Savannah River
Nuclear Solutions LLC
A Fluor Daniel Partnership

INTEROFFICE MEMORANDUM

SRNL-L6200-2010-00027 Rev. 1

Date: November 18, 2010

To: Kent Rosenberger

From : Greg Flach GMF 11/15/2010
Thong Hang TH 11/15/2010

Copy: Heather Burns
Jeff Jordan
Daniel Schep

Subject: **SRNL Design Checking for H-Tank Farm PORFLOW Modeling**

PORFLOW modeling in support of the H-Tank Farm (HTF) Performance Assessment (PA) has been design checked per Procedure Manual E7, 2.60 *Technical Reviews* following guidance provided by WSRC-IM-2002-00011, Rev. 2, *Technical Report Design Check Guidelines*. The purpose of this memorandum is to summarize technical findings and resolutions originating from multiple SRNL design checkers. Additional quality assurance checks have been performed by Savannah River Remediation LLC but are not documented here.

Alan Wu

Alan Wu, now retired, checked that dimensions from engineering drawings were correctly implemented by Jeff Jordan in the PORFLOW model representations of waste tanks and ancillary equipment. As noted in Appendix A, a discrepancy in the height of Type III/IIIA tanks was found and corrected.

Thong Hang

Thong Hang checked that fractured concrete and grout material properties described in the PORFLOW modeling report SRNL-L6200-2010-00026 (Jordan et al. 2010) were correctly generated by Greg Flach and Jeff Jordan starting from Or and Tuller (2000). No technical concerns were found as indicated in Appendix B.

Greg Flach

Greg Flach checked that Jeff Jordan and Daniel Schep correctly implemented modeling scenarios, cases and inputs defined by Savannah River Remediation LLC in PORFLOW vadose zone flow and transport simulations. Appendix C enumerates a few technical findings, all of which has been satisfactorily resolved.

A discrepancy between the suction head and saturation was observed in some vadose flow simulations, due to the imposition of numerical relaxation in order to achieve mass balance convergence.

Specifically, the saturation reported by PORFLOW was found to be somewhat different from the saturation computed from PORFLOW pressure using the specified water retention curve. The current simulation results were judged to be adequate for the Revision A draft of the HTF PA because the base case (Case A) results appear to be biased toward higher doses, i.e., conservative. Tighter adherence to the specified water retention curve is required for the final Performance Assessment however.

Following an inventory change for I-129, a best-estimate Kd change for Ra, a modification application of the cross-flow factor (SRNL-L6200-2010-00027, Rev. 1) and PORFLOW re-runs to a tighter convergence tolerance, PORFLOW results were reexamined. No technical issues were discovered.

References

Jordan, J, G. Flach and D. Schep, 2010, *PORFLOW Modeling Supporting the H-Tank Farm Performance Assessment*, SRNL-L6200-2010-00026.

Or, D. and M. Tuller, 2000, *Flow in unsaturated fractured porous media: Hydraulic conductivity of rough surfaces*, Water Resources Research, v. 36, n. 5, 1165-1177.

Procedure Manual E7, 2.60, *Technical Reviews*.

Savannah River National Laboratory, 2004, *Technical Report Design Check Guidelines*, WSRC-IM-2002-00011, Rev. 2.

Appendix A - Design checking performed by Alan Wu

Design Check: Vadose zone grids in HTF PA modeling	**Date:** 8/30/2010
Design check scope, instructions, and/or general comments: Check for correct implementation of tank geometry	

No.	Comment	Proposed Resolution	Analyst Response	Checker Concur? Y,N
	One minor error was originally discovered in the height of the inside of the tank for the Type III and IIIA's. The height of the inside of these tanks was approximately 5.5" too short due to a mistake in the calculation.	Revise PORFLOW grid accordingly	Done	Y

If checker has no comments, check here. ☐ Add additional rows above, as needed.

Analyst Name (print): Jeff Jordan	**E-Signature (or sign/date/scan hardcopy):** (Not required if no comments)
Checker Name (print): Alan Wu	**E-Signature (or sign/date/scan hardcopy):**

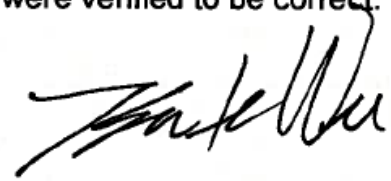
H Farm Waste Tank Model Input

Tsu-Te Wu to: Jeffrey Jordan 05/27/2010 09:22 AM

The geometric input data for Type I, II, III, IIIA, IV models of the H-Area tank farm waste tanks were reviewed. An additional Type IIIA model was created due to a different depth to water table. Additional Type I and Type II geometric models were created to represent a failed liner at time zero. These additional models were reviewed as well. The local Mesh2d.tec file, which is created as part of the preprocessor logic, was reviewed and compared to the associated input package and drawings as needed.

One minor error was originally discovered in the height of the inside of the tank for the Type III and IIIA's. The height of the inside of these tanks was approximately 5.5" too short due to a mistake in the calculation. These values were corrected. The geometric input data was reviewed again after the error were corrected.

