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(a) Author (Print/Sign): M. P. Connelly M.P. Connelly	Date: 04/15/2010
(b) Responsible Manager (Print/Sign): S. J. Eberlein	Date: 04/15/2010
(c) Reviewer (Optional, Print/Sign): K. J. Dunbar	Date: 04/15/2010
(d) Reviewer (Optional, Print/Sign):	Date:

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M. P. Bergeron	E6-31		
M. P. Connelly	E6-31		
S. J. Eberlein	E6-31		
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Meeting Minutes for the WMA C PA Features, Events, and Processes Working Session

M. P. Connelly
Washington River Protection Solutions LLC
Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-08RV14800

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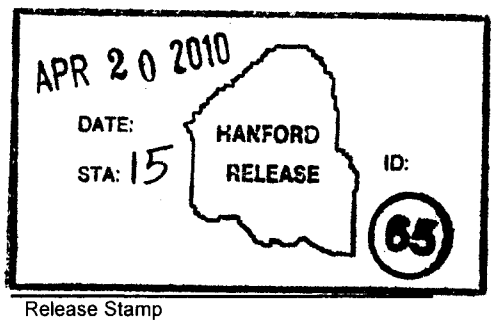
Abstract: Summary of meeting between DOE-ORP, Washington Department of Ecology, Environmental Protection Agency, Nuclear Regulator Commission, Native American Tribes, and stakeholders regarding Features, Events, and Processes Working Session for the Waste Management Area C performance assessment. The 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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Meeting Minutes

Waste Management Area C Performance Assessment
Features, Events, and Processes Working Session

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

on
March 30, 31, and April 1, 2010

LIST OF TERMS

Abbreviations and Acronyms

BBI	Best-basis inventory
CCl4	carbon tetrachloride
CHPRC	CH2M HILL Plateau Remediation Company
CM	Conceptual Model
DOE	U.S. Department of Energy
DOE-HQ	DOE-Headquarters
DOE-ORP	DOE-Office of River Protection
DOE-ORP-TFP	DOE-ORP-Tank Farm Project
DOE-RL	U.S. Department of Energy, Richland Operations Office
Ecology	State of Washington Department of Ecology
EIS	Environmental Impact Statement
EM HQ	DOE Office of Environmental Management-Headquarters
EPA	U.S. Environmental Protection Agency
FEP	Features, Events, and Processes
HAB	Hanford Advisory Board
HTWOS	Hanford Tank Waste Operations Simulator
NRC	U.S. Nuclear Regulatory Commission
PA	performance assessment
PNNL	Pacific Northwest National Laboratory
POA	plan of action
SST	single-shell tank
TBP	tributyl phosphate
TC&WM	Tank Closure and Waste Management
UPR	unplanned release
WMA	waste management area
WRPS	Washington River Protection Solutions, LLC

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 Nez Perce and Yakama Tribes met at the Ecology offices in Richland, Washington on 30 March through 1 April 2010.

Roster of Participants		
Name	**Organization**	**E-Mail**
Arlt, Hans	NRC	hans.artl@nrc.gov
Barnes, Mike	Ecology	miba461@ecy.wa.gov
Bergeron, Marcel	WRPS	marcel_p_bergeron@rl.gov
Caggiano, Joe	Ecology	jcag461@ecy.wa.gov
Charboneau, Stacy	DOE-ORP-TFP	stacy_l_charboneau@orp.doe.gov
Connelly, Micheal	WRPS	michael_connelly@rl.gov
Crandall, Tom	EM HQ	thomas.crandall@em.doe.gov
Delistraty, Damon	Ecology	ddel461@ecy.wa.gov
Dunning, Dirk	ODOE	dirk.a.dunning@state.or.us
Eberlein, Susan	WRPS	susan_j_eberlein@rl.gov
Fort, Les	WRPS	leslie_a_fort@rl.gov
Goswami, Dib	Ecology	dgos461@ecy.wa.gov
Hedges, Jane	Ecology	jhad461@ecy.wa.gov
Jentzen, Brenda	Ecology	bjen461@ecy.wa.gov
Koll, Ron	DOE-ORP-TFP	ronald_j_koll@orp.doe.gov
Kozak, Matt	Intera	mkozak@intera.com
Lehman, Linda	CHPRC	linda_l_lehman@rl.gov
Letourneau, Martin	DOE-HQ	martin.letourneau@em.doe.gov
Lowman, Don	NRC	donald.lowman@nrc.gov
McKenney, Chris	NRC	christepher.mckenney@nrc.gov
Nichols, Will	CHPRC	william_e_nichols@rl.gov
Panesko, Vince	HAB	vince@owt.com
Quigley, Keith	WRPS	keith_d_quiqley@rl.gov
Riggsbee, Wade	Yakima	wriggsbee@yahoo.com
Rochette, Beth	Ecology	broc461@ecy.wa.gov
Saulnier, George	Areva Federal Svcs.	george.saul@areva.com
Skorska , Maria	WRPS	maria_b_skorska@rl.gov
Sobczyk, Stan	Nez Perce	stans@nezperce.org
Trenchard, Glyn	DOE-ORP-TFP	glyn_d_trenchard@orp.doe.gov
Wallace, Jeanne	Ecology	jewa461@ecy.wa.gov
Whalen, Cheryl	Ecology	cwha461@ecy.wa.gov
Wood, Marc	CHPRC	marcus_i_wood@rl.gov

