Users Manual for FTF Open Items Database

General Information

The purpose of the F-Area Tank Farm (FTF) open items database is to document resolution of technical issues identified during US Nuclear Regulatory Commission (US NRC's) review of the FTF performance assessment (DOE, 2010a) and basis document (DOE, 2010b). A secondary purpose of the database is to assist NRC with fulfilling its monitoring responsibilities under the National Defense Authorization Act for Fiscal Year 2005 (e.g., will assist with development of a monitoring plan for FTF). Certain information provided in the database should be considered qualitative or semi-quantitative in nature and subject to change based on the accumulation of additional information. This user's guide contains information on the natural and quality of information available in the database to assist users with proper use and interpretation of the information extracted from the database.

Because the database contains information regarding NRC's prioritization and suggested path forward for resolution of key technical issues identified during NRC staff's review, NRC expects that the database will be useful to DOE staff while responding to NRC's requests for additional information (NRC, 2010) on the FTF PA and Basis document, as well as during DOE's development of a PA maintenance plan for FTF. As such, NRC staff plan to collaborate with DOE staff regarding the prioritization and suggested path forward for key technical issues identified in the database. This discussion will be facilitated with additional presentation materials that lay out NRC staff's understanding of facility risk and key barriers mitigating the risks associated with FTF tank residuals.

Assumptions

The following assumptions were made in developing the database.

- Due to the working level nature of information provided in the database, the quality of information provided in the database is expected to be fair initially (initially constructed in Feb 2011) and to increase over time during the early stages of development. For example, the database will be updated as a result of meetings between NRC and DOE staffs during the FTF revision 1 RAI resolution period (December to April 2011) and during development of NRC's TER and monitoring plan for FTF (mid to late 2011).

- Data provided in the FTF open issues database is expected to change over time. In addition to initial changes to the database based on meetings held between NRC and DOE staffs to reach consensus with respect to the risk significance and difficulty level in closing key technical issues for FTF, NRC expects the database to change over time as issues are resolved (and as issues are added) based on the collection of additional information. In this sense, the FTF open issues database is expected to represent a living document with data periodically archived and development focused on both the preservation and collection of additional information.

- The structure of the database may need to change based on NRC/DOE staff exchanges, to accommodate future needs, and/or to integrate with other data management tools.

- It is anticipated that information from the database will be used to produce tables for NRC's Periodic Compliance Monitoring Report currently issued annually. As such, key tables and reports from the database will be a matter of public record.

Key Tables and Queries

Table	Fields	Notes
Open Items	Open Items Related Comment # Category (Technical) Priority Difficulty	Open items were developed based on NRC's RAIs and Clarifying Comments on the FTF revision 1 PA and Basis Document (NRC, 2010). Open items are cross-walked to NRC's RAIs (related comment #). Priority and difficulty categories are assigned to each open item based on a semi-quantitative ranking as indicated in the priority and issue category or issue difficulty tables below.
Recommend ations	Recommendations Recommendation Category	Recommendations reflect subject matter expert's ideas regarding how open items might be closed based on the amount of model support already available and/or the risk-significance of the issue. Some open issues have several recommendations. In some cases, multiple lines of evidence may be needed to close a given issue given its risk-significance or given the difficulty in reducing uncertainty surrounding the issue. Other open items may be closed using only one method of support (for cases where some model support is available, the issue is readily resolved, and/or the risk-significance of the issue is relatively low), , although several methods may be listed . Recommendations are qualitative or semi-quantitative in nature (e.g., reflect judgments).
Path Forward	Open Items Recommendations Recommendation Categories	This table links open items and recommendations. There is one record for each open item. Recommendations are currently a multi-valued field (multiple recommendations are stored as a character string in one field for each open item).
Query on Open Items and Path Forward Tables	Multiple Fields from Open Items and Path Forward Tables	Although aggregated in the path forward table, recommendations are disaggregated back into individual records in this query. As a result, there may be several open item records (one record for every recommendation associated with the open item).

