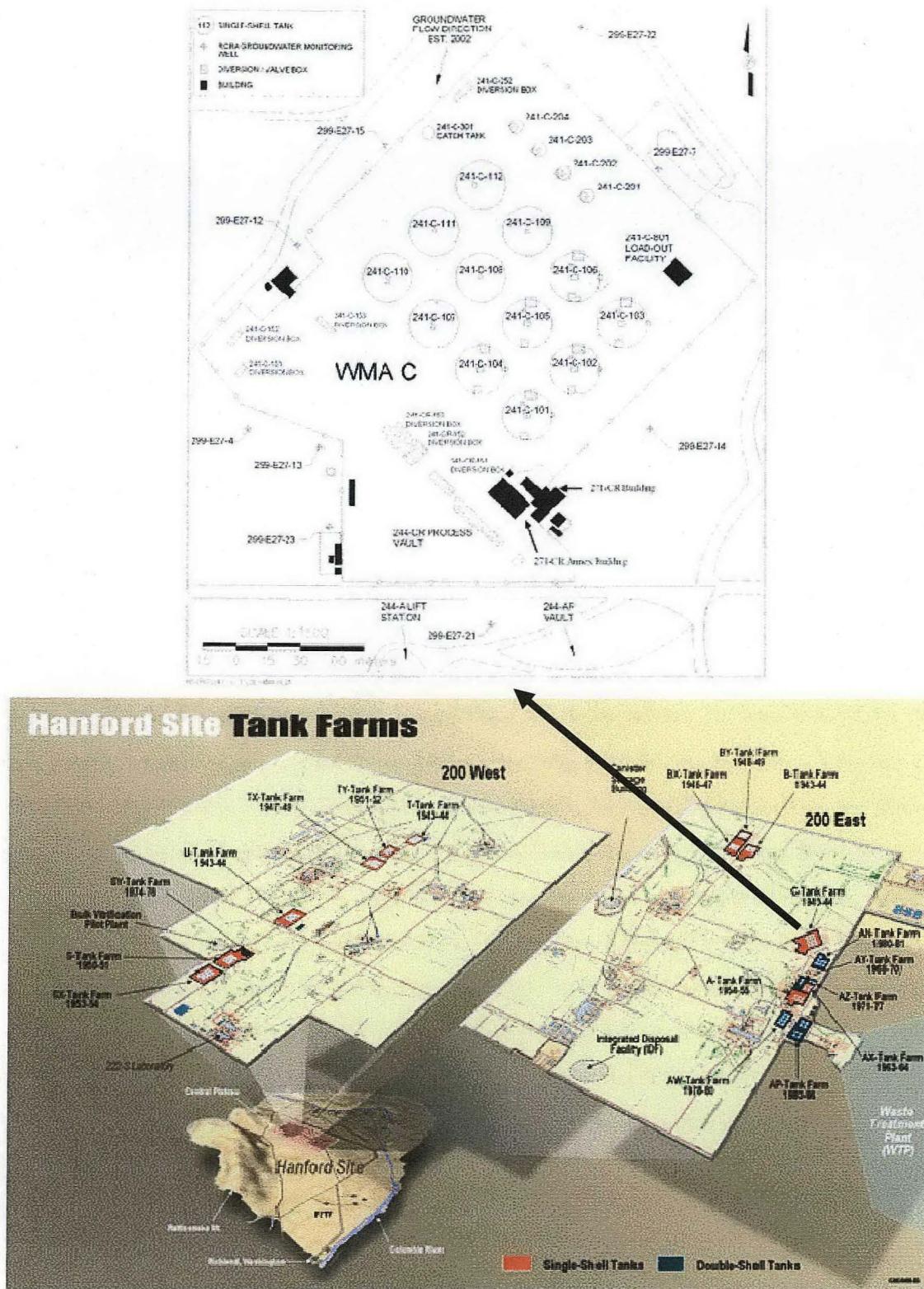


Fig. 2. Single-shell tanks and related facilities in Waste Management Area C in 200 East area of the Central Plateau of the Hanford Site.

A baseline risk assessment is required to support RCRA and RCW 70.105, "Hazardous Waste Management Act"[3] decisions associated with non-radiological contamination. Both radiological and hazardous chemical investigations and remediation are underway for WMA C as part of the Federal Facilities Compliance Agreement Process. A PA is also required under DOE Order 435.1[4, 5, and 6] to support decisions about closure activities at facilities with radioactive waste, as well as waste determination evaluations for incidental materials that are not able to be retrieved and are left in SSTs at closure.

