Report on “Engineered Systems #2 Working Session—Steel Corrosion; Concrete/Grout Degradation”

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Background

The U.S. Department of Energy (DOE), Office of River Protection, has established a program for retrieval and closure of 149 single-shell tanks at the Waste Management Area C (WMAC) of the Hanford Site in south central Washington. In the future, DOE and the U.S. Nuclear Regulatory Commission (NRC) will consult on waste determinations for these tank closures. In addition, the tanks will be closed in coordination with the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) in accordance with the Tri-Party Agreement and State-approved closure plans.

DOE has requested NRC staff to participate with DOE, EPA, and Ecology in holding a series of working sessions to develop a long-term human health and environmental assessment for WMAC. The working sessions intend to capitalize on early interactions between the regulatory agencies and tribal and stakeholder communities, with a goal of producing the WMAC performance assessment. This performance assessment ultimately will be the basis of the related waste determinations, *Resource Conservation and Recovery Act of 1976* (RCRA) closure plans, and *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) records of decision. The intent of technical discussions at the working sessions is to provide sufficient transparency and traceability of the conceptual models, exposure scenarios, and specific data and parameter values used in the performance assessment calculations.

The Engineered Systems #2 Working Session, which focused on tank degradation, infrastructure degradation, and cementitious waste forms, was held from July 27 to 29, 2010, in Richland, Washington. The primary purpose of the session was to provide a forum for detailed discussions of the important features, events, and processes related to tank, pipeline, and ancillary equipment degradation that will need to be considered and used in the WMAC performance assessment. The working session agenda included (i) a review of past working session decisions and tank structural integrity work, (ii) degradation of tank steel liner and structural concrete, (iii) initial scoping calculations and proposed “denominator” (analogous to “reference”) and sensitivity cases for contaminant release from residuals, and (iv) the toxicological look ahead and exposure scenarios. The detailed agenda with a list of speakers is provided in the Appendix of this report.

NRC requested the participation of Dr. Roberto Pabalan at the Engineered Systems #2 Working Session and his technical assistance in reviewing the working session documentation and presentations, particularly on cementitious waste form degradation. R. Pabalan’s comments and conclusions regarding the Engineered Systems #2 Working Session presentations, documentation, and discussions are provided in the following sections.

General Comment on the Engineered Systems #2 Workshop

The working session was well organized and provided a useful forum for detailed discussions of the key features, events, and processes relevant to the degradation of the engineered system, including tank (steel liner, concrete, grout), pipeline, and ancillary equipment that need to be considered and used in the WMAC postclosure performance assessment. The organizers were open to questions and comments regarding the approach being proposed for the performance assessment and encouraged participants to provide their input during and after the session by communicating with DOE staff. The session engendered fruitful interaction between the various stakeholders, which should help minimize critical comments on the DOE performance assessment approach later in the performance assessment development process and reduce delays in the DOE schedule for tank closure resulting from those comments.

Comments on Workshop Report and Presentations

Fort, et al. (2010) Report on "Corrosion and Structural Degradation Within Engineered System in Waste Management Area C"

The Fort, et al. (2010) report was made available to the working session participants through the website http://wir-workshops.wrpstoc.com/uploads/files/_whitepapers/engin_no2/RPP-RPT-46879_-_Rev_00.pdf (user ID and password required). General topics discussed in the report include (i) review of the existing engineered features of WMAC, (ii) key features and processes related to corrosion of steel components and elements of tanks and ancillary equipment, (iii) key features and processes related to tank structure and concrete degradation, (iv) review of conceptual models of contaminant release from tank waste residuals, and (v) proposed reference and sensitivity cases for contaminant release from residual tank wastes.

The discussion of key features, events, and processes related to corrosion of steel and metallic components provided in Section 4 of the report is comprehensive and succinct. Degradation processes considered include stress corrosion cracking, uniform corrosion, concentrated cell corrosion, microbiologically induced corrosion, erosion-related corrosion, hydrogen embrittlement, thermal embrittlement, radiation embrittlement, creep and stress relaxation, fatigue, and wear. The report concluded that nitrate- and hydroxide-induced stress corrosion cracking is the dominant degradation mechanism for the tank steel liners, and contributing factors are the (i) lack of heat treatment to relieve stress at weldments, (ii) waste chemistries with pH less than 10 and low nitrite concentration, and (iii) operational temperatures greater than 100 °C [212 °F]. This conclusion, however, is relevant only to the operational stage of the Hanford tanks. The report did not discuss the likely degradation mechanisms during the postclosure period and how these mechanisms should be accounted for in performance assessments.