Agenda for WMA C PA – Engineered Systems #1 March 30 through April 1, 2010 Ecology's Office, Richland WA	
Mar. 30	**Review of Working Session Process and FEPs Approach**
8:00 AM	Refreshments
8:15 AM	Introductions
8:30 AM	**Goals and Objectives of FEPs Working Session (S. Eberlein)**
8:45 AM	**Review of Working Session Process (S. Eberlein)**
9:00 AM	**Working Session Decisions and Timing (M. Connelly)**
9:30 AM	Break
9:45 AM	**Working Session Decisions and Timing - continued**
10:15 AM	**Working Session Open Discussion and Q/A**
10:45 AM	**FEPs Application: Past to Current State (Eberlein et al.)**
11:30 AM	Lunch
12:45 PM	**FEPs Past to Present continued**
1:15 PM	**Implications of Past FEPs for Future Conditions**
2:15 PM	Break
2:30 PM	**FEPs Present to Future – Key Features**
3:30 PM	**FEPs** (Open Discussion and Q/A)
4:00 PM	Adjournment
Mar. 31	**FEPs Present to Future**
8:00 AM	Refreshments
8:15 AM	**FEPs Present to Future – Key Processes (Vadose Zone)**
9:00 AM	**FEPs Present to Future – Key Events (Vadose Zone)**
9:30 AM	Break
9:45 AM	**FEPs Present to Future – Key Processes (Tanks, Equipment)**
10:30 AM	**FEPs Present to Future – Key Events (Tanks, Equipment)**
11:00 AM	**FEPs Present to Future – Key Processes (Surface, Cap)**
11:30 AM	Lunch

Agenda for WMA C PA – Engineered Systems #1 March 30 through April 1, 2010 Ecology's Office, Richland WA	
12:45 PM	**FEPs Present to Future – Key Events (Surface, Cap)**
1:15 PM	**Outcome Based Analysis for Processes, Events**
2:15 PM	Break
2:30 PM	**FEPs International Approach/Scoping Calculations (Matt Kozak)**
3:30 PM	**Open Discussion and Q/A**
4:00 PM	Adjournment
April 1	**EIS Discussions, FEPs Review, Closeout**
8:00 AM	Refreshments
8:15 AM	**Input from the Tank Closure and Waste Management EIS (M. Burandt)**
9:30 AM	Break
9:45 AM	**TC & WM EIS Discussion and Q/A**
11:00 AM	**FEPs Working Session, Discussion and Q/A**
11:30 AM	Lunch
1:00 PM	**Review of Consensuses/ Review of Notes /Working Session Feedback**
1:15 PM	**Working Session Feedback**
1:30 PM	**Look Forward to May Natural Systems Working Session and Field Trip**
2:00 PM	**Other Issues and Comments**
2:30 PM	Adjournment

Summary Notes from 30 March – 1 April 2010 Office of River Protection Waste Management Area C Tank Farm Performance Assessment Input Meeting

Discussion: DOE is pursuing closure of Waste Management Area C (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 U.S. Environmental Protection Agency (EPA) and Ecology in accordance with the Tri-Party Agreement and State-approved closure plans. The DOE, NRC, and Ecology met for the sixth 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.