Other Look-up Tables

Table/Fields	Note
Radionuclides	List of Key Radionuclides (Some open items may be specific to certain key radionuclides)
Tanks	List of Tanks (Some open items may be specific to particular tanks)
RAI and CC #s	Cross-walk to NRC comment or RAI
TechCat	Technical Categories such as Near-field, Far-field, etc.
TechSubCat	Sub-categories such as steel liner, basemat, waste release (under near-field)
RecomCat	Recommendation categories such as literature review, expert elicitation, peer review, modeling, calculations, experiments
IssueCat	Expected difficulty in closing out technical issue (semi-quantitative). See table of issue categories (difficulty) below.
Priority	Expected priority based on risk-significance (semi-quantitative). See table of priorities below.

Example Tables

Technical Categories

ID	Technical_Issue_Category
1	Criterion 2
2	Waste classification
3	Inventory
4	Near-field
5	Far-field
6	Performance Assessment
7	Intruders
8	Site Stability
9	Infiltration
10	Uncertainty

Technical SubCategories

ID	Tech_SubCategory
2	Steel Liner
3	Solubility--CZ
4	Basemat
5	Fast Pathway
6	Vadose Zone
7	Saturated Zone
8	Kd-Saturated Zone
9	Cap
10	Biosphere Parameter
11	Bisophere Scenario
12	Waste Release
13	Intruders
14	Site Stabilty
15	Performance Assessment
16	Uncertainty

Priority Table

Issue Priority	Priority Description
1	Top Priority--Is Very Important to Compliance Demonstration (Factor of 10 impact on peak dose or significant barrier with respect to time [10,000 years])
2	Medium Priority--Is Important But Not Crucial to Compliance Demonstration (Factor of 2 impact on peak dose or significant barrier with respect to time [1000 years])
3	Low Priority--Is of Lesser Significance to Compliance Demonstration (Risk-significance unknown, model support relatively greater, or dependent on less uncertain information)

Open Issue Category (Difficulty) Table

Category	Category Description
1	NRC expects that DOE will need to conduct longer-term activities to resolve the technical issue
2	NRC expects that DOE will be able to close the issue in the near-term (e.g., with additional calculations, literature reviews, modeling)
3	DOE may be able to easily resolve the issue with readily available information

References

DOE, 2010a. "Performance Assessment for the F-Tank Farm at the Savannah River Site" SRS-REG-2007-00002, Rev. 1, Prepared for US DOE by Savannah River Remediation, LLC (SRR) Closure & Waste Disposal Authority Aiken, SC 29808. March 31, 2010.

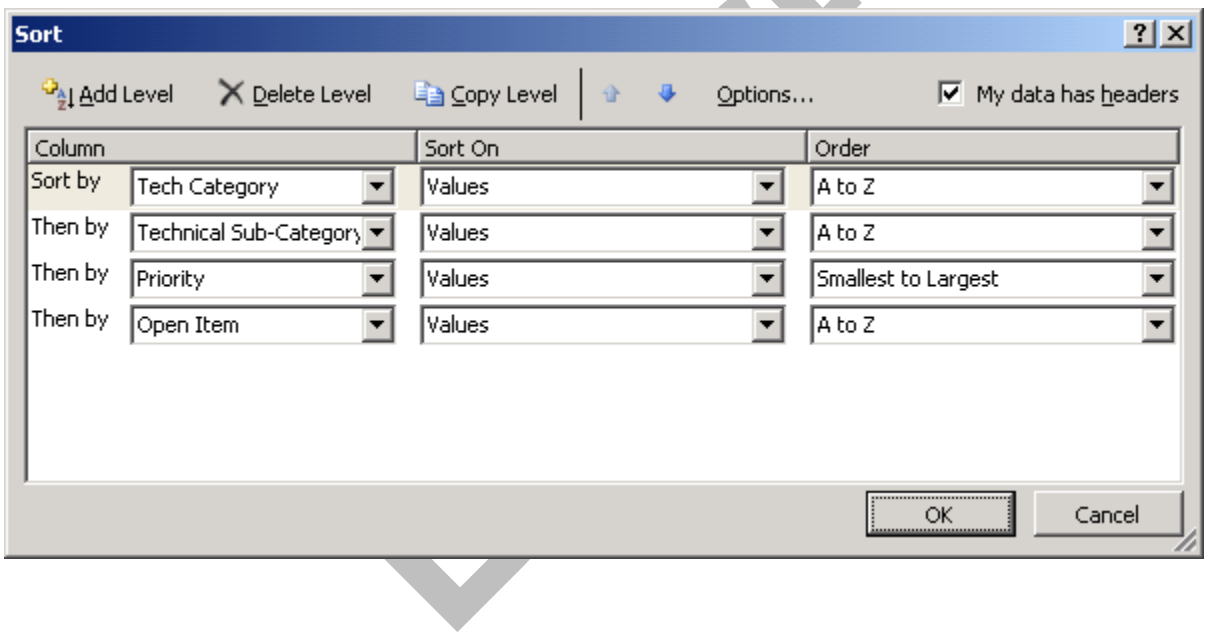
DOE, 2010b. "Draft Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site," DOE/SRS-WD-2010-001, Rev. 0. DOE. September 30, 2010.