Section 5 of the report discussed conceptual models of tank concrete structure and emplaced grout degradation and reviewed the key features, events, and processes related to concrete structure and grout degradation. Although the first paragraph of Section 5 stated that a range of estimated degradation rates that could be considered in the WMAC performance assessment would be presented, no estimated degradation rates were included in the report. Key features, events, and processes that could potentially affect the stability and strength of tank concrete structures and grout were presented in Section 5.1, including (i) elevated temperatures, (ii) aggressive chemical attack, (iii) corrosion of embedded steel, (iv) freezing and thawing, (v) calcium hydroxide leaching, (vi) aggregate and alkali reaction, (vii) creep and shrinkage, and (viii) radiation effects. The considered processes are comprehensive, but the discussion is too general to be useful for WMAC performance assessment model development. Processes that most likely would be important during the postclosure period should be identified and approaches to abstract these processes should be discussed. A report by Langton (2007) would be a useful reference.

Section 5.5 of the Fort, et al. (2010) report discussed potential tank grout degradation processes, including (i) weathering, (ii) abrasion, (iii) mechanical loads, (iv) freeze-thaw cycles, (v) alkali-aggregate reactions, (vi) sulfate attack, (vii) delayed ettringite formation, and (viii) steel corrosion induced by CO_2 and chloride ion ingress. The report concluded that weathering, abrasion, mechanical loads, and freeze-thaw cycles are unimportant degradation processes because the tanks are buried at depth underground. Sulfate attack and delayed ettringite formation also were concluded to be unimportant mechanisms for grout degradation in Hanford single-shell tanks because of the (i) small amount of sulfate in the tank waste residual, (ii) the use of low sulfate mix water and aggregate, (iii) the low sulfate content of the enhanced RCRA Subtitle C barrier, and (iv) the addition of blast furnace slag and fly ash to the Hanford tank grout, which reduces the grout permeability and potential for external sulfate attack. These conclusions are reasonable if the statements regarding the low sulfate content in residual waste, mix water, aggregate, and RCRA Subtitle C barrier are correct.

In discussing the potential for corrosion-induced cracking of the grout, the report stated that the single-shell tanks will have relatively little steel incorporated into the grout, unlike normal reinforced concrete where significant amounts of rebar are present. The report acknowledged that this degradation pathway will need to be considered separately for each tank because the amount of steel equipment left in the tanks will vary. It was stated that chloride ions are not present in high amounts in the surrounding soil at Hanford and will thus limit corrosion-induced cracking of the grout; this conclusion is reasonable. The report stated that calculations of the rate and extent of steel corrosion for equipment in the grout or the tank steel liner were outside the scope of the report. If the rate and extent of steel corrosion were to be analyzed, a useful reference would be Subramanian (2008). The approach described in Subramanian (2008) was used in the Savannah River Site F-Tank Farm performance assessment (WSRC, 2008). NRC staff commented on the modeling approach described in Subramanian (2008) and WSRC (2008). The NRC comments and DOE responses are documented in SRR (2010).