In conclusion, all the geometric input data for Type I, I_noliner, II, II_noliner, III, IIIA, IIIAWest (different depth to water), and IV were verified to be correct.



Appendix B - Design checking performed by Thong Hang

Design Check: Fractured concrete and grout characteristic curves used in HTF PA	**Date:** 8/30/2010
Design check scope, instructions, and/or general comments: Check for correct implementation of fractured cementitious material characteristic curves based on Or and Tuller (2000)	

No.	Comment	Proposed Resolution	Analyst Response	Checker Concur? Y,N

If checker has no comments, check here. ☐ Add additional rows above, as needed.

Analyst Name (print): Greg Flach	**E-Signature (or sign/date/scan hardcopy):** (Not required if no comments)
Checker Name (print): Thong Hang	**E-Signature (or sign/date/scan hardcopy):**

Design Check for H-Tankfarm vadose zone flow runs

Thong Hang to: Jeffrey Jordan, Gregory Flach 06/15/2010 09:02 AM

I completed the design check for all vadose zone flow runs for the H-Tankfarm. I checked the S-Kr (fractured_basemat.skr and fractured_grout.skr) and S-p (fractured_basemat.sp and fractured_grout.sp) data provided by the Perl program and used in the Porflow input files for Tank types I, II, III, IIIA, and IV of Cases A, B, C, D, and E. Data were compared to those calculated by Greg Flach's spreadsheets. In all cases, data for both grout and concrete were checked at the start and end time intervals (TI01 and TI40) and in some transition time intervals which vary depending on Tank types and Cases. All comparisons showed excellent agreement between the spreadsheet data and the Perl program data. It should be mentioned that prior to using the spreadsheet I did check to make sure it accurately represents the calculation proposed by Or and Tuller.

Appendix C - Design checking performed by Greg Flach

Design Check: PORFLOW analyses for HTF PA	**Date:** 8/30/2010
Design check scope, instructions, and/or general comments: PORFLOW setup of vadose zone flow and transport, barrier analysis, and aquifer transport	

No.	Comment	Proposed Resolution	Analyst Response	Checker Concur? Y,N
1	Vadose zone flow: The material type labels for the primary and secondary vertical liners are swapped for Type IIIA and IIIAWest tanks. The mislabeling presently has no effect on results because the two zones (19 and 20) are assigned the same properties. Nonetheless the labels should be corrected to avoid confusion and future errors.	Revise pre-processing logic and input files with zone ID numbers.	Pre-processing logic has been revised	Y
2	Vadose zone flow: The TypeI, CaseA, Eh transition occurs at 11761 years but "transitions.tab" indicates 11760, perhaps due to a truncation operation rather than rounding.	Revise pre-processing logic to report the correct transition time.	Pre-processing logic has been revised	Y
3	Vadose zone flow: The "TimelineFlow" property summary files are missing information on porosity, density and characteristic curve. This does not affect the bottom-line results but would aid checking.	Include these data in the summary output files.	Makefile has been modified to report the additional information	Y
4	Vadose zone transport: For ancillary equipment, the "CONTAM_1" and "CONTAM_2" regions are reversed, such that inventory is being placed in an unintended layer.	Re-label the zones or swap assignment of the inventory source.	Labels have been swapped	Y
5	Vadose zone flow: For the Cases D and E the primary liner should initially be intact in the fast-flow (FF) region, and degrade at the prescribed rate for the rest of the liner.	Revise the material specification files to assign properties uniformly for the primary liner.	Input specifications have been revised accordingly	Y
6	Barrier analysis: Perturbations to soil Kd values are not observed in affected cases (barrier analysis cases 2-4, 6, 8), possibly due to a case sensitivity issue	Confirm case sensitivity and change to lowercase input for Kd material names	Case sensitivity confirmed, and barrier analysis input changed to lowercase	Y

Design Check: PORFLOW analyses for HTF PA	**Date:** 8/30/2010
Design check scope, instructions, and/or general comments: PORFLOW setup of vadose zone flow and transport, barrier analysis, and aquifer transport	

No.	Comment	Proposed Resolution	Analyst Response	Checker Concur? Y,N
7	Vadose zone flow: Numerical relaxation on saturation could introduce a disconnect between simulated pressure and saturation, i.e., the water saturation relationship may not be exactly honored during numerical iterations.	Confirm that the water retention relationship is being adequately satisfied in flow simulations	Some discrepancies were observed that warrant tighter convergence. Numerical convergence is adequate for PA Revision A because results appear to biased toward higher doses (conservative), but results will be refined for PA Revision B.	Y

If checker has no comments, check here. ☐ Add additional rows above, as needed.

Analyst Name (print): Jeffrey Jordan	**E-Signature (or sign/date/scan hardcopy):** (Not required if no comments)
Checker Name (print): Greg Flach	**E-Signature (or sign/date/scan hardcopy):**