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

1. Goals and Objectives of Working Session
2. Review of Working Session Process and Working Session Decisions and Timing
3. Features, Events, and Processes (FEPs) Application: Past to Current State
4. Features, Events, and Processes (FEPs) Application: Present to Future – Key Features
5. Features, Events, and Processes International Approach/Scoping Calculations
6. Features, Events, and Processes (FEPs) Application: Present to Future – Key Processes
7. Features, Events, and Processes (FEPs) Application: Past to Current State – continued
8. Features, Events, and Processes (FEPs) Application: Present to Future – continued
9. Features, Events, and Processes (FEPs) Application: Surface Conditions and Caps
10. Features, Events, and Processes (FEPs) Application: Tanks and Pipelines
11. Input from the Tank Closure and Waste Management EIS
12. General Discussion, Questions and Answers

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

Goals and Objectives of Working Session

- DOE-ORP Staff provided an overview of planned agenda and activities for this working session.

Review of Working Session Process and Working Session Decisions and Timing

- DOE-ORP Staff provided an overview of information that has been addressed through previous working sessions. Meeting participant discussed residual inventory estimates based on the Hanford Tank Waste Operations Simulator (HTWOS) model.

- Meeting participants discussed how to document and accept uncertainty in residual inventory estimates for various residual inventory sources. It was suggested that DOE separate its presentation of sensitivity from its presentation of uncertainty so that the two are not confused.
- Meeting participants discussed how to develop estimates of residual inventory for different aspects of the tank farm components
- Meeting participants discussed what information may be available to develop estimates of uncertainty in the residual inventory data and the differences between sensitivity analyses and uncertainty analyses.
- Meeting Participants discussed assessment context assumptions (e.g., point of assessment, time of assessment) that have been established through previous working sessions and alternative times/points that should be assessed.
- Meeting participants discussed soil inventory assumptions that have been established through previous working sessions and alternatives that should be assessed, including likelihood that leaks and release have occurred that have not yet been discovered or identified.
- Meeting participants discussed the roles of sensitivity and uncertainty analyses in the assessment context assumptions.

Features, Events, and Processes (FEPs) Application: Past to Current State

- DOE-ORP Staff presented an overview of the need to be able to explain the evolution of features, events, and processes in the tank farm, including the presence of contaminants in the groundwater beneath WMA-C.
- Meeting participants discussed what additional features, events, and processes should be added to our conceptual understanding of WMA-C.
- DOE-ORP Staff believes that incorporation of these additional features, events, and processes will provide a reasonable explanation for existing groundwater contamination below WMA-C.

Features, Events, and Processes (FEPs) Application: Present to Future – Key Features

- DOE-ORP Staff presented an overview of the key features that are necessary to understanding what we expect to happen in WMA-C from the present into the future.
- DOE-ORP Staff identified both the man-made and natural parts of the system that are considered key features, including the vadose zone features such as clastic dikes, other fast flow or preferential pathways, clay lenses, fines layers, and channels.
- Meeting participants identified additional features that should be included in our understanding of the WMA-C vadose zone. Other important features will include the physical properties of the system, including contamination and moisture already present in the system.

- DOE-ORP Staff provided an overview of the other key features of the system, including the tank, tank liner, waste form, and some type of engineered surface barrier.

Features, Events, and Processes International Approach/Scoping Calculations

- DOE-ORP Staff provided an overview of how FEPS are used in the international community and an approach to using simplified calculations to help understand the relative importance of particular FEPs relative to others.
- DOE-ORP Staff presented a simplified scoping calculation model based the Eco-Lego computer code, which was originally developed by the Swedish government in the 1990s for use in analyzing FEPs.
- Meeting participants discussed the merits and concerns associated with various approaches to doing performance assessment modeling, both in terms of the scoping calculations presented with Eco-Lego and by other approaches.

Features, Events, and Processes (FEPs) Application: Past to Current State – continued

- DOE-ORP Staff presented a preliminary list of key features for each of the major units of the vadose zone, representing past to current conditions, including geometry, physical properties, hydraulic properties, transport properties, natural preferential pathways, man-made preferential pathways, moisture conditions, and contamination.
- DOE-ORP Staff also presented a preliminary list of the key processes operating within the major units of the vadose zone, representing past to current conditions, including but not limited to physical alteration by past waste release, dissolution, sorption/desorption, precipitation, oxidation/reduction, complexation, colloid transport, flow, precipitation, evaporation, recharge, and drainage.
- Meeting participants offered additional features, events, and processes to be added to the list prepared by the DOE-ORP Staff for past to current state conditions of the vadose zone.

