Savannah River Remediation
AECOM |BECHTEL | CH2M | B&W | AREVA

AUG 1 2 2015

SRR-CWDA-2015-00097
RSM Track #: 10667

Sherri R. Ross
Waste Disposition Programs
Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

Dear Ms. Ross:

ACTION ITEM FOLLOW-UP IN SUPPORT OF U.S. NUCLEAR REGULATORY COMMISSION SALT WASTE DISPOSAL ONSITE OBSERVATION VISIT ON JULY 7-8, 2015

Ref:

1. SRR-CWDA-2015-00086, *Savannah River Site Salt Waste Disposal NRC Onsite Observation Visit, July 7-8, 2015*, Savannah River Site, Aiken, SC, Revision 1, July 2015.
2. SRR-CWDA-2014-00006, *FY2014 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site,* Savannah River Site, Aiken, SC, Revision 2, September 2014.
3. SRR-CWDA-2013-00073, *Updates to the Saltstone Disposal Facility Fate and Transport Model,* Savannah River Site, Aiken, SC, Revision 2, August 2014.

A Salt Waste Disposal onsite observation visit by the U. S. Nuclear Regulatory Commission (NRC) was held at the Savannah River Site (SRS) on July 7-8, 2015. During the visit outbrief, a number of Action Items were captured (Reference 1, slides 52-54). Information relative to four of the remaining open Action Items is provided below. The four Action Items included in this transmittal are:

7. *DOE to provide NRC information on water tank (Syracuse) used as model for SDU 6.*
10. *DOE to provide NRC a listing of existing papers relative to technetium reduction/solubility.*
14. *DOE to provide NRC documentation on how locations along the 100-meter boundary were determined for the GoldSim Model.*
15. *DOE to provide NRC documentation on how to set up computer for a GoldSim run.*

Action Item 7

Saltstone Disposal Unit (SDU) 6 is a commercial water tank design that was modified for use as a Saltstone Disposal Unit at SRS. Savannah River Remediation (SRR) conducted a site visit of a water tank constructed for commercial service for the city of Syracuse, New York. Two tanks of the design similar to SDU 6 were constructed and placed in service at the Syracuse facility. Based on discussions with the Syracuse project staff, SRR initiated additional review and evaluation, ultimately leading to the SDU 6 design. Additional vendor information on the Syracuse commercial design is available at http://www.dntanks.com/projects/twin-water-tanks-at-the-westcott-reservoir/

Action Item 10
A listing of existing papers relative to technetium reduction/solubility is provided in the table below.

Title / Web Address	Author	Journal	Year	Vol.	Pg.
X-ray Absorption Spectroscopy Studies of Reactions of Technetium, Uranium and Neptunium with Mackinawite http://www.ncbi.nlm.nih.gov/pubmed/15063549	Livens, F.R.	Journal of Environmental Radioactivity	2004	74	211
Reoxidation Behavior of Technetium, Iron, and Sulfur in Estuarine Sediments http://pubs.acs.org/doi/abs/10.1021/es052184t	Burke, I.T.	Environmental Science and Technology	2006	40	3529
An X-ray Absorption Spectroscopy Study of the Coprecipitation of Tc and Re with Mackinawite (FeS) http://www.sciencedirect.com/science/article/pii/S0883292799000451	Wharton, M.J.	Applied Geochemistry	2000	15	347
Treatment of Radioactive Wastes: An X-ray Absorption Spectroscopy Study of the Reaction of Technetium with Green Rust http://www.sciencedirect.com/science/article/pii/S0021979703008361	Pepper, S.E.	Journal of Colloid and Interface Science	2003	268	408
Technetium Behavior In Sulfide and Ferrous Iron Solutions http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=8117744&fileId=S1946427400382628	Lee, S-Y, & Bondietti, E.A	Materials Research Society Symposia Proceedings ORNL CONF-821107—32 DE83 003418	1983	15	-
The Solubility of Technetium(IV) at High pH https://dspace.lboro.ac.uk/dspace-jspui/handle/2134/3115	Warwick, P.	Radiochimica Acta	2007	95	709