Section 5.6 of Fort, et al. (2010) described other factors that could cause grout monolith cracking in addition to those described in previous paragraphs, including plastic shrinkage, drying shrinkage, thermal cracking, and structural cracking due to loss of underlying support or an excessive load. The report concluded that these processes are unlikely to contribute significantly to Hanford tank grout degradation. However, it is possible the effect of thermal cracking may have been underestimated. At the Idaho National Laboratory, the tank grout was poured in several layers to minimize the potential for thermal cracking (CH2M–WG Idaho, LLC, 2007). But Section 5.4.1 of the Fort, et al. (2010) report stated “It is the intent of Hanford to control (i.e., limit) cold joint formation by maintaining as continuous a pour schedule as possible.” A continuous tank grout pour would increase the temperature rise and temperature gradient within the grout as the grout hydrates and could increase the potential for cracking as the grout cools and hardens. Section 5.6.1 stated “Calculations on the temperature profiles in the SSTs as a function of heat of hydration and placement rate revealed a maximum temperature in the tank of 55 °C [130 °F],” but no reference was provided. It is not clear whether the calculation is for the full height of the single-shell tank and what grout composition was assumed in the analysis. The maximum temperature would depend on the thickness of the grout pour and the degree of substitution of supplementary cementitious materials (i.e., fly ash, blast furnace slag) for Portland cement. For example, R. Pabalan’s independent calculations using the spreadsheet model of Bamforth (2007) indicated the maximum temperature for a 4.6-m [15-ft]-high tank grout would be 63 °C [145 °F] for a grout composition of 60:40 Portland-cement:fly-ash and 76 °C [169 °F] for grout with no fly ash.

Section 5.7 of the report discussed examples of ancient structures that used pozzolanic materials analogous to modern cement. Some of these structures, such as the Pantheon, Hadrian’s Wall, and Roman aqueducts, have existed for more than 2,000 years in the face of weathering, abrasion, wars, and neglect. The report stated that the longevity of these structures suggests that the lifetimes for the grout monoliths within the projected single-shell tanks also could extend to the thousands of years. However, an analogy between the grouted tank monoliths and ancient structures is questionable given that the compositions and exposure conditions are different. Also, as pointed out by a workshop participant, the ancient structures that exist today are not necessarily evidence of long-term performance, but rather the poor performance of the other parts of the structure that did not survive.

Section 6 of the report provided a good summary of the conceptual model of contaminant release from waste residuals. The conceptual model was described as follows. The contaminants initially will be leached from residual waste remaining in the tanks by existing pore water and diffuse slowly through the grout emplaced in the tank around the waste residuals. Over the long term, the emplaced grout, tank steel liner, and reinforced concrete in the base, sides, and dome of the tanks are expected to degrade allowing natural infiltration passing through the surrounding backfill to migrate into the grout-filled tank and contact the residual wastes. Infiltrating water will leach contaminants from the residual waste, migrate out of the tank, reenter the natural environment beneath the tanks, and pass through the vadose zone to the underlying water table, which is approximately 200 ft [61 m] below the tank bottom.
Table 6-1 of the report summarized features, processes, and off-normal external events related

to the engineered system and contaminant release from tank residuals within WMAC. The list is comprehensive and adequately considers the key features, events, and processes for both near-term and long-term postclosure periods.

Section 6.2 described the proposed reference and sensitivity cases for contaminant release from waste residuals. A reference case and three sensitivity cases for contaminant release from tank residuals were proposed. The reference case assumes contaminant releases are diffusion controlled from intact emplaced grout, with a diffusion coefficient of 1.0×10^{-9} cm^2/s [1.6×10^{-10} in^2/s]. Sensitivity Case 1 assumes an initial diffusion-controlled release followed by complete degradation of the emplaced grout and advection-controlled release after 100 years (Case 1a) or 500 years (Case 1b), during which transport is affected by infiltration rates and chemical adsorption onto surrounding soils. Both Cases 1a and 1b assume a diffusion coefficient of 1.0×10^{-9} cm^2/s [1.6×10^{-10} in^2/s] during the diffusion-controlled period. Sensitivity Cases 2 and 3 assume diffusion control with diffusion coefficients of 1.0×10^{-8} cm^2/s and 1.0×10^{-14} cm^2/s [1.6×10^{-9} in^2/s and 1.6×10^{-15} in^2/s], respectively. The three different diffusion coefficients for the reference case and sensitivity cases are stated to reflect the range of values determined from leaching tests of stabilizing grout formulations on simulated Hanford Site tank wastes. M. Kozak presented preliminary results of the reference and sensitivity cases (see following section).