Additionally, the Richland Operations Office of DOE (DOE-RL) will close other facilities near WMA C and will be responsible for producing the Hanford Site Composite Analysis, which discusses the impacts from all sources at the Hanford Site.

The final WMA PA will be based on final closure decisions following the issuance of the final Tank Closure and Waste Management Environmental Impact Statement (TC&WM EIS) and issuance of the Record of Decision (ROD) and data collected prior to closure. A draft TC&WM EIS[7] was published in the Federal Register on October 30, 2009 which has started a 140-day public review period. .

OVERALL SCOPING PROCESS

Staff from DOE, U.S. Nuclear Regulatory Commission (NRC), Washington State Department of Ecology (Ecology), and U.S. Environmental Protection Agency (EPA) have been participating in a scoping process involving series of technical exchanges (working sessions). These technical exchanges focus on the proposed inputs for "Long-Term Human Health and Environmental Assessment for Waste Management Area C" (WMA C PA). Participation by the Tank Farm Operations Contractor (TOC), Washington River Protection Solutions, LLC (which has the general responsibility for the preparation of the WMA C PA and the planning and implementation of closure activities) has provided general administrative services and technical expertise to support the scoping process and technical working sessions. Other participants in the working sessions include the Oregon Department of Energy, several tribal nations, members of the Hanford Advisory Board, and other stakeholders and members of the public.

The working sessions are intended to capitalize on early interactions between the regulatory agencies, tribal and stakeholder communities with a goal of producing the WMA C PA. Ultimately, the related Waste Determinations, RCRA Closure Plans, and *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA)[8] RODs will be based on the PA. Technical discussions allow for the identification and clarification of specific technical questions related to 1) conceptual models and alternatives, 2) exposure scenarios, and 3) specific data and parameter values that will be needed to support development and implementation of the numerical model calculations used in the PA. The choices made and the bases for the choices are expected to be documented during the scoping process to provide sufficient transparency, and ensure that all decisions about the scope, the methods used, and the specific parameter and data values selected for the WMA C PA are traceable for this assessment.

The goals and objectives of the scoping process were established in an initial planning session conducted in February of 2009. This initial session was also used to establish a schedule and sequence of technical working sessions that would help communicate and facilitate solicitation of regulator and stakeholder input on the overall scope, methods, and data used in the WMA C PA (see Table I). This involvement approach is based on lessons learned from previous efforts such as the Hanford Tanks Performance Assessment Initiative, the C-106 closure process, recent performance assessments at other DOE Sites,

review of National Research Council recommendations on risk assessments as well as various assessments across the DOE complex.

Table I. Completed and Future Working Sessions for WMA C Performance Assessment.

Working Session Number	Working Session Topic	Working Session Dates
0.	Working Session Goals, Objectives, and Processes^a	Feb. 24-25, 2009
1.	Tank Residual Inventories following Retrieval^a	May 5-7, 2009
2.	Performance Assessment Context and General Conceptual Models^a	Sept. 1-3, 2009
3.	Soil Inventories from Past Releases^a	Oct. 27-29, 2009
4.	Engineered System #1 (Detailed conceptual models of recharge, barrier degradation, and tank residual waste release) ^a	Jan. 26-28, 2010
5.	Natural System (Detailed conceptual models of near surface environmental, vadose zone, and groundwater systems)	Mar. 30-April 1, 2010
6.	Engineered System #2 (Detailed conceptual models of steel corrosion/degradation, grout degradation for tanks and related facilities)	May 25-27, 2010
7.	Review of Conceptual Model(s) and Key Features, Events, and Processes for Engineered and Natural Systems	July 27-29, 2010
8.	Exposure Scenarios (Detailed conceptual models and data associated with exposure scenarios)	Sept. 28-30, 2010
9.	Selection and Application of Risk Assessment and Performance Assessment Numerical Codes	Jan. 25-27, 2011
10.	Results from Initial Risk and Performance Assessment Analyses	Aug. 30-Sept. 1, 2011
11.	To be determined	Oct. 25-27, 2011
12.	Results from Final Risk and Performance Assessment Analyses	Jan. 24-26, 2012

^aCompleted Working Session.