Title / Web Address	Author	Journal	Year	Vol.	Pg.
Sulfur Speciation in Granulated Blast Furnace Slag: An X-ray Absorption Spectroscopic Investigation http://www.sciencedirect.com/science/article/pii/S0008884609001215	Roy, A.	Cement and Concrete Research	2009	39	659
Heterogeneous Reduction of Tc(VII) by Fe(II) at the Solid–Water Interface http://www.sciencedirect.com/science/article/pii/S0016703708000215	Peretyazhk, T.	Geochimica et Cosmochimica Acta	2009	72	1521
Technetium Sulfide: Fundamental Chemistry for Waste Storage Form's Application http://digitalscholarship.unlv.edu/thesesdissertations/2259/	Ferrier, M.G.	Ph.D. Thesis, University Nevada, Las Vegas	-	-	-

Action Item 14

Attachment 1 contains a description of how the 100-meter points of compliance were developed for the FY2014 SDF Special Analysis (Reference 2) GoldSim model.

Action Item 15

Attachment 2 contains documentation for establishing and operating the FY2014 SDF Special Analysis (Reference 2) GoldSim model.

Closed Action Items

Information to support Action Items 1-6, 9, 11, and 13 were included in a DVD previously provided to the NRC (i.e., sent by UPS to Terrance Brumfield on 7/21/2015) and those Action Items are consider closed by SRR. The following information was provided:

1. *DOE to provide NRC an electronic copy of presentation material including action items and attendance rosters. [SRR-CWDA-2015-00086, Revision 1]*
   - Revision 1 included on DVD
2. *DOE to provide NRC the 2015 midyear groundwater monitoring report when available.*
   - SRNS-TR-2015-00132 included on DVD
3. *DOE to provide NRC an electronic copy of FY2015 Saltstone Core-Drilling Mock-up Summary, SRR-CWDA-2015-00002.*
   - included on DVD
4. *DOE to provide NRC an electronic copy of Saltstone Disposal Facility SDU Cell 2A Core Drill Summary, SRR-CWDA-2015-00087.*
   - included on DVD

5. *DOE to provide NRC an electronic copy of Summary of Saltstone Disposal Unit Cell 2A Core Drill Activities, SRR-CWDA-2015-00066*
   - included on DVD
6. *DOE to provide NRC an electronic copy of Determination of SDF Inventories through 9/30/2014, SRR-CWDA-2014-00124*
   - included on DVD
9. *DOE to provide NRC an electronic copy of photographs from SDF/SPF tour on 7/7/2015.*
   - photographs added to revised presentation, see Action Item 1, and also included on DVD as "July 7, 2015 photos.pptx"
11. *DOE to provide NRC an electronic copy of SDU 2A Core Sample Test Designation, SRNL-L3100-2015-00108.*
    - included on DVD
13. *DOE to provide NRC information available on production well (SDU 6) depth and potential impact on surface settlement.*
    - information added to revised presentation, provided per Action Item 1

Open Action Items (Items 8 and 12)

Two Action Items from the visit remain open at this time.

8. *DOE to provide NRC SDU 5B inventory through 6/30/2015.*
   - documentation of inventory in-progress
12. *DOE to provide NRC information on SDU 3 and SDU 5 fill height restrictions related to resolution of mercury PISA.*
    - information will be provided upon resolution of current SDU fill height restrictions

If you have any questions please contact me at (803) 557-8960.

Sincerely,

Steven A. Thomas
Manager
Waste Disposal Authority

fms/kmz

Att.

c:

K. H. Rosenberger, 705-1C
L. B. Romanowski, 705-1C
F. M. Smith, 705-1C
S. P. Simner, 705-1C
J. K. Fortenberry, 766-H
E. J. Freed, 704-S
J. R. Vitali, 704-30S
D. J. Ferguson, 704-S

Attachment 1: 100-Meter Points of Compliance Development

In early July 2006, technical staff from the NRC provided to DOE a Microsoft Word document that included questions related to the GoldSim model used to support the FY2014 SDF Special Analysis (reference 2). Although the questions were discussed and resolved verbally, it was determined that the document that describes the GoldSim model, *Updates to the Saltstone Disposal Facility Fate and Transport Model*, SRR-CWDA-2013-00073 (reference 3), did not provide accurate documentation to describe how the 100-meter points of assessment were determined.