Features, Events, and Processes (FEPs) Application: Present to Future – continued

- DOE-ORP Staff presented a preliminary list of key features for each of the major units of the vadose zone, representing current to future conditions, including geometry, physical properties, hydraulic properties, transport properties, natural preferential pathways, man-made preferential pathways, moisture conditions, and contamination.
- DOE-ORP Staff also presented a preliminary list of the key processes operating within the major units of the vadose zone, representing current to future conditions, including but not limited to physical alteration by past waste release, dissolution, sorption/desorption, precipitation, oxidation/reduction, complexation, colloid transport, flow, precipitation, evaporation, recharge, and drainage.
- Meeting participants offered additional features, events, and processes to be added to the list prepared by the DOE-ORP Staff for present to future conditions of the vadose zone.

Features, Events, and Processes (FEPs) Application: Surface Conditions and Caps

- DOE-ORP Staff presented preliminary lists of features, events, and processes for surface conditions and caps for during operations, during institutional control, and after institutional control. Features include surface vegetation, backfill, and the various layers of the cap. Processes include but are not limited to evaporation, precipitation, recharge, evapotranspiration, and drainage.
- Meeting participants offered additional features, events, and processes to be added to the list prepared by the DOE-ORP Staff for surface conditions and caps during operations, during institutional control, and after institutional control.

Features, Events, and Processes (FEPs) Application: Tanks and Pipelines

- DOE-ORP Staff presented preliminary lists of features, events, and processes for tanks and pipelines. Features of the tanks include the steel liner, grout, sidewalls, and basemat. Processes include but are not limited to infiltration, leaching, corrosion, redox, oxidation, human intrusion, bio-intrusion, and geochemistry changes.
- Meeting participants offered additional features, events, and processes to be added to the list prepared by the DOE-ORP Staff for tanks and pipelines.

Input from the Tank Closure and Waste Management EIS

- TC & WM EIS Staff provided an overview of the methods used in the TC & WM EIS to model transport, including the model codes used, simplifying assumptions made, and sensitivities of the modeling approach.
- Meeting participants queried TC & WM EIS Staff about the modeling approaches and the possible relevance to the closure of WMA-C.

Features, Events, and Processes (FEPs) Application: Outcome-Based Analysis

- DOE-ORP Staff led a discussion among the meeting participants concerning potential outcomes and decisions that may impact the selection of particular features, events, and processes for the analyses, or which may impact the overall approach to preparing a performance assessment for WMA-C.

General Discussion, Questions and Answers

- The meeting facilitator led a discussion among meeting participants about general issues and outstanding concerns among the meeting participants.
- Meeting participants discussed topics for the next workshop to be held in May 2010.

Waste Management Area C Features, Events and Processes (FEPS)
Working Session Flip Charts
March 30-April 1, 2010
Washington State Department of Ecology Building
Richland, Washington

After each working session, flip charts that include changes and/or comments will be put in Review Comment Record (RCR) format and distributed to working session participants.

Decisions and Timing Sheet of Performance Assessment Inputs

- PA needs to described uncertainties related to residual inventories.
- The possibility that waste is between liner and concrete as a result of bulging should be kept as a placeholder for future tank farm closure activities.
- To residual inventory box, add BBI 2009 90% and BBI 2009 99.9% cases.
- 10x issue. A document will be produced showing uncertainty in each step of estimation process.
- Rationale for utilizing the 10x factor for diversion boxes (where 10x is unlikely) and pipelines (where 10x could be the low end, especially when considering unknown leaks) is difficult to justify.
- Need to distinguish between 'sensitivity' and 'uncertainty' on this sheet. Sensitivity (what is important to model) and uncertainty (what we know or don't know) will be separated. On chart, consider two columns, one for sensitivity and one for uncertainty.
- PA needs to walk reader thru how uncertainty is used. Wherever possible, use quantified numbers for uncertainties, particularly when sensitivity analyses indicate quantification is important. This approach relies heavily on getting the FEPS right.
- Will Mike's paper be quantity or quality? Mike is trying to do both—where you have statistical basis, use it. Where it doesn't exist, use qualitative discussion to provide better understanding.
- For pipelines, the Conceptual Model should assume a reasonable estimate of full pipes. The group should try to agree on CM's that everyone feels are close to reality then do sensitivity analyses to determine important parameters to see where you need to characterize. Ensure pipeline feasibility study for WMA-C will be integrated (it should be completed this summer so this should work).
- Uncertainty associated with constituents is also important. Currently using existing data. Should compare actual retrieval numbers to estimates to determine effectiveness of estimation process.
- Need to estimate leaks that haven't yet been identified.