By the date of this symposium, four technical sessions have been completed. They addressed 1) the estimated tank waste residual inventories in SSTs and related facilities (Session 1 in May 2009), 2) a high-level overview of the assessment context and general conceptual models of WMA C (Session 2 in September 2009), 3) the estimated inventories that have been and will be released to soils beneath the WMA C (Session 3 in October 2009), and 4) the recharge, barrier degradation, and tank residual waste releases following the emplacement of the surface engineered barrier and grout in tanks – Engineered System #1 (Session 4 in January 2010).

Several working sessions are planned in the coming months to cover detailed discussions of 1) conceptual models of the near-surface environment, vadose zone, and groundwater systems – Natural System (Session 5 in March 2010); 2) conceptual models of tank corrosion/degradation and grout degradation – Engineered System #2 (Session 6 in May 2010); 3) a review of overall conceptual models and key features, events, and processes (FEPs) of the Engineered and natural systems (Session 7 in July 2010); and 4) exposure scenarios (Session 8 in September 2010). The overall objective of the completed and planned technical working sessions is to present the detailed state of knowledge and understanding for

each selected topic area and to systematically solicit input from regulators and stakeholders on conceptual models, key FEPs, and other potential model input prior to the initial iterations of the planned baseline risk and performance assessments planned in fiscal years 2011 and 2012.

This WMA C PA will support the needs of the regulatory agencies involved in the formal review and approval of documents associated with the closure of WMA C and Tri-Party Agreement[1]-established RCRA Corrective Actions in WMA C that rely on the long-term human and environmental assessments. The goal of the working sessions or associated documents is not to interpret the results of the assessment with regards to regulatory implications. Such evaluations will be done as part of the separate regulatory review of the documents that directly support the regulatory decisions. No consensuses reached in these working sessions will negate the regulatory authority of any agency involved in the scoping process.

Working session participants are divided into four classifications: 1) Leads, 2) Members, 3) Subject Matter Experts (SMEs), and 4) Observers.

Leads: Each of the regulatory agencies (DOE, NRC, Ecology, and EPA) has a designated Lead. Administrative duties for each working session have been assigned to an Administrative Secretary. This role has been filled by a representative of the TOC. This representative is also designated as the Lead for the TOC. Leads have the ability to sign documents/minutes and commit the organization represented. Leads can submit to the Lead for DOE, through the Administrative Secretary, any changes in participants from their organization, any draft alternate materials, and any issue papers.

Members: The Leads of the regulatory agencies and the TOC select Members of their organization who are expected to actively participate in every working session. For other organizations, the appropriate management selects members, submitting their names to the Lead for DOE, through the Administrative Secretary.

Subject Matter Experts: SMEs attend and present materials at working sessions for which they are designated. Presentation material is provided to the Administration Secretary by the start of the working session. Names of the SMEs are submitted to the Lead for DOE through the Administrative Secretary.

Observers: Observers are participants who may only attend a few meetings. Names of observers are submitted to the Lead for DOE through the Administrative Secretary at least two weeks before the working session that they will be attending. The lead for DOE may limit the number of observers due to space constraints or other factors.

The regulatory agencies officially sponsoring the working sessions include 1) DOE-ORP, DOE-RL, and DOE Office of Environmental Management (DOE-EM); 2) EPA; 3) NRC; and 4) Ecology. All of the working sessions (see Table I for the list of working sessions) have been and will be hosted by Ecology at their Richland, Washington Office.

Other notable participants include:

- The Oregon Department of Energy
- The Tank Waste Committee – Hanford Advisory Board
- The Confederated Tribes of Umatilla Indian Reservation
- The Environmental Restoration and Waste Management Program – Nez Perce Tribe
- The Yakama Indian Nation
- CH2M-Hill-Plateau Remediation Contractor and Subcontractors
- AREVA Federal Services, LLC

- Science Applications International Corporation representing the TC&WM EIS effort
- Pacific Northwest National Laboratory.

WORKING SESSION ORGANIZATION AND SUPPORTING MATERIALS

Each working session runs over a three-day period and the agenda of a working session commonly contains the following general elements:

- Statement of goals and objectives of the working session
- Introduction of participants
- Review of ground rules and scope of the working session
- Discussion of unresolved issues from previous working sessions
- Presentations and discussions of the current topical areas
- Presentation of draft material and justification
- Presentation of any alternate viewpoints (suggested by working session participants)
- General discussion
- Detailed topical review of the presentation and technical written materials
- Review of preliminary meeting notes
- Review of concurrences, agreements, actions and issues
- Presentation of the next working session's topic (presentation of general areas to be covered and methods to be used in generation of draft materials)
- Solicitation of feedback on working session.