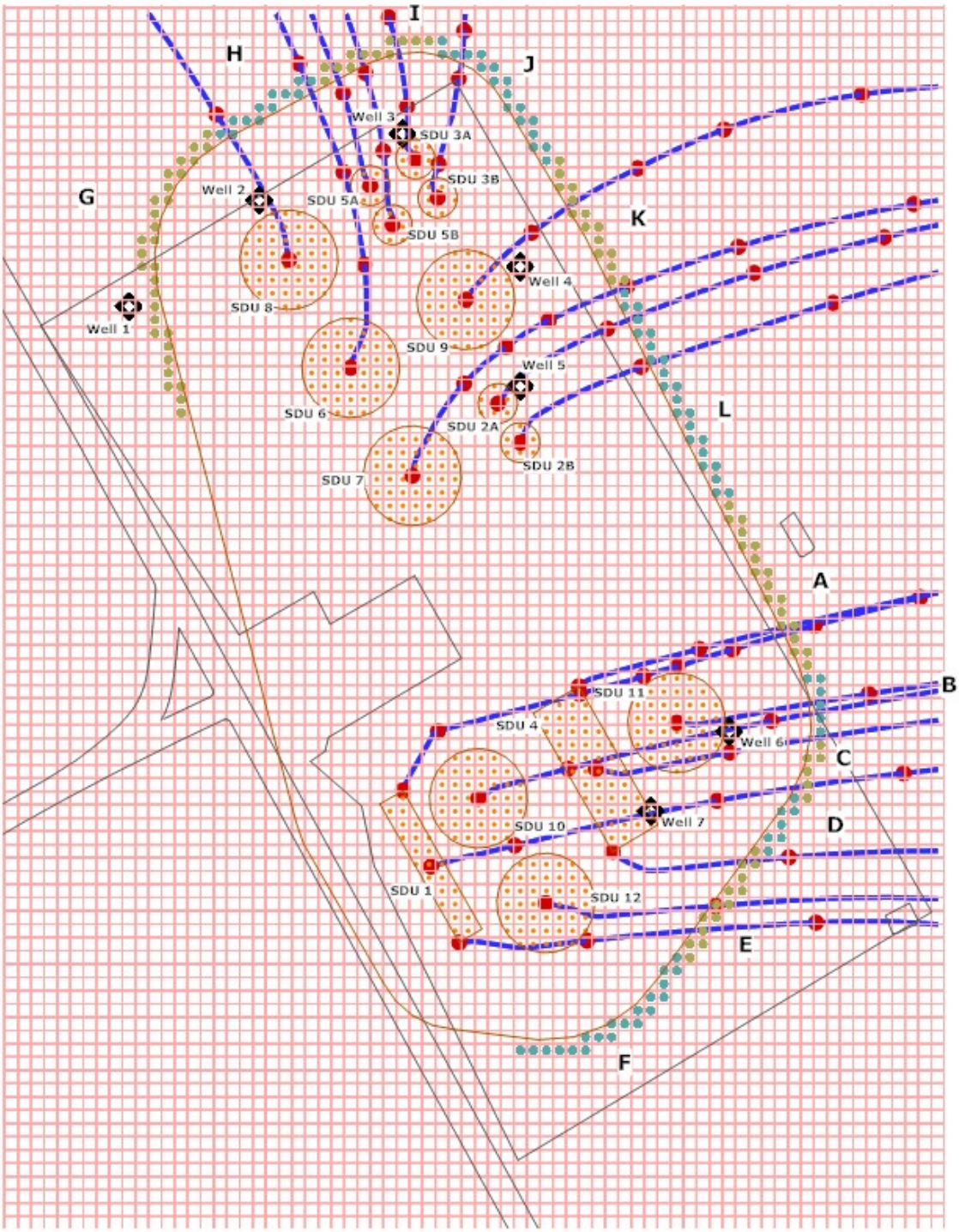
Section 4.1.1 of SRR-CWDA-2013-00073 states that, "Radionuclide concentrations at the mid-points of sectors along the 100-meter boundary (Figure 4.1-2) form the basis of the SDF GoldSim Model MOP dose calculations." This is no longer correct in the latest GoldSim model revision.