NRC, 2010. "NRC Staff Comments on the Draft Basis for Section 3116 Determination and Associated Performance Assessment for the F-Tank Farm at the Savannah River Site," US NRC, Washington, DC, 20555. December 2010.

Data Tables

The following data tables were extracted from the FTF Access Database on February 14, 2011. The open items are not listed in order of absolute priority, although near-field issues are listed first as this category of open issues is most risk-significant in NRC staff's estimation. The information is filtered by technical category (i.e., near-field, far-field, all other technical categories) and then sorted by (i) technical sub-categories (e.g., steel liner, solubility, basemat), (ii) priority, and (iii) open items as illustrated in Figure 1 below:

Figure 1 Grouping and sorting of data in the tables that follow



ID	Open Item	Related Comment	Tech Category	Priority	Resolution Difficulty	Technical Sub-Category	Recommendation(s)	Lit Review	Analog	Calculations/ Modeling	Experiments	PeerReview/ ExpertElicitation	Additional Justification
23	Basis for lack of consideration of basemat by-pass in basecase	RAI-NF-14	Near-field	1	2	Basemat	Re-run basecase with more technically defensible parameters given current knowledge base, Provide additional information justifying the approach			X			X
22	Basis for probability of basemat by-pass	RAI-NF-14	Near-field	1	2	Basemat	Re-run basecase with more technically defensible parameters given current knowledge base, Provide additional information justifying the approach			X			X
14	Np Kds in middle-aged and old-aged cementitious materials (basemat)--solubility limited	RAI-NF-7	Near-field	2	2	Basemat	Re-run basecase with more technically defensible parameters given current knowledge base, Conduct additional experiments to study sorption of key radionuclides to basemat, Provide additional information justifying the approach, Conduct literature review	X		X	X		X
13	Pu Kds in middle-aged and old-aged cementitious materials (basemat)--solubility limited	RAI-NF-7	Near-field	2	2	Basemat	Re-run basecase with more technically defensible parameters given current knowledge base, Conduct additional experiments to study sorption of key radionuclides to basemat, Provide additional information justifying the approach, Conduct literature review	X		X	X		X
20	Support for use of young cements (40-year old) in Kd testing for basemats	RAI-NF-12	Near-field	2	2	Basemat	Provide additional information justifying the approach						X
16	Consideration of a more mobile fraction of Pu in CZ	RAI-NF-8	Near-field	1	1	Solubility--CZ	Identify solid phases key radionuclides are associated with in various sludge types (sequential extractions or other methods), Conduct solubility studies on tank sludges, Include additional complexity in modeling; re-run models; abstract process level model			X	X		
15	Consideration of a more mobile fraction of Tc in CZ	RAI-NF-8	Near-field	1	1	Solubility--CZ	Identify solid phases key radionuclides are associated with in various sludge types (sequential extractions or other methods), Conduct solubility studies on tank sludges, Include additional complexity in modeling; re-run models; abstract process level model			X	X		
2	Identify Pu solubilty limiting phases	RAI-NF-8, R/	Near-field	1	1	Solubility--CZ	Identify solid phases key radionuclides are associated with in various sludge types (sequential extractions or other methods), Conduct solubility studies on tank sludges, Characterize minerology of various sludge types in SRS tanks				X		
1	Identify Tc solubilty limiting phases	RAI-NF-8, R/	Near-field	1	1	Solubility--CZ	Identify solid phases key radionuclides are associated with in various sludge types (sequential extractions or other methods), Conduct solubility studies on tank sludges, Characterize minerology of various sludge types in SRS tanks				X		
8	Longevity of reducing conditions	RAI-NF-1	Near-field	1	1	Solubility--CZ	Conduct experiments to study the conditioning of SRS groundwaters in cements w/ varying levels of degradation				X		
17	Possibility of radionuclide release during iron phase transitions (from magnetite to hematite)	RAI-NF-9	Near-field	1	1	Solubility--CZ	Identify solid phases key radionuclides are associated with in various sludge types (sequential extractions or other methods), Conduct solubility studies on tank sludges, Characterize minerology of various sludge types in SRS tanks, Re-run basecase with more technically defensible parameters given current knowledge base			X	X		
19	Support for likelihood of solubilty limiting phases	RAI-NF-11	Near-field	1	1	Solubility--CZ	Conduct solubility studies on tank sludges, Expert elicitation on probability of various solubility limiting phases, Re-run basecase with more technically defensible parameters given current knowledge base, Conduct literature review	X		X	X	X	
18	Support for parameter distributions related to chemical transition times	RAI-NF-10	Near-field	1	1	Solubility--CZ	Conduct experiments to study the conditioning of SRS groundwaters in cements w/ varying levels of degradation, Expert elicitation on chemical transition times				X	X	
9	General versus localized corrosion as dominant mechanism	RAI-NF-2	Near-field	1	2	Steel Liner	Collect analog data on carbon steel in contact with cement, Conduct experiments to study impact of various hydrologic configurations on corrosion rates (fully immersed, partially immersed [corrosion at liquid/air interface], wet/dry cycling), Conduct accelerated corrosion experiments with carbon steel in contact with cements of varying levels of degradation, Re-run basecase with more technically defensible parameters given current knowledge base, Conduct literature review	X	X	X	X		
21	Groundwater in-leakage into tanks leading to unconditioned water and conditions closer to carbon steel in contact with soil	RAI-NF-13	Near-field	1	2	Steel Liner	Collect analog data on carbon steel in contact with cement, Conduct experiments to study impact of various hydrologic configurations on corrosion rates (fully immersed, partially immersed [corrosion at liquid/air interface], wet/dry cycling), Conduct experiments to study the conditioning of SRS groundwaters in cements w/ varying levels of degradation		X		X		