Decision and Timing-Assessment Context

- White paper has definition of WMA-C that might be useful.
- Important not to get tangled up in POA's since they are just data points.
- Ecology needs a POA inside the WMA fence-probably by the tank that will likely have the highest impact.

- Need to look at flow channels to determine highest impact.
- For contamination that will have highest impact greater than 10,000 or 50,000 years, text will be required to explain the approach.
- Need to consider actual construction practices and not just current Washington state codes. An example is PNNL building digging to 60 feet. This sort of construction should probably be included in sensitivity analysis. Don't constrain this case only to intruders since that case usually only includes radionuclides. This issue will be covered in more detail in the exposure scenarios session.
- To address intruder over time the PA will need to report the inventory over time.
- Should RPP-RPT-41919 actually be 41918?
- Need strong justification for no C-111 inventory from a leak (current attribution to evaporation). Need UPR addition here from Les or at least make sure the waste associated with this potential UPR is accounted for.
- Is C-108 a leaker? WRPS doesn't think so. Stan says gamma anomaly and other changes over 30 years may be indicative of a leak.
- Residual inventory from CR vault retrieval could be useful in estimating other catch tanks and pipelines.

FEPS Past To Present

- Consider other water sources (hydro test water disposed next to farm, fire hose, water line breaks, septic tanks, hydrant flushing, etc.)
- Old groundwater or dry wells filled, capped, or not, could be preferential pathways.
- Diversion boxes were a common cause of UPRs and a source of water from washdowns.
- Lateral flow from clay lenses.
- Tops of flood events (fines layers) act as lateral downflow.
- Undulated bottoms in channels can result in focused areas for breakthrough of water and contaminants.
- Resistivity testing in the 1970's included chemical injections that might impacted contaminant transport.

Features Present to Future

- Could backfill around tanks serve as a pond and therefore a source? If so, it could be made worse by the umbrella effect of SSTs. There is characterization data that provides evidence this has occurred.
- Perform quick 1D calcs starting with simple geologic layers then add one feature at a time to determine what is important.
- Need more clarity on undifferentiated Hanford gravels/cold creek unit/ringold formation and if more features (sublayers) exist in the layer.
- Add scenario, model and parameter uncertainties to the WMA-C glossary.

Vadose Zone (Past)

- Feature: Hydrologic barriers.
- Feature: Current 'major units' are too 'major'. Need finer units. Past studies show 5 cm fines layers across large areas. What is modellable? (F)
- Process: reactive transport, biotic processes (including microbial induced degradation and corrosion).

- Feature: Flora and Fauna.
- Feature: In major units: surface (w/ biota, backfill, vz)
- For each session, have cartoon that essentially shows the scope of session.
- Feature: Flood induced heterogeneities are features that impact subsurface flow.
- Process: Soil chemistries that cause radionuclides to behave differently.
- Process: 'Hydraulic mining' by plant roots.
- Process: Under contamination include solvents (TBP, CCl4, etc.) that may have enhanced radionuclide transport.
- Feature: Perched water.
- Process: Type of leak. Big leak spreads, small leak creates 'pipe.'

Vadose Zone (Future)

- Process: Solubility limited chemistry.
- Process: Cation/anion exchange.
- Process: Parametric transport through barometric pumping.
- Remove 'colloid transport' (it's in the wrong place).
- Process/Event: Both past and future periodic flooding events.
- Process/Event: Water table changes resulting in a smaller or bigger vadose zone.
- Event: Dam removal or failure.
- Process: What happens to clastic dikes over time?
- Process: Does geochemistry (of water and other media) change over time? E.g. waste could change pH of water.
- Process/Event: Climate change (ice age).
- FEPs should be categorized in big vs. small, long vs. short timing issues.
- Event: Construction (resevoirs, dams, roads, buildings, etc.)
- Event: Subsidence.
- Process/Event: Effect of eng. System on VZ (chemical, physical).