The initial basis for determining the points of assessment was the stream traces from each source, as shown in Figure 1 of this Attachment. For GoldSim, hypothetical points of assessment were assumed to lie on or directly adjacent to the point of intersection for these stream traces and the 100-meter boundary, thus providing a basis for inputs to the GoldSim plume functions with respect to the centerline and offset distances.

Once these inputs were implemented, the GoldSim model was run for the Evaluation Case and a qualitative sector-by-sector dose comparison against the equivalent PORFLOW dose results was performed. For most sectors, the comparison matched nicely; however the comparison of the Sector J dose results from GoldSim were found to be much lower than the Sector J dose results from PORFLOW. Upon inspection, it was determined that this differences was an artifact of bimodal plume spreading caused by the flow-divide in the north east corner of the facility (see Figure 2 of this Attachment). Given this finding, the inputs to the GoldSim plume functions (i.e., centerline and offset distances) were adjusted to correct for the differences between the stream traces and the plumes.

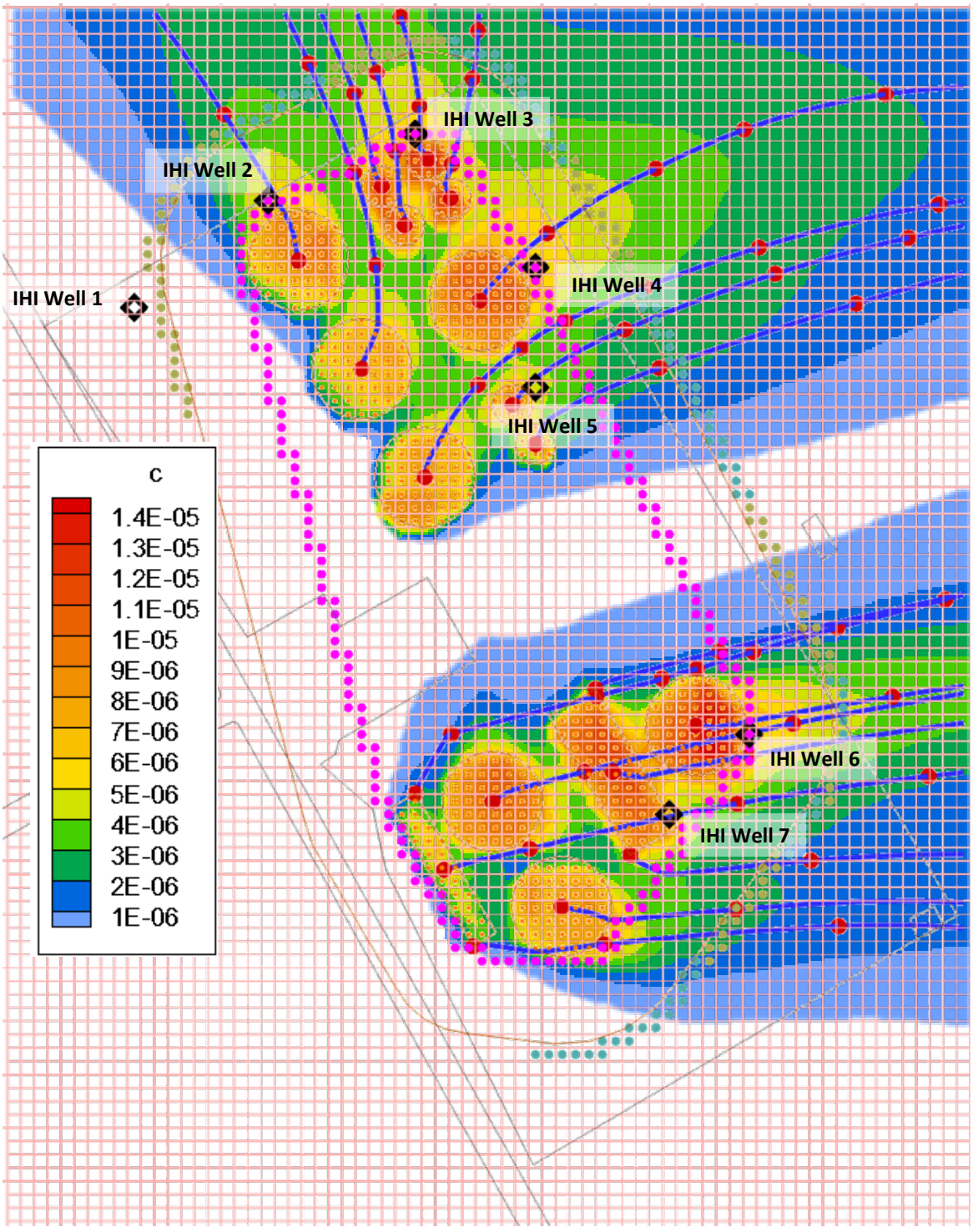
Figures 3 through 14 of this Attachment provide the resulting sector-by-sector dose comparisons. The improved similarities between the GoldSim results and the PORFLOW results provide confidence the plume inputs used in the GoldSim model provide an appropriate representation of contaminant transport. Note that these comparisons were generated during model development (i.e., prior to all model updates) and may not accurately reflect the final dose results from the FY2014 SDF Special Analysis.