M. Kozak Presentation, "Initial Scoping Analysis of the Engineered Barrier Systems at WMA-C"

M. Kozak discussed preliminary results of the analysis for the reference and sensitivity cases described in the Fort, et al. (2010) report, as well as the results of six additional sensitivity cases (Cases 4 to 9). The stated purpose of the scoping analyses is to provide initial insight into key parameters and phenomena and evaluate initial reference case and calculation variants. Case 4 assumes initial release by diffusion, with a low initial diffusion coefficient of 1.0×10^{-14} cm^2/s [1.6×10^{-15} in^2/s], but with a failure at 500 years as in Case 1b. Case 5, which assumes an intermediate diffusion coefficient and diffusion control lasting throughout the calculation period, was included to provide insight into the transition from the reference case to Case 3. Case 6 assumes gradual changes in engineered system properties, with the flow rate and effective diffusion coefficient increasing linearly with time. Case 7 assumes gradual releases from the residual waste, with all other parameters set to the reference case. Ninety-nine percent of the contaminants are released as a band release (constant release rate over time) over 1,000 years, with the remaining 0.1 percent released instantaneously. Case 8, which assumes reduced advective flow rates {1.0×10^{-4}, 1.0×10^{-5}, and 1.0×10^{-6} m/y [3.3×10^{-4}, 3.3×10^{-5}, and 3.3×10^{-6} ft/y]} through the engineered components, was included to investigate the transition between diffusive-controlled release and advective-controlled release. Case 9 assumes diffusion-controlled release at all times, with an even higher effective diffusion coefficient than Case 2.

M. Kozak concluded that (i) the calculated release rate for cases that are diffusion controlled at all times is at the low end of the results for the sensitivity cases, (ii) advection through the waste and engineered features has an important effect on the calculated radionuclide concentration at the well, (iii) high diffusion coefficients produce similar results to low advection rates, and (iv) taking credit for the bitumen liner at the tank bottom likely will have a strong effect on estimates of radionuclide release. Using a diffusion coefficient of 1.0×10^{-14} cm^2/s [1.6×10^{-15} in^2/s] in the calculations results in zero release. Detailed information on the model and parameters M. Kozak used was not available during the workshop, but the preliminary results indicate the analyses will help identify important parameters and phenomena needed for performance assessment of the Hanford WMAC.

K. Subramanian Presentation, "Corrosion and Degradation of Steel Liner—Steel Integrity Parameters—Savannah River" and "Life Estimation of High Level Waste Tank Steel for F-Tank Farm Closure Performance Assessment"

K. Subramanian described the approach used at the Savannah River Site for evaluating the steel liner performance, which is documented in Subramanian (2008). The objective of the assessment was to determine the time period that steel liners of the Savannah River Site F-Tank Farm tanks can act as barriers to contaminant release. During the postclosure period, carbonation reduces the concrete and grout pore water pH, which leads to loss of passivity of steel to corrosion. Carbonation is a complex function of concrete permeability, relative humidity, and CO_2 availability. K. Subramanian used a simple CO_2 diffusion model, assuming the concrete vaults are water saturated and CO_2 transport is in the aqueous phase. Based on a range of CO_2 diffusion coefficients, a range of times to carbonation of the concrete/tank steel interface (i.e., time to steel liner corrosion initiation) was calculated. The CO_2 diffusion model was acknowledged to be nonmechanistic (i.e., the CO_2 diffusion coefficient in concrete is assumed constant and does not account for the effects of water saturation, permeability, and tortuosity). Rather, these effects are accounted for in the calculations by using a range of CO_2 effective diffusion coefficients {1×10^{-8} to 1×10^{-3} cm^2/sec [1.6×10^{-9} to 1.6×10^{-4} in^2/sec]}. This range bounds the CO_2 diffusion coefficient in water {1.9×10^{-5} cm^2/sec [2.9×10^{-6} in^2/sec]} (Tamimi, et al., 1994), but not in air {0.14 cm^2/sec [0.022 in^2/sec]} (Pritchard and Curie, 1982). The concrete and grout carbonation rate would be faster; hence, the steel corrosion could initiate earlier if the CO_2 pathway was dry or had low moisture content.

Another mechanism K. Subramanian considered in the assessment is chloride-induced breakdown of the passive film and corrosion supported by oxygen diffusion. Time to chloride-induced corrosion initiation is based on a simple empirical model that depends on the concrete cover thickness, water/cement ratio, and chloride ion concentration. The equation is from a Federal Highway Administration report (Clear, 1976). Using a range of chloride ion concentrations, chloride-induced corrosion initiation times were calculated for Savannah River Site Types I, III, and IV tanks, as were corrosion rates for Types I, III, and IV tanks as a function of oxygen diffusivity through the concrete.

