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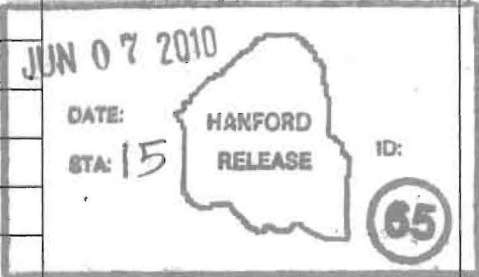
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Meeting Minutes for the WMA C PA Natural Systems Working Session

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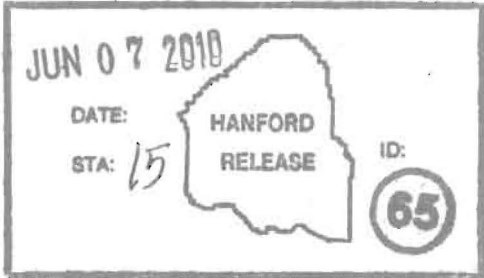
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Key Words: Waste Management Area C, Performance Assessment, tank closure, waste inventory

Abstract: Summary of meeting between U.S. Department of Energy, Office of River Protection, Washington State Department of Ecology, U.S. Environmental Protection Agency, U.S. Nuclear Regulator Commission, Native American Tribes, and stakeholders regarding Natural Systems Working Session for the Waste Management Area C Performance Assessment. The meeting minutes consist of roster of attendees, summary notes taken at the meeting and content of flip charts used during the meeting.

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Nancy A Fouad 6-7-10
Release Approval Date



Release Stamp

Approved For Public Release

Meeting Minutes

**Waste Management Area C Performance Assessment
Natural Systems Working Session**

held at

**Washington State Department of Ecology Offices
3100 Port of Benton Boulevard
Richland, WA 99352**

on

May 24 through May 27, 2010

LIST OF TERMS

Abbreviations and Acronyms

CEES	Columbia Energy and Environmental Services
CESI	Columbia Environmental Services, Inc.
CHPRC	CH2M HILL Plateau Remediation Company
CLARC	Model Toxics Control Act Cleanup Levels and Risk Calculations
CRESP	Consortium for Risk Evaluation with Stakeholder Participation
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
DOE	U.S. Department of Energy
DOE-EM	U.S. Department of Energy, Office of Environmental Management
DOE-HQ	U.S. Department of Energy, Headquarters
DOE-ORP	U.S. Department of Energy, Office of River Protection
DOE-RL	U.S. Department of Energy, Richland Operations Office
Ecology	State of Washington Department of Ecology
EIS	Environmental Impact Statement
FEP	Features, Events, and Processes
HAB	Hanford Advisory Board
NRC	U.S. Nuclear Regulatory Commission
PA	performance assessment
PBOX	Probability Box
PNNL	Pacific Northwest National Laboratory
STOMP	Subsurface Transport Over Multiple Phases
TC & WM	Tank Closure and Waste Management
UPR	unplanned release
WMA	waste management area
WRPS	Washington River Protection Solutions, LLC
YN ERWM	Yakama Nation Environmental Restoration and Waste Management

Attendees: Representatives from Department of Energy-Office of River Protection (DOE-ORP), DOE-Richland Operations Office (DOE-RL), DOE-Headquarters (DOE-HQ), the Washington State Department of Ecology (Ecology), the U.S. Nuclear Regulatory Commission (NRC), State of Oregon, and representatives of the Confederated Tribes of the Umatilla, Nez Perce, and Yakama Tribes met at the Ecology offices in Richland, Washington on 24 – 28 May 2010. The roster of participants is given below.

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This working session also included a field trip to the site for participants to view important natural and man-made features such as clastic dikes, different geologic formations, the field lysimeter test facility, the barrier over B-57 crib, and Waste Management Area C (WMA C). The agenda includes the site visited for the field trip.