Figure 1: SDF 100-Meter Modeled Cells and Sectors



[Source: SRR-CWDA-2014-00006, Rev. 2, Figure 5.2-1]

Figure 2: Illustration of SDF Layout with Representative Tracer Plumes



[Source: SRR-CWDA-2014-00006, Rev. 2, Figure 6.4-1]

Figure 3: 100-Meter Point of Assessment Development and Comparison for Sector A

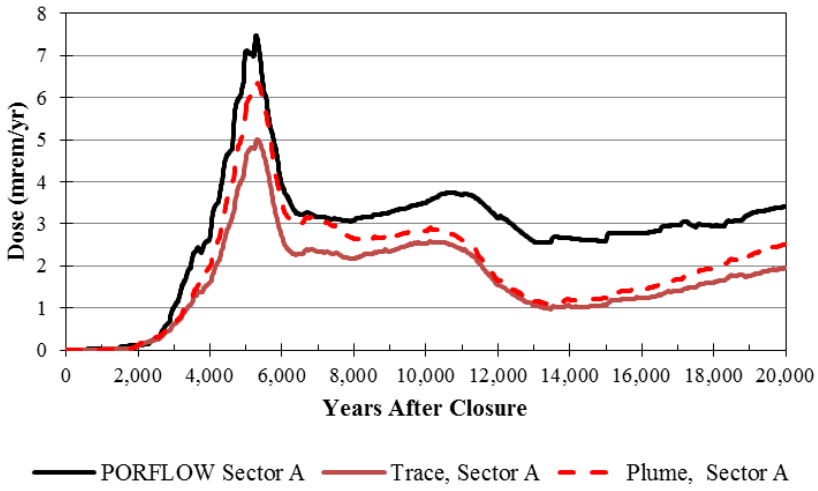