K. Subramanian also discussed a Monte Carlo approach for estimating the time-to-failure of the tank liner, which is able to represent the uncertainties in the deterministic approach and also allow for a large number of simulations. The life of the tank liners was assumed to be a function of the time to corrosion initiation plus the time for corrosion to propagate through the liner. The failure time calculations accounted for (i) chloride-induced depassivation followed by general corrosion, (ii) carbonation-induced depassivation followed by general corrosion, and (iii) a combination of (i) and (ii). K. Subramanian concluded that the high-level waste tank can act as a barrier to radionuclide release after closure. If the Hanford WMAC performance assessment takes credit for the tank steel liner as a barrier, the modeling approach K. Subramanian presented could be useful for evaluating tank steel liner performance. NRC staff commented on the modeling approach described in Subramanian (2008). The NRC comments and DOE responses are documented in SRR (2010).

L. Fort Presentation, “Steel Liner Corrosion”

L. Fort discussed a brief history of WMAC construction and the features of engineered facilities and summarized key features, events, and processes affecting steel liner corrosion, which was detailed in Fort, et al. (2010). L. Fort listed the following recommendations for performance assessment: (i) the lifetime of a 0.64-cm [0.25-in] steel liner degraded by uniform corrosion is estimated to be ~250 years, (ii) the effect of the liner will generally not be considered in the performance assessment, and (iii) the effect of a range in liner lifetimes will be examined in scoping and sensitivity cases. Recommendation (ii) generated comments that taking zero credit for the liner may not be conservative. K. Subramanian pointed out that a Savannah River Site analysis indicated that an intact liner could act as bathtub and its subsequent failure could cause a higher dose peak. The assumption in Recommendation (i) regarding the ~250 years lifetime of a 0.64-cm [0.25-in] steel liner was questioned because the assumed 0.025 mm/yr [1 mil/yr] corrosion rate does not necessarily apply to the postclosure period.

L. Fort Presentation, “Degradation of Tank Structural Concrete”

L. Fort provided a good summary of the key features, events, and processes related to tank structural concrete degradation, which is also discussed in Fort, et al (2010). L. Fort concluded that the lifetime of tank structural concrete is estimated to be at least 500 years. However, the basis for this conclusion is not well supported in the presentation or in the Fort, et al. (2010) report. It is apparently based on corrosion rate measurements on concrete cylinder samples taken of Hanford tank concrete, but detailed information and data uncertainty were not available at the workshop. Also, the data derived from the concrete samples are likely applicable to the operational period and not to the postclosure period.

L. Fort listed the following recommendations for performance assessment: (i) the hydraulic effect of tank structure generally will be considered in performance assessment; (ii) changes in hydraulic properties that approximate the effect of tank structures (including emplaced grout) will be evaluated; (iii) the effect of these changes on contaminant release over a range of estimated time frames will be examined; and (iv) additional sensitivity cases may be considered.

L. Fort Presentation, "Degradation of Ancillary Equipment, Pipelines, Diversion Boxes"

L. Fort indicated that the effect of ancillary equipment and pipelines in controlling contaminant release will not be considered in performance assessment. Instead, the assumed inventories of residual wastes will be placed in the soil profile at the depth of pipelines and facilities and will be immediately available for advective transport to lower parts of the vadose zone. This approach is reasonable given the uncertainty in barrier performance of the ancillary equipment and pipeline materials.