Surface conditions (1943-2019)

- Under 'grading backfill', delete 'evapotranspiration' add 'evaporate.'
- Feature: Add 'contamination.'
- Feature: Preferential pathways.
- Event: Water additions (e.g. fire hydrants)
- Event: Unplanned releases (including fuel, herbicides, etc.)
- Event: Excavation.
- Event: Construction excavation for new pipelines, diversion boxes, etc.
- Event: Pipeline leaks to surface
- Process: Biota (critters).
- The 'surface', shallow vadose zone and deep vadose zone have been defined in a graphic that Mark Triplett has.
- Process/Event: Dust storms.
- Event: Events associated with operations, retrievals, characterization and closure.
- Delete 'surface graveled surface' (it is confusing).
- Any pre 1944 features that need to be considered? West Lake?

- Feature: Hanford townsite and irrigation canal? (probably not close enough to be a feature of importance).

During surface institutional Controls (100 yrs post closure)

- Add biota column.
- Cap performance in arid environments. This is an uncertainty.
- What level of barrier performance would provide better (significant) results?
- Mike will post Savannah River F Area PA documents and responses on website.
- Event: Subsidence.

Surface (after institutional Control)

- Process: plane diseases, precipitation, sun, and asphalt.
- Process for armored surface storage layer: Root growth.
- Process for drainage layer: root growth, clogging (particles), cattle ruts, bio-intrusion.
- Process for asphalt layer: oxidation, volitilization, seismic, thermal, biodegradation, age hardening, flow in-creep, and construction joint weakness.
- Process: Side slope instability.
- Process: Chemical leaching (asphalt).
- Event: Man-made stuff: maintenance, fire fighting, drilling, excavation, construction, atv recreation.
- Process: Vegetations changes over time.
- Process: Biointrusion (critters).
- Process: Deterioration of geomembrane.
- Process: Freeze/thaw cycling.
- Event: Dessication through drought.
- Event: Episodic storms (winter, summer, water and wind).
- Process: Local erosion due to heterogeneity.

Tanks

- Event: Pour bad grout.
- Event: Retrieval equipment in tank.
- Process: Heat impacts on tank structure.
- Include man-made events from above.
- Event: Grout impacts tank structural integrity (settling)
- Event: Seismic.
- Process: Leaching out of grout might have pH impacts and other geochemistry changes. Steel degradation might impact colloidal transport.
- Process: Redox impacts along cracks.
- Process: Biota intrusion.
- Feature: Gunite in tank.
- Feature: Existing but unknown flaws in tank.

Pipelines

- Feature: Preferential flow on pipetroughs and pipes in general.
- Process: Galvanic and ground loop corrosion (for tanks too).

- Event: Removal of pipe.
- Process: Increased corrosion due to microbes.
- Chemistry of catch tanks and pipes is necessary.

Mike to update and post FEPS sheets on website for comment.

Outcome Discussion

- Early and significant impact indicating we were wrong.
- Cap gone or partially gone.
    - Poor construction, lack of cap materials, inconsistent material quality.
    - Normal degradation of cap.
- Big water infiltration.
    - Water. New missions/human use (golf course, neighborhood, nuke plants, irrigation)
    - Water. Gully washer, angry cloud.
    - Water. Columbia or Yakima river course changes.
    - Water. Rising groundwater.
- Big impact.
    - Bad assumptions, bad modeling, missing sources, fast pathways, looked too narrowly, conceptual and numeric don't match, lack of sufficient testing, lack of data, lack of independent review.
- Bad outcome.
    - Grout doesn't set up in tanks. Undetected voids (bridging). No grout, tank collapse. Subsidence into soil.

What We Did

10x still an issue

- Clarity on sensitivity vs. uncertainty
- Mike's estimation document.
- Will get easier as iterations proceed and we figure out what is important and where more work is needed.

Disconnect between PA, EIS and final barrier design.
Final decision on grout formulation and other items similar to barrier.
For future sessions, FEPs should be presented not in lists but cartoons.