Figure 4: 100-Meter Point of Assessment Development and Comparison for Sector B

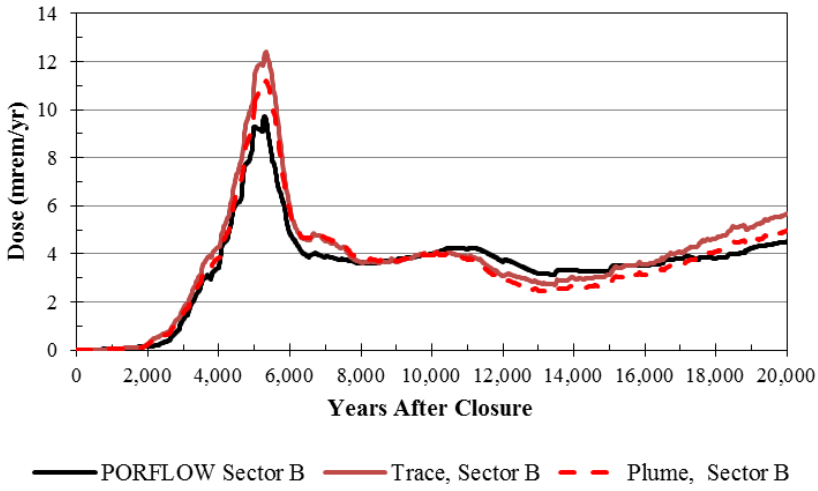


Figure 5: 100-Meter Point of Assessment Development and Comparison for Sector C

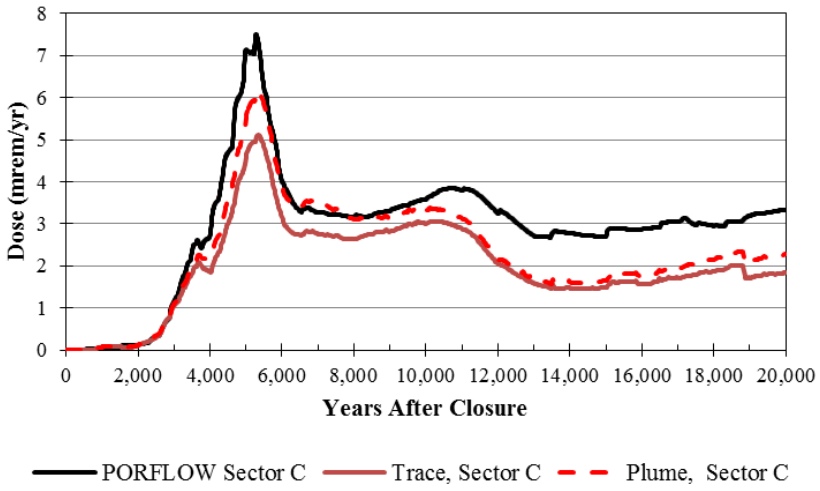


Figure 6: 100-Meter Point of Assessment Development and Comparison for Sector D

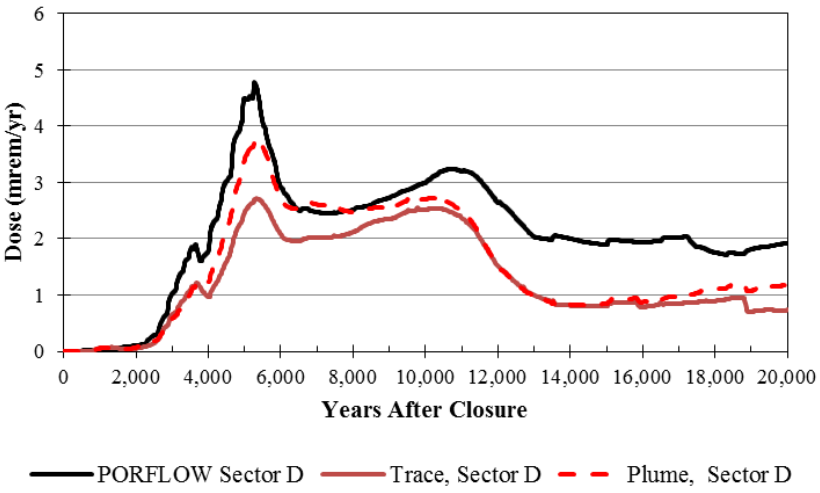


Figure 7: 100-Meter Point of Assessment Development and Comparison for Sector E