Agenda for WMA C PA – Natural Systems May 25-27, 2010 Ecology’s Office, Richland Washington	
May 24	Field Trip Guide – Kevin Lindsey (GSI Water Solutions, Inc.)
8:30 AM	2440 Stevens Center – Badging
8:50 AM	2440 Stevens Center – Pre-Trip Briefing
9:30 PM	Army Loop Road Stop – Hanford formation with emphasis on clastic dikes and other features
10:30 PM	Field Lysimeter Test Facility Stop – Recharge and Barrier Testing
11:45 PM	White Bluffs Boat Launch – Overview of Hanford Geologic Framework and Lunch
1:00 AM	Hanford Prototype Barrier Stop – Barrier testing program
2:00 AM	Reactor Compartment Disposal Area Stop – Hanford formation sediments and features
3:00 AM	WMA C Stop – Overview of WMA C facilities
4 PM	Return to 2440 Stevens Center
May 25	Session Goals/Objectives and Vadose Zone System
8:00 AM	Refreshments
8:15 AM	Introductions
8:30 AM	Brief Review of Key Outcomes of Previous FEPs Working Session (T. Martin)
8:45 AM	Goals and Objectives of Natural System Working Session (M. Bergeron)
9:00 AM	Review of Hydrogeologic Framework and Vadose Zone Contamination at WMA C
9:30 AM	Break
9:45 AM	Factors Affecting Moisture Movement in Vadose Zone (M. Rockhold)
10:45 AM	Effects of Preferential Pathways (C. Murray)
11:30 AM	Lunch
1:00 PM	<i>Hanford’s Subsurface - Dominant Features, Processes and Events (Dirk Dunning, DOE-State of Oregon)</i>
2:15 PM	Break
2:30 PM	Discussion of Alternative Conceptual Models (M. Bergeron)
3:00 PM	Recommended Vadose Zone Flow and Transport Parameters
4:00 PM	Adjournment

Agenda for WMA C PA – Natural Systems May 25-27, 2010 Ecology’s Office, Richland Washington	
Mar. 26	Regional Geologic Framework, Scoping Calculations, Groundwater System
8:00 AM	Refreshments
8:15 AM	Regional and Local Geologic Framework and Tectonics (S. Reidel)
9:30 AM	Break
9:45 AM	Regional and Local Geologic Framework and Tectonics (continued)
10:15 AM	<i>Results of Recent Seismic Work in 200 East Area (Potential presentation by Ted Repasky, Confederated Tribes of Umatilla Indian Reservation)</i>
11:00 AM	Unconfined Aquifer System (M. Bergeron)
11:30 AM	Lunch
12:45 PM	Groundwater Contamination (M. Bergeron)
1:30 PM	Scoping Calculations Update (Matt Kozak)
2:15 PM	Break
2:30 PM	Scoping Calculations Update (continued)
3:00 PM	Recommended Flow and Transport Properties
3:15 PM	Discussion of Proposed Cases for Vadose Zone and Groundwater Flow and Transport Simulation
4:00 PM	Adjournment
May 27	Natural System Working Session Review, Closeout, and EIS Discussions
8:00 AM	Refreshments
8:15 AM	Natural System Working Session, Discussion and Q/A
8:45 AM	Review of Consensuses/Review of Notes/Working Session Feedback
9:30 AM	Break
9:45 AM	Input from the Tank Closure and Waste Management EIS (M. Burandt)
10:30 AM	TC & WM EIS Discussion and Q/A
11:00 PM	Look Forward to Engineering System #2 Working Session (July)
11:15 PM	Other Issues and Comments
11:45 PM	Adjournment

Summary Notes from May 25 through May 27, 2010 Office of River Protection Waste Management Area C Tank Farm Performance Assessment Input Meeting

Discussion: DOE is pursuing closure of WMA C, located at the Hanford Site. At some point in the future, DOE and NRC will consult on waste determinations for these tank closures; additionally these tanks will be closed in coordination with the U.S. Environmental Protection Agency and Ecology in accordance with the *Hanford Federal Facility Agreement and Consent Order* and State-approved closure plans. The DOE, NRC, and Ecology met for the seventh of a series of technical exchanges on the proposed inputs for a WMA C Performance Assessment (PA). The technical exchanges are intended to capitalize on early interactions between the agencies with a goal of developing DOE's WMA C PA. Technical discussions during the meeting are intended to allow for the clarification of general modeling approaches and for the identification of other specific questions.