Technical reports and/or data packages are created to provide background material for the topical areas being discussed in each of the working sessions. This written material is prepared prior to each working session to provide a straw man for the working sessions to solicit input from participants. This written material references existing work and provides justification for the recommended path forward for a particular topic area of the PA. The written material provides a discussion of the role of uncertainty in the specific subject area of interest (conceptual models, numeric models, or model parameters) and what cases the PA should consider to adequately describe or bound the uncertainty.

The Administrative Secretary is expected to send draft technical background materials to DOE-ORP about six weeks before the working session. The Administrative Secretary is expected to revise the material based on review by DOE-ORP and finalize the draft material for transmittal to Leads and Members four weeks prior to the working session date.

The agenda and all supporting presentation and written technical material is posted on a website dedicated to the WMA C PA working sessions prior to each working session for registered participants::

Written material is prepared prior to each working session to provide a straw man for the working sessions to solicit input from participants. This written material references existing work and provides justification for the recommended path forward. The written material provides a discussion of the role of uncertainty in the specific subject area of interest (conceptual models, numeric models, or model parameters) and what cases the performance assessment should run so that the performance assessment can adequately describe or bound the uncertainty.

All presentation materials for the working session are made available to the Administrative Secretary by the start of the working session so they can be distributed at the meeting or posted on a working session

website for members participating in the workshop by telephone. If the materials are not sent in advance, then the presenter is expected to make sufficient copies of the presentation materials for distribution at the working session.

One of the goals for each working session is to reach consensus on the submitted technical reports and data packages. Working session decisions are made by consensus of the Leads of Regulatory Agencies present at each working session. If consensus cannot be reached, the Leads are expected to agree at the working session on how to proceed to resolve any disputes or differences of opinion. The submitted technical materials and data packages are expected to be eventually used as sections in the PA. Any suggested revisions to the written materials can be submitted to the Administrative Secretary during the working session.

In addition to the draft technical written materials, other key references have been made electronically available and posted on the DOE-ORP web site accessible by registered working session participants. Leads for regulatory agencies are encouraged to contact the preparers of the draft material to request other reference information of interest that should be posted for a specific session.

Each of the working sessions has been facilitated to focus discussions and to capture important issues, consensuses, and action items raised by all participants. These notes are generally captured on flipcharts used during each working session which become part of the general meeting notes for each session. The general ground rules for each session put forth by the facilitator include the following: 1) each working session participant will be treated with respect and 2) all participants will observe the various deadlines associated with each working session.

Detailed notes of the working session meeting (including copies of presentation) are also created and maintained by the TOC. The Lead from DOE-EM has also created a set of notes that capture the main points, conclusions, and consensuses from each working session.

LESSONS LEARNED FROM SCOPING PROCESS

The scoping process and related working sessions have provided a valuable approach for building trust and reaching a common understanding with the regulator and stakeholder community on the state of knowledge for the WMA C. The process of soliciting inputs and technical guidance on the specific methods, modeling approaches, and modeling parameters and data is ongoing and will continue through upcoming working sessions. Other important lessons learned from the scoping process and working sessions are described in the following section.

Opportunities for Sharing Regulator and Stakeholder Community Inputs

The working session participants represent a diverse knowledge base of varied technical backgrounds that offers many points of view and perspectives. In our attempts to capture some of these alternative viewpoints, participants from regulator and stakeholder groups have been invited to assist with making presentations where appropriate or given specific opportunities to provide alternative points of view in topical areas of interest. This solicitation process has so far yielded two presentations from the regulator community and two presentations from interested stakeholders on specific topics.

Involved regulator presentations included the following:

- A presentation entitled “High-level approach to estimate soil inventories” by Ecology staff during the Soil Inventory Working Session (Session 4 held October 26 to 28, 2009). This is a joint process used by Ecology, DOE, and the TOC to estimate soil inventories from historical tank and pipeline leaks and losses.
- A presentation entitled “Features, Events, and Processes” by NRC staff during a session on the FEPs process of the Soil Inventory Working Session (Session 4 held on October 26 to 28, 2009).