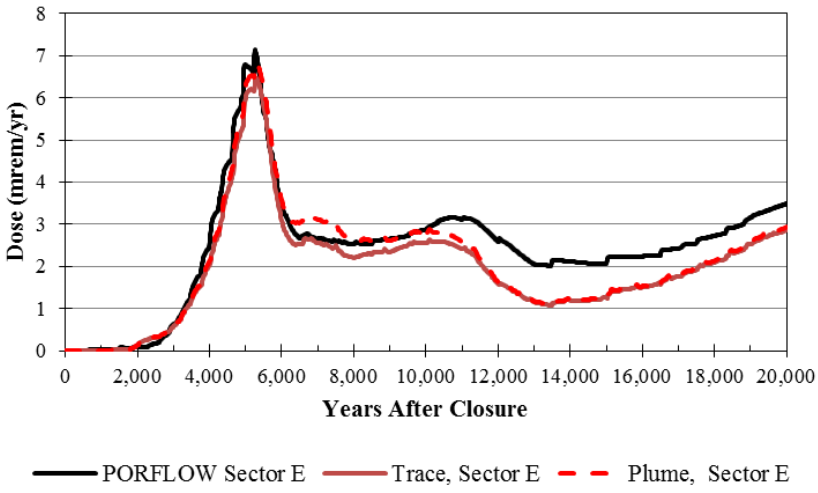


Figure 8: 100-Meter Point of Assessment Development and Comparison for Sector F

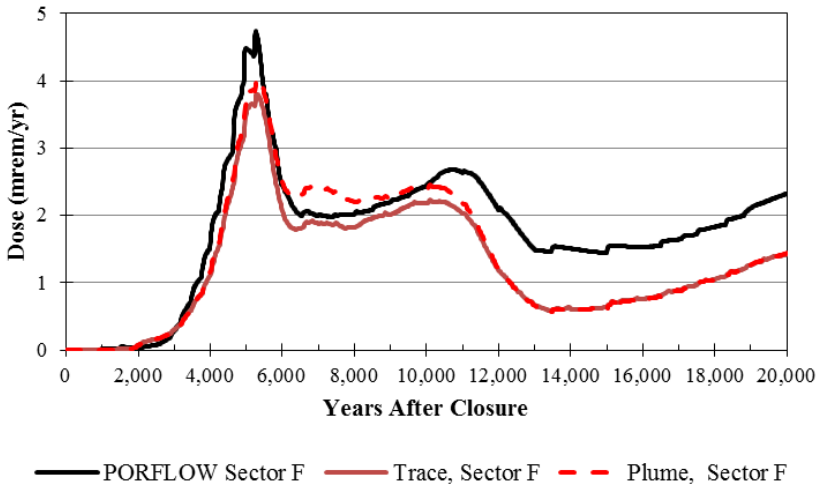


Figure 9: 100-Meter Point of Assessment Development and Comparison for Sector G

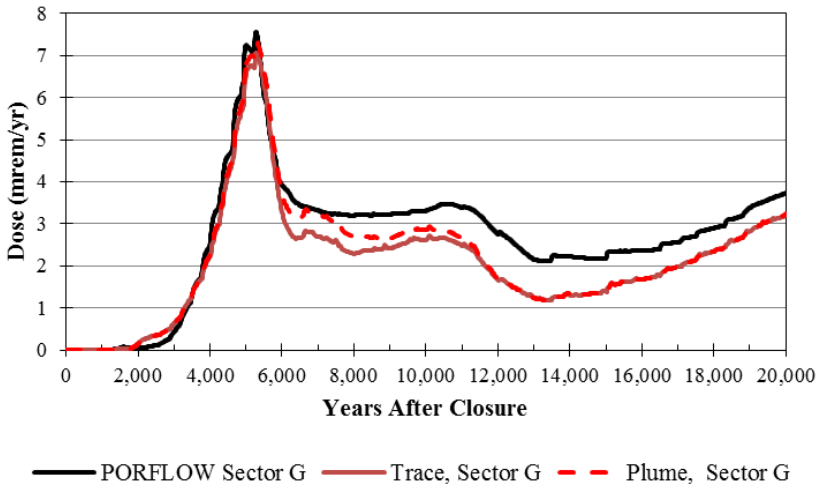


Figure 10: 100-Meter Point of Assessment Development and Comparison for Sector H