On 24 May 2010, meeting participants toured the Hanford Site to observe geologic features that would be discussed during the subsequent Natural System Working Session.

Topics: The following specific topical areas were discussed during the meeting:

1. Review of Key Outcomes of Previous Features, Events, and Processes (FEPs) Working Session
2. Goals and Objectives of Natural System Working Session
3. Review of Hydrogeologic Framework and Vadose Zone Contamination at WMA C
4. Factors Affecting Moisture Movement in Vadose Zone
5. Effects of Preferential Pathways
6. Hanford's Subsurface – Dominant Features, Processes, and Events
7. Discussion of Alternative Conceptual Models
8. Recommended Vadose Zone Flow and Transport Parameters
9. Regional Geologic Framework, Scoping Calculations, Groundwater System
10. Unconfined Aquifer System
11. Groundwater Contamination
12. Scoping Calculations Update
13. Recommended Flow and Transport Properties and Discussion of Proposed Cases for Vadose Zone and Groundwater Flow and Transport Simulation
14. Natural System Working Session Review, Closeout, and Environmental Impact Statement (EIS) Discussions
15. Natural System Working Session, Discussion and Q/A
16. Look Forward to Engineering System #2 Working Session
17. Other Issues and Comments

Summary: The following summarizes the discussion during the meeting, by topical area.

Review of Key Outcomes of Previous Features, Events, and Processes (FEPs) Working Session

- The working session facilitator led a review of key outcomes of previous FEPs working session.

Goals and Objectives of Natural System Working Session

- DOE-ORP Staff provided an overview of goals and objectives for this working session on the natural system.

Review of Hydrogeologic Framework and Vadose Zone Contamination at WMA C

- DOE-ORP provided an overview/review of the hydrogeologic framework and vadose zone contamination at WMA C as discussed during previous working sessions.

Factors Affecting Moisture Movement in Vadose Zone

- Pacific Northwest National Laboratory (PNNL) Staff presented an overview of the key factors affecting moisture movement in the vadose zone.
- PNNL Staff presented vadose zone infiltration and transmission studies which were performed at Oregon State University.
- PNNL Staff presented animations of Subsurface Transport Over Multiple Phases (STOMP) model simulation results to illustrate impact of vadose zone heterogeneities.
- Meeting participants discussed the ability to model presumed and observed features in the vadose zone.
- PNNL Staff concluded that with sufficient site characterization and calibration data, we can obtain very good correspondence between observed and simulated vadose zone flow and transport behaviors. However, it was noted that modeling results for the deep vadose zone below the 200 Areas plateau have uncertainties. Uncertainty reduction may require more characterization and monitoring data, focused experiments, and innovative parameterization and modeling approaches.

Effects of Preferential Pathways

- PNNL Staff provided an overview of some of the potential effects of preferential pathways on vadose zone transport. Information presented focused on unsealed boreholes and clastic dikes.
- PNNL Staff noted that unsealed boreholes can provide preferential pathways that lead to faster than expected transport through the vadose zone to groundwater. Typically, this has been found to not be a significant contributor under dry unsaturated conditions, but has been found to be a contributor in certain situations.
- PNNL Staff noted that earlier construction techniques, e.g., not sealing casings, can lead to preferential pathways.

- PNNL Staff noted that there are currently 71 dry wells within WMA C which are potential vertical leakage pathways through the vadose zone.
- PNNL Staff noted that tank farms have flooded during extreme meteorological events. Unsealed boreholes could provide vertical pathways for flood waters. However, it was also noted that most of the dry wells only go down to 100 feet, so there is still a large distance that contamination would need to travel to groundwater.
- PNNL Staff provided an overview of clastic intrusions and their potential impact on vadose zone transport. Such conditions could occur if saturated, unconsolidated fine-grained sediments of the Hanford formation were disturbed by an earthquake, leading to rapid dewatering.
- PNNL Staff discussed the potential effects of clastic dikes on vadose zone transport. Locations of clastic dikes are well mapped in the Southeast portions of the Hanford Site, and less so to the North and West, however, it is expected that clastic dikes may exist in those areas also.
- PNNL Staff noted that clastic dikes have been traced to a depth of at least 20 meters in more than 30 excavations. Dikes have been detected in boreholes at depths up to 75 meters in 200 West Area, but continuity to the surface is unknown. A number of measurements have been made of clastic dike matrix properties. In most cases, there was no readily discernable difference between dike and host mineralogy, however, there was an observable difference in grain size, with the clastic dike matrix being much finer grained.
- PNNL Staff noted that dikes might induce complex breakthrough patterns at the water table. At low fluxes, fine textured clastic dikes may have a higher transport velocity than coarse-textured dike or matrix, but absolute transport rates for both are still very low. At intermediate fluxes, dike and surrounding matrix flows are similar. However, field work suggests that coarse-grained bands in clastic dikes are very discontinuous and presence of clay in the clastic dikes may help retard transport for some contaminants.
- PNNL Staff noted that clastic dikes do not appear to be as common in the coarser-grained areas, including WMA C.