10	Time invarient and low diffusion coefficients for CO2 (carbonation) and O2 (after chloride-induced corrosion)	RAI-NF-3, R/	Near-field	1	2	Steel Liner	Collect analog data on carbon steel in contact with cement, Conduct experiments to study impact of various hydrologic configurations on corrosion rates (fully immersed, partially immersed [corrosion at liquid/air interface], wet/dry cycling), Conduct accelerated corrosion experiments with carbon steel in contact with cements of varying levels of degradation, Re-run basecase with more technically defensible parameters given current knowledge base, Conduct literature review	X	X	X	X		
12	Wet-dry cycling of tank bottoms	RAI-NF-13	Near-field	1	1	Steel Liner	Collect analog data on carbon steel in contact with cement, Conduct experiments to study impact of various hydrologic configurations on corrosion rates (fully immersed, partially immersed [corrosion at liquid/air interface], wet/dry cycling), Re-run basecase with more technically defensible parameters given current knowledge base		X	X	X		
11	Assumption that corrosion only proceeds from one-side	RAI-NF-4	Near-field	2	2	Steel Liner	Re-run basecase with more technically defensible parameters given current knowledge base			X			X
25	Consequences of early release due to partial failure of steel liner	RAI-NF-16	Near-field	1	1	Waste Release	Re-run basecase with more technically defensible parameters given current knowledge base, Include additional complexity in modeling; re-run models; abstract process level model			X			
24	Probability and consequences of a Condition 2 waste release scenario	RAI-NF-15, (	Near-field	1	2	Waste Release	Expert elicitation on probability of various configurations of tank system evolution, Re-run basecase with more technically defensible parameters given current knowledge base			X		X	
27	Impact of upwards diffusion in tank grout to results; in-tank hydraulics (diffusion or advection dominated)	RAI-NF-10	Near-field	2	2	Waste Release	Provide additional modeling results and evaluation			X			
26	Lack of support for moisture characteristic curves	CC-NF-9	Near-field	2	2	Waste Release	Re-run basecase with more technically defensible parameters given current knowledge base			X			