Involved stakeholder presentations included the following:

- A technical presentation entitled “*241-C Tank Farm and Recent Groundwater Contamination at the Hanford Site, Washington*” given by a technical staff member from the Nez Perce Tribe during discussions of alternative conceptual models discussion of the Assessment Context Working Session (Session 3 held on September 1 through 3, 2009).
- A presentation on “Soil Inventory Uncertainty” given by staff from the Oregon Department of Energy during the Soil Inventory Working Session (Session 4 held on October 27 through 29, 2009).

These presentations were appreciated by all participants and yielded valuable technical input to the detail discussions for the related topical area. Soliciting involvement from the regulatory community participants and interested stakeholders during the future working session will continue to be a priority for the scoping process.

Use of Features, Events, and Processes (FEPs) Methodology

The commitment to the use of a graded approach involving the FEPs analysis methodology for the WMA C PA has arisen from the emphasis placed in working sessions by NRC staff on using a structured process for the identification of important and relevant FEPs in development of conceptual models. The FEPs methodology is a process that has been used in geologic repository programs internationally for logically identifying, classifying, and screening comprehensive lists of potentially relevant FEPs[9, 10].

The development of conceptual models and exposure scenarios for the WMA C PA considers results from work done by DOE-RL at the Site under the Groundwater Vadose Zone Program and documented in “Groundwater/Vadose Zone Integration Project: The Application of Feature, Event, and Process Methodology at the Hanford Site”[11] and “A Comprehensive and Systematic Approach to Developing and Documenting Conceptual Models of Contaminant Release and Migration at the Hanford Site”[12]. Within this program, DOE-RL was looking for a systematic methodology to promote consistency and completeness in the development of the conceptual model at Hanford and to provide needed backup documentation to support ongoing long-term assessments. After a review of existing methodologies, the Groundwater Vadose Zone Program selected and made use of a methodology called the Features, Events, and Processes Analysis Methodology that has been in use within the international community for development of conceptual models to support nuclear waste disposal system PAs.

Other working session participants have been supportive of NRC’s recommendation to emphasize the FEPs approach in development of conceptual models and alternatives. However, the level of detail used to screen and develop supporting documentation for including or excluding FEPs in support of the PA has not yet been clearly articulated.

Future planned working sessions related to discussions of Engineered and natural systems associated with the WMA C will provide an emphasis on addressing relevant FEPs in the development of related conceptual models and alternatives. As a straw man for working session discussions, a primary emphasis will be placed on key FEPs identified in guidance for NRC staff reviews of waste determinations as provided in NUREG-1854, "NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations. Draft Final Report for Interim Use"[13]. Presentation and technical materials provided for these sessions will also build upon the FEPs related to work done by DOE-RL.

Use of Scoping Calculations to Support Future Working Sessions

As the working sessions have evolved, discussions regarding key FEPs related to the development of conceptual models and viable alternatives have progressed in complexity among the participants. As a result, a need has been recognized by the working session participants that some preliminary scoping calculations may be useful to include in future working sessions to begin to evaluate the importance of certain alternative conceptual models, scenarios, and/or PA related factors. The methodologies used, the breadth of such scoping calculations, and how they would be used to inform the working sessions on particular topical areas has not yet been addressed.

CONCLUDING REMARKS

A number of benefits have resulted from involving a diverse group of technical, regulatory, and stakeholder entities in the development of a long-term WMA C performance assessment. A major benefit is engaging and informing the State and federal regulatory agencies, tribes, and other stakeholders in detailed technical discussions of various aspects of the engineered and natural system performance. As a result, useful ideas and thoughtful suggestions on modeling inputs and key modeling assumptions have resulted and it is expected to yield a more technically defensible and robust preliminary PA and subsequent iterations. With the broad range of inputs received, these analyses will likely be more responsive in addressing the wide range of regulatory and public concerns about system performance and related uncertainties. The results of this assertive effort will be more readily and quickly accepted by the technical, regulatory, and stakeholder communities.

The framework and public involvement model being used to support this PA effort and eventual closure of the WMA C will eventually be used to support PA efforts associated with closure of the other tank farms at Hanford. This type of approach may also be useful and directly transferable to PA efforts associated with similar waste and disposal sites across the DOE complex and the country.

KEY CONTACT INFORMATION

The following contact information is provided to the reader if there is an interest in learning more about the WMA C PA scoping process and related working sessions.

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