Hanford's Subsurface – Dominant Features, Processes, and Events

- State of Oregon Staff presented an overview of their perspectives on the dominant features, processes, and events in the Hanford subsurface.
- State of Oregon Staff noted that there is immense parameter uncertainty associated with the Hanford subsurface.
- State of Oregon Staff identified highly preferential lateral flows, preferential vertical flow, highly preferential paleochannels, lateral displacement on the top of the cold creek formation, and inter-aquifer connections and flow as dominant features.
- State of Oregon staff identified inter-aquifer flow, river stage oscillations, simple ion exchange chemistry, simple solubility chemistry, salvation and complexation chemistry, colloid formation and transport, and complex water infiltration as dominant processes.

- State of Oregon Staff identified climatic oscillation and glaciation, catastrophic flooding, episodic massive Cascadia earthquakes, episodic eruptions of new supervolcanos, fires that denude the site, and large changes in human culture and land use.
- State of Oregon Staff provided an overview of the surface and vadose zone conceptualizations. The lowest most layer being the basalt basement from Columbia River Flood Basalts. It was noted that soils between many layers create confined aquifers.
- State of Oregon Staff noted that there are deep regional tectonic activities that are not well enough understood.
- State of Oregon Staff noted that layered soils probably contribute to lateral flows.
- State of Oregon Staff noted that clastic dikes are present in all single-shell tank WMAs, but actual locations are not mapped.
- State of Oregon Staff noted that the major actinides share common features of their chemistry.

Discussion of Alternative Conceptual Models

- DOE-ORP Staff provided an overview of alternative conceptual models for the vadose zone operational period that have been discussed in previous workshops in order to refresh meeting participant memories and to discuss the relevance of each of the alternative conceptual models given information that has been learned through subsequent working sessions. Alternative conceptual models for the vadose zone operational period include: (1) known waste leaks driven down with natural recharge and additional unknown sources of water; (2) increased lateral flows through gravelly matrices; (3) known waste leaks driven down by natural recharge along preferential pathways; (4) known waste leaks driven down by natural recharge and unknown sources of additional water.
- Meeting participants discussed how past releases in the tank farms have affected soil chemistry and could impact the transport characteristics of future releases.

Recommended Vadose Zone Flow and Transport Parameters

- DOE-ORP Staff provided an overview of the flow and transport properties for the vadose zone system that are proposed to be used in the performance assessment. Proposed flow properties for the major units include moisture retention characteristics, unsaturated-saturated hydraulic conductivity, and moisture and tension-dependent anisotropy. Transport properties for the major units include bulk density, range of distribution coefficients for constituents of concern, diffusivity, and macro-dispersion.
- DOE-ORP Staff identified the 3 key references supporting the development of the vadose zone assumptions for the WMA C performance assessment.

- DOE-ORP provided an overview of contaminant specific distribution coefficients that are proposed to be used in the performance assessment. Estimated values from samples at WMA C and other locations at the Hanford Site will be used, then compared to the Model Toxics Control Act Cleanup Levels and Risk Calculations (CLARC) table and Oak Ridge Risk Assessment System, assigned to an appropriate Kd bin, then compared against the Technical Guidance Document for the Tank Closure and Waste Management (TC & WM) EIS to ensure consistency.