ID	Open Item	Related Comment	Tech Category	Priority	Resolution Difficulty	Technical Sub-Category	Recommendation(s)	Lit Review	Analog	Calculations/ Modeling	Experiments	PeerReview/ ExpertElicitation	Additional Justification
45	Pu Kd in the saturated zone	CC-FF-9	Far-field	1	1	Kd-Saturated Zone	Sorption experiments with groundwater in contact with calcareous zone sediments, Perform additional sorption studies to study Pu speciation & transport in the subsurface, Increase complexity of Pu transport modeling (e.g., consider various fractions of varying mobility and reactive transport), Include additional complexity in modeling; re-run models; abstract process level model			X	X		
29	Impact of calcareous zone dissolution on transport	RAI-FF-1	Far-field	2	2	Kd-Saturated Zone	Sorption experiments with groundwater in contact with calcareous zone sediments, Perform additional sorption studies to study Pu speciation & transport in the subsurface, Provide additional information justifying the approach, Perform geochemical modeling			X	X		X
32	Impact of grout leaching on saturated zone transport	RAI-FF-4	Far-field	2	2	Kd-Saturated Zone	Provide additional information justifying the approach, Include additional complexity in modeling; re-run models; abstract process level model			X			X
38	Location of clays in the SZ; impact of clay Kd assignments on results	CC-FF-6	Far-field	2	3	Kd-Saturated Zone	Re-run basecase with more technically defensible parameters given current knowledge base, Provide additional information justifying the approach, Sensitivity analysis to determine risk significance			X			X
36	C-14 Kds in the saturated zone (used higher Kds for batch experiments at longer equilibration times)	CC-FF-7	Far-field	3	2	Kd-Saturated Zone	Re-run basecase with more technically defensible parameters given current knowledge base, Provide additional information justifying the approach			X			X
37	Np Kds in the saturated zone (higher for sand, lower for clay); clarify ranges used in PA	CC-FF-8	Far-field	3	2	Kd-Saturated Zone	Re-run basecase with more technically defensible parameters given current knowledge base, Provide additional information justifying the approach, Sensitivity analysis to determine risk significance			X			X
33	Adequacy of the 100 m point of compliance	RAI-FF-5	Far-field	2	3	Saturated Zone	Provide additional information justifying the approach, Provide additional modeling results and evaluation			X			X
34	Benchmarking issues (indicates PORFLOW results may be biased low); dispersivities	RAI-FF-3, RA	Far-field	2	2	Saturated Zone	Re-run basecase with more technically defensible parameters given current knowledge base, Provide additional information justifying the approach, Include additional complexity in modeling; re-run models; abstract process level model, Provide additional modeling results and evaluation			X			X
35	Hydrogeological conceptul model uncertainty (vertical gradients, groundwater flow divide)	CC-FF-11	Far-field	2	3	Saturated Zone	Provide additional information justifying the approach, Sensitivity analysis to determine risk significance, Provide additional modeling results and evaluation			X			X
28	Impact of calcareous zone dissolution on flow	RAI-FF-1	Far-field	2	2	Saturated Zone	Provide additional information justifying the approach, Include additional complexity in modeling; re-run models; abstract process level model, Perform tracer tests at the seepline			X	X		X
31	Verify that PORFLOW has an acceptable amount of hydrodynamic and numerical dispersion	RAI-FF-3	Far-field	2	2	Saturated Zone	Re-run basecase with more technically defensible parameters given current knowledge base, Provide additional information justifying the approach, Sensitivity analysis to determine risk significance			X			X