K. Rosenberger Presentation, "Concrete and Grout Degradation Findings and Implementation—Savannah River Site"

K. Rosenberger described the implementation of concrete and grout degradation in the Savannah River Site F-Tank Farm performance assessment. The approach is based on Langton (2007), which assessed the various chemical degradation mechanisms including sulfate attack, alkali aggregate attack, acid leaching, carbonation, and rebar corrosion. Carbonation, which results in rebar corrosion, was calculated to be the dominant degradation mechanism of tank vault reinforced concrete, with a concrete degradation rate of 20.8 cm [8.2 in] in 1,000 years. For tank fill grout, carbonation also was determined to be the dominant degradation mechanism due to corrosion of cooling coils, with a rate of 35.6 cm [14.0 in] in 1,000 years. The Langton (2007) results were used to calculate the degradation timing of the tank concrete and fill grout for each tank type in the Savannah River Site F-Tank Farm. The tank concrete was assumed to be fully degraded when the carbonation front reached one-half the minimum thickness of tank concrete. The tank fill grout was assumed to be fully degraded when the carbonation front reached one-half the thickness of the grout. While material is degrading, it is assumed that hydraulic properties change linearly from initial properties to fully degraded properties. The changes in cementitious material properties affect flow and thus the timing of chemical property changes (i.e., Eh and pH changes to solubility and K_ds).

DOE has not decided whether to apply in Hanford WMAC performance assessments the approaches used for the Savannah River Site F-Tank Farm performance assessment. One reason is the soil residual inventory at Hanford is likely to be higher than the tank waste residual inventory; thus the contribution of the latter to dose may not be significant compared to the former. In that case, detailed modeling of tank concrete, tank liner, and tank grout degradation may not be necessary. The use of one-off sensitivity analyses, which was mentioned at the workshop, could provide sufficient information to determine whether more detailed modeling is warranted.

Summary

The working session provided a useful forum for detailed discussions of the key features, events, and processes relevant to the degradation of the engineered system that will need to be considered in the WMAC postclosure performance assessment. The workshop achieved its objective of providing traceability and transparency for the conceptual models, data, and parameter values to be considered in performance assessment calculations. The series of working sessions DOE organized should help minimize critical comments on the DOE performance assessment approach later in the performance assessment development process and reduce delays in the DOE schedule for tank closure resulting from those comments.

The approach DOE plans to use to model the engineered system in its WMAC performance assessment is not yet finalized. Sensitivity analyses and one-off analyses should provide adequate information to determine whether relatively detailed modeling of the tank steel liner and concrete/grout degradation is warranted. If it is, the modeling approaches applied to the Savannah River Site F-Tank Farm performance assessment would be an appropriate starting point for the analyses.

References

Bamforth, P.B. "Early-age Thermal Crack Control in Concrete." London, U.K.: CIRIA. 2007.

CH2M-WG, LLC. "Compliance and Monitoring Plan for Performing Grouting at the INTEC Tank Farm Facility Closure Project." PLN–2309. Rev. 2. Idaho Falls, Idaho: CH2M–WG Idaho, LLC. 2007.

Clear, K.C. "Time-to-Corrosion of Reinforcing Steel in Concrete Slabs." FHWA–RD–76–70. Washington, DC: Federal Highway Administration. 1976.

Fort, L.A., M.P. Bergeron, and M.P. Connelly. "Corrosion and Structural Degradation Within Engineered System in Waste Management Area C." RPP–RPT–46879, Revision 0. Richland, Washington: Washington River Protection Solutions, LLC. 2010.

Langton, C. "Chemical Degradation Assessment of Cementitious Materials for the HLW Tank Closure Project." WSRC–2007–00607, Revision 0. Aiken, South Carolina: Savannah River National Laboratory. 2007.

Pritchard, D.T. and J.A. Currie. "Diffusion of Coefficients of Carbon Dioxide, Nitrous Oxide, Ethylene and Ethane in Air and Their Measurement." European Journal of Soil Science. Vol. 33. pp. 175–184. 1982.

SRR. "Comment Response Matrix for Nuclear Regulatory Commission (NRC) Comments on the F-Tank Farm Performance Assessment (SRS–REG–2007–00002, Revision 0, dated June 27, 2008)." SRR-CWDA–2009–00054, Revision 0. Aiken, South Carolina: Savannah River Remediation Closure & Waste Disposal Authority. 2010.

Subramanian, K.H. "Life Estimation of High Level Waste Tank Steel for F-Tank Farm Closure Performance Assessment." WSRC–STI–2007–00061, Revision 2. Aiken, South Carolina. Savannah River National Laboratory. 2008.

Tamimi, A., E.B. Rinker, and O.C. Sandall. “Diffusion Coefficients for Hydrogen Sulfide, Carbon Dioxide, and Nitrous Oxide in Water over the Temperature Range 293–368 K.” Journal of Chemical and Engineering Data. Vol. 39. pp. 330–332. 1994.