Regional Geologic Framework, Scoping Calculations, Groundwater System

- PNNL Staff provided an overview of the regional geologic framework of the Hanford area and vicinity, including the stratigraphy and drainage history of the area and the tectonic history of the area.
- Staff of the Confederated Tribes of the Umatilla Indian Reservation provided an overview of seismic survey work that they have conducted across the Hanford Site.
- DOE-ORP Staff provided additional information concerning previous presentations on effective bulk densities for major units in WMA C. The effective bulk densities presented do appear to have been adjusted to reflect gravel content.
- DOE-ORP Staff provided additional information concerning previous presentations on characteristics of high-impact areas and what is known about pH and electrical conductivity impacts to soil from previous spills and releases.

Unconfined Aquifer System

- DOE-ORP Staff provided an overview of the key features, events, and processes of the regional groundwater flow and transport system, including major units, their properties, potential preferential pathways, water chemistry and contamination, recharge, discharges, and contaminant loading.
- Meeting participants discussed the water bearing units and confining beds as part of the features associated with the Hanford Site.

Groundwater Contamination

- DOE-ORP Staff provided an overview of the existing known groundwater contamination in WMA C and observed changes in concentrations over time. A number of regional plumes cross over into WMA C, including tritium, iodine, nitrate, and technetium.

Scoping Calculations Update

- DOE-ORP Staff provided an overview of scoping calculations prepared to try to help understand how much water is needed to be added to the system to explain existing observations. The analysis is also intended to provide insight into system behavior and help understand potential implications for future performance and considerations for the performance assessment.

- DOE-ORP Staff noted that the scoping calculations applied simple assumptions, including one-dimensional steady-state flow assumptions and simple application of Darcy's Law.
- DOE-ORP Staff used information from a well-studied unplanned release (UPR-82) as the example to apply the scoping calculations to. Knowing the depth of plume seepage over time, unit gradient flow rates and infiltration rates were calculated that correspond to how far the plume has moved. It appears that movement of existing contamination can be explained within existing background infiltration or slightly above, which could be explained by other known additions of water, e.g., fire hoses, leaking water lines.

Recommended Flow and Transport Properties and Discussion of Proposed Cases for Vadose Zone and Groundwater Flow and Transport Simulation

- DOE-ORP Staff provided an overview of the parameter values that are proposed to be used for the flow and transport properties in the WMA C PA.
- Meeting participants discussed the particulars of the proposed parameter values and the scenarios that they would apply to. Meeting participants also discussed proposed cases for local-scale models and the effects of each that would be modeled.

Natural System Working Session Review, Closeout, and EIS Discussions

- TC & WM EIS staff provided an overview of the natural system assumptions and discussions that are addressed in the TC & WM EIS. It was noted that some changes are being made to the assumptions in the modeling based on comments that have been received on the draft EIS.

Natural System Working Session, Discussion and Q/A

- DOE-ORP Staff provided an overview of the topics discussed in this working session and the overall messages.
- Meeting participants were encouraged to generate topics and issues for future discussions and for preparing scoping calculations on.

Look Forward to Engineering System #2 Working Session

- Meeting participants discussed issues that will be addressed in future working sessions including Engineering System #2. Engineering System #2 will address degradation, corrosion, and overall evolution of the engineered systems, waste forms, and residuals over time.

Other Issues and Comments

- None.

**Waste Management Area C Natural Systems Working Session Flip Charts
May 25-May 27, 2010
Washington State Department of Ecology Building
Richland, Washington**

Review of FEPS working session

- 10x issue
 - Clarity on sensitivity versus uncertainty.
 - Mike's estimation document. Damon and Kevin mentioned the Probability Box (PBOX) process that helps with stats when there is little data.
 - Estimating uncertainty will get easier as iterations proceed.
- Disconnect between PA, EIS and final barrier design.

General Discussion

- Between dosimetry and numeric codes sessions (8 months) we should have a means to communicate progress and maintain transparency.
- Data package says there is no H3 subsurface layer, this conflicts with Table 3-1 in data package. Terminology should be consistent.
- One year from now (when Mike gets data) we will hold an eco/direct contact working session (hopefully in April-May 2011).
- Slide 101: 'Unsealed wells' probably don't need to be in denominator case. They also should be deleted from the post-closure period.
- Kd's should be processing ranges (even extreme), not single point values.
- Can we get a clearer picture of how we get from here to the Appendix I PA and how information feeds back at each step? This will be on the next working session agenda. Maybe we can use the swimlane chart.