ID	Open Item	Related Comment	Tech Category	Priority	Resolution Difficulty	Technical Sub-Category	Recommendation(s)	Lit Review	Analog	Calculations/ Modeling	Experiments	PeerReview/ ExpertElicitation	Additional Justification
5	Infilling of lateral drainage layer with coarser sediments	RAI-IE-2	Infiltration	2	2	Cap	Re-run basecase with more technically defensible parameters given current knowledge base, Conduct literature review, Look at natural analogs	X	X	X			
6	Basis for reduced infiltration rate due to residual cap performance	RAI-IE-3	Infiltration	2	2	Cap	Re-run basecase with more technically defensible parameters given current knowledge base			X			
7	As-emplaced versus assumed cap performance	CC-IE-1	Infiltration	3	2	Cap	Re-run basecase with more technically defensible parameters given current knowledge base			X			
30	Impact of calcareous zone on site stability	RAI-SS-3	Site Stability	2	2	Site Stabilty	Provide additional information justifying the approach, Include additional complexity in modeling; re-run models; abstract process level model			X			
39	Conservatism of basecase in the face of large uncertainty	RAI-PA-1	Performance Assessment	1	1	Performance Assessment	Peer review of DOE's basecase configuration					X	
40	Identification of FEPs	RAI-PA-2	Performance Assessment	2	1	Performance Assessment	Conduct literature review	X					
41	Basis for inventory uncertainty	CC-IN-1	Uncertainty	3	3	Uncertainty	Provide additional information justifying the approach, Collect Sampling Data				X		X
42	Support for barriers to intrusion over 10,000 year compliance period	CC-IT-1	Intruders	2	3	Intruders	Provide additional information justifying the approach						X
43	Lack of consideration of uncertainty in transfer factors/basis for selection of basecase values	RAI-IT-1, RA	Intruders	2	2	Biosphere Parameter	Re-run basecase with more technically defensible parameters given current knowledge base, Provide additional information justifying the approach, Conduct literature review, Sensitivity analysis to determine risk significance	X		X			X
44	Drinking water ingestion rates	RAI-IT-3	Intruders	3	3	Biosphere Parameter	Re-run basecase with more technically defensible parameters given current knowledge base, Provide additional information justifying the approach, Conduct literature review	X		X			X
46	Configuration development, configuration probabilities	RAI-UA-1	Performance Assessment	1	1	Performance Assessment	Expert elicitation on probability of various configurations of tank system evolution					X	
47	Uncertainty in timing versus magnitude of peak dose	RAI-UA-2	Uncertainty	3	3	Uncertainty	Provide additional modeling results and evaluation			X			
48	Configurations E and F (consider in the basecase)	RAI-UA-4	Uncertainty	2	3	Uncertainty	Provide additional modeling results and evaluation			X			
49	Intruder sensitivity analysis	CC-IT-2, CC	Intruders	2	3	Intruders	Provide additional information justifying the approach, Sensitivity analysis to determine risk significance, Provide additional modeling results and evaluation			X			X

Experimental Grouping	Recommendations
Longevity of Reducing/High pH Conditions	Conduct experiments to study the conditioning of SRS groundwaters in cements w/ varying levels of degradation
Solubility	Characterize minerology of various sludge types in SRS tanks
	Conduct solubility studies on tank sludges
	Identify solid phases key radionuclides are associated with in various sludge types (sequential extractions or other methods)
Sorption	Conduct additional experiments to study sorption of key radionuclides to basemat
	Perform additional sorption studies to study Pu speciation & transport in the subsurface
	Sorption experiments with groundwater in contact with calcareous zone sediments
Steel Liner	Conduct accelerated corrosion experiments with carbon steel in contact with cements of varying levels of degradation
	Calculate aqueous and gaseous diffusion coefficients with variable degradation states of cement
	Conduct experiments to study impact of various hydrologic configurations on corrosion rates (fully immersed, partially immersed [corrosion at liquid/air interface], wet/dry cycling)
Additional Experiments	**Recommendations**
Note: These experiments are not expected at this time. Depending on RAI responses and additional information that is collected, these experiments may be recommended in the future.	
Calcareous Zone	Interwell geophysical tomography (e.g., electrical resistivity tomography and borehole ground-penetrating radar tomography) and 3D pressure interference tests (http://math.lanl.gov/~dmt/papers/Illman-2005-Asymptotic.pdf) could provide information on preferential flow pathways in the LZ of UTR
Basemat	Additional sorption experimentes to simulate aged cementitious materials and/or more representative conditions.