WSRC. “Performance Assessment for the F-Tank Farm at the Savannah River Site.” SRS–REG–2007–00002, Revision 0. Aiken, South Carolina: Washington Savannah River Company. 2008.

APPENDIX
Agenda for WMA C PA—Engineered Systems #2 Working Session

Agenda for WMA C PA –
Engineered Systems #2 Working Session
Steel Corrosion; Concrete/Grout Degradation
July 27-29, 2010
Ecology's Office, Richland WA

July 27 am	**Introductions, Goals and Objectives - Engineered System #2 Session, Review of Past Working Session Decisions, Tank Structural Integrity Work**
8:00 am	**Refreshments**
8:15 am	**Introductions** (C. Kemp/S. Eberlein)
8:45 am	**C- Farm Decision Schedule** (C. Kemp/J. Lyon)
9:00 am	**Goals and Objectives of Engineered Systems #2 Working Session** (S. Eberlein)
9:15 am	**Updates on Past Working Session Decisions, Natural System & Open items** (M. Connelly)
9:45 am	Break
10:00 am	**Continued - Updates on Past Working Session Decisions, Natural System & Open items** (M. Connelly)
10:30 am	**Tank Structural Integrity Work Underway** (K. Boomer)
	Other Perspectives on Tank Structural Integrity Work (D. Dunning - ***DOE-State of Oregon)***
11:30 am	Lunch
July 27 pm	**Features of Engineered System #2: Degradation of Tank Structural Concrete**
12:45 pm	**Steel Liner Corrosion** (L. Fort)
1:30 pm	**Corrosion and Degradation of Steel Liner - Savannah River** (K. Subramanian, SRS & Hanford Integrity Integration)
2:00 pm	Break
2:15 pm	**Continued - Corrosion and Degradation of Steel Liner - Savannah River** (K. Subramanian, SRS & Hanford Integrity Integration)
3:00 pm	**Dissolution and Degradation of Tank Structural Concrete** (L. Fort)
4:00 pm	Adjournment
July 28 am	**Degradation of Tank Structural Concrete (continued)**
8:00 am	**Refreshments**
8:15 am	**TC&WM EIS - Waste Form Release Assumptions** (EIS team)
9:15 am	**Degradation of Ancillary Equipment; Pipelines, Diversion Boxes (CR Vault)** (L. Fort)
9:45 am	**Infrastructure Closure Planning** (S. Eberlein)
10:15 am	Break
10:30 am	**Grout Mixing Studies and Testing** (K. Quigley)
11:00 am	**Grout Degradation Findings Result of Carbonate and Sulfates** (K. Rosenberger, SRS & Hanford Integrity Integration)
11:30 am	Lunch
July 28 pm	**Initial Scoping Calculations; Proposed Denominator and Sensitivity Cases for Contaminant Release from Residuals**
12:45 pm	**Steel and Concrete Degradation (Open Discussion and Q & A)**
1:00 pm	**Initial Scoping Analysis of Contaminant Release from Tank Waste Residuals** (M. Kozak)
2:00 pm	**Review of Proposed Denominator and Sensitivity Cases** – (M. Bergeron)
2:30 pm	Break

2:45 pm	**Animation of WMA C Water Quality Data** (S. Sobczyk, Nez Perce Tribe)
3:15 pm	**3-D Model of Pipelines of WMA C** (M. Connelly)
4:00 pm	Adjournment
July 29 am	**Toxicological Look Ahead, Exposure Scenarios; Engineered System #2 Working Session Close-out/Feedback, Look Forward**
8:00 am	Refreshments
8:15 am	**Toxicological Look Ahead, Exposure Scenarios** (P. Thomason)
9:15 am	**Toxicological Look Ahead, Exposure Scenarios** (Open Discussion and Q&A)
9:30 am	Break
9:45 am	**Engineered System #2** (Open Discussion and Q&A)
10:30 am	**Review of Consensuses and Notes** (T. Martin)
11:00 am	**Working Session Feedback** (T. Martin)
11:15 am	**Look Forward to Upcoming Working Sessions** (S. Eberlein)
11:30 am	Adjournment