Vadose Zone Features and Processes (Mark Rockhold)

- Two big issues from tour: Clastic dikes and laminar layers. It is possible that subsurface modeling may not matter to dose-it could just be a different timing. Also, could be way off in timing since field observations are different (lateral versus vertical movement of water) than modeling results.
- Mark's STOMP runs show all results depend on the assumptions—you can get any result you want by adjusting assumptions.
- Need to be conscious of inherently variable things versus things we can get more data on and better understand.

Effect of Preferential Pathways (Chris Murray)

- What happens when lateral moving contamination hits clastic dikes? Does it break in? Does it retard movement? Chris' work does not answer these questions.
- Consider upscaling through propagational fracture models (this is difficult given the polygonal nature of dikes).

Dirk's Presentation

- We will have to run 'what if' scenarios (dikes and other uncertainties) to see what is important.
- Decreased flux leads to increased fine grain transport.
- Increased flux leads to decreased fine-grained transport.
- It is clear that a 'one size fits all' vadose zone approach will not work as each tank farm subsurface is different.

Marcel's slides

- Ensure titles are accurate when creating slides. For example, some of the slides titled "Alternative Conceptual Model of Vadose Zone Flow and Transport to Groundwater" really should be labeled "Alternative Conceptual Model of Vadose Zone."
- K_d can be significantly altered by chemistry (Kinkaid document). Mike will obtain the pH graph for C42-97 which shows chemistry changes in the vadose zone due to presence of caustic.
- K_d can also be impacted by overlapping plumes.
- Are the densities on slide 44 correct? Mike and Marcel checked and found the densities included gravel densities.
- Features Slide 52: Add upwelling and/or discharge to the unconfined aquifer to this slide (maybe place in a 'hydraulic heads' category).
- Slide 52: Consider Black Rock reservoir as a feature.
- Slide 52: Acknowledge the 'Hanford Formation' is made up of many varied layers.
- Slide 52: Consider fractured flow top of top 29 feet of basalt.
- Be aware of potential for contaminant movement between unconfined to confined aquifers.

Mike's Distribution Coefficient slides

- Slide 45: This slide shouldn't say CLARC table "for the 100 Areas." This issue also exists on slide 48. The CLARC table for the 100 Areas is really an interpretation by Steve Clark.
- Slide 46: Many of the 33 uranium samples may actually be natural uranium.

- Slide 46: How were pore water samples obtained? May be some issues with the technique.
- Consider using a fixed rate retardation factor instead of K_d for uranium in dry soils.
- Not sure if low uranium K_d really is low—need more numbers to support K_d . If K_d leads to uranium not hitting groundwater, you have to be sure K_d is correct. Need several K_d 's (high, medium, low) to see what matters.
- Mike trying to be consistent with EIS although he acknowledges the PA may include something that varies from the EIS.

Regional Geologic and Tectonic Framework (Steve)

- This process should use the stratigraphy on Steve's 'comparative stratigraphy 200W and 200E' slide as our consistent terminology.

Matt's Presentation

- Dirk to provide Matt suggestions on needs to model lateral flow to elastic dike and flow downward on surface of dike.
- Dealing with uncertainties and lateral movement remains important.

Proposed Vadose Zone and Groundwater Flow and Transport

- Base case should be realistic. It doesn't make sense to perform sensitivity analyses on a best case. Current denominator case is intended to be realistic and additional denominator cases may be added.
- Need to acknowledge and deal with micro-variations in the subsurface or modeling will not be valid.
- Will model releases both with initial condition based on current characterization data and based on date and location of leak.

What we did

- Subsurface features greatly increase uncertainty and must be addressed.
- K_d 's should be ranges (even extreme ranges) to assist in figuring out what matters.
- Activities need to provide information that supports decision-making.
- We will hold an eco/direct contact working session.
- Input on denominator/sensitivity cases should go to Mike and Marcel.