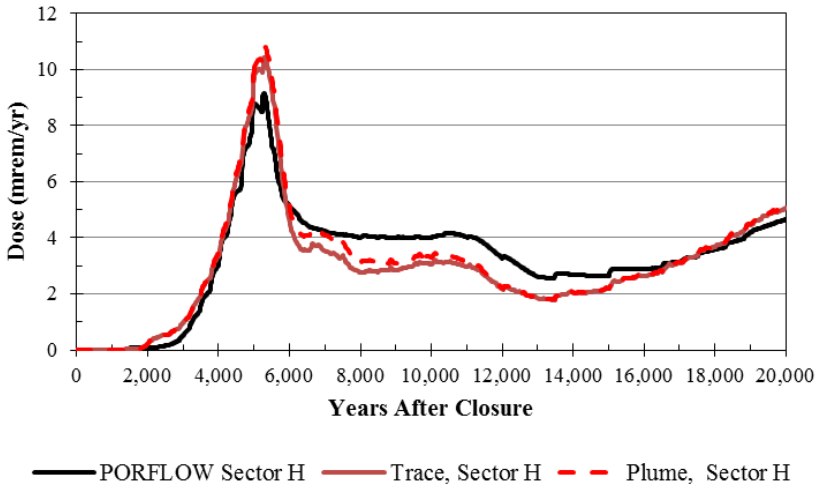


Figure 11: 100-Meter Point of Assessment Development and Comparison for Sector I

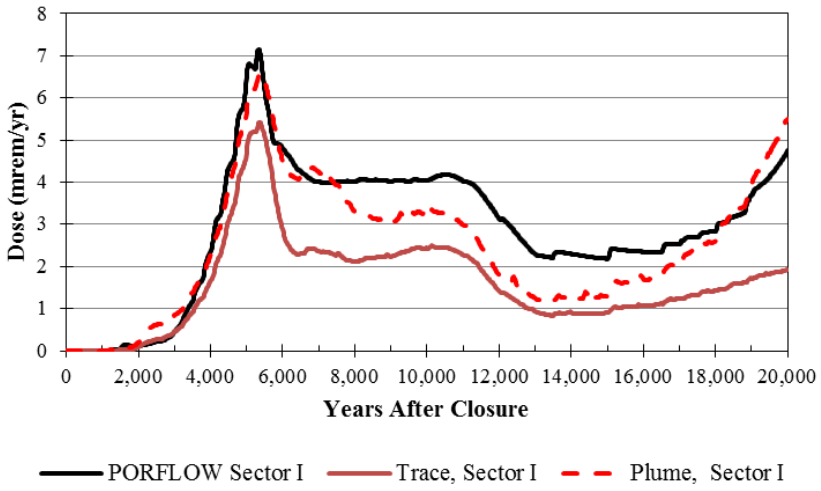


Figure 12: 100-Meter Point of Assessment Development and Comparison for Sector J

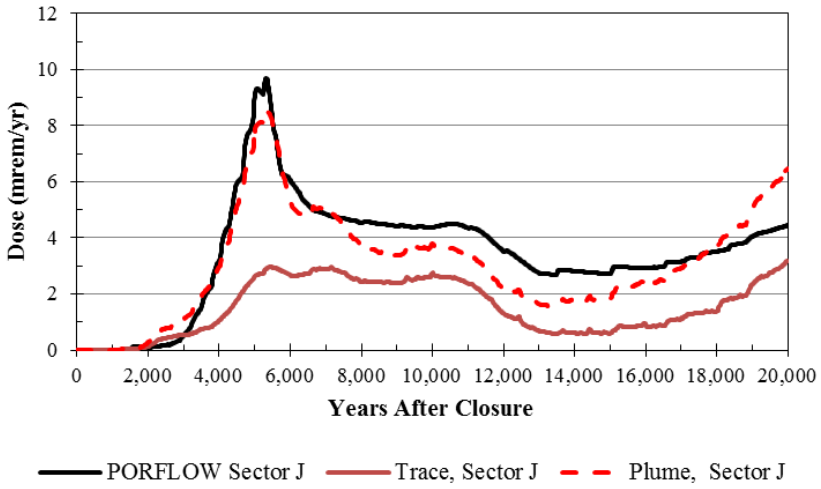


Figure 13: 100-Meter Point of Assessment Development and Comparison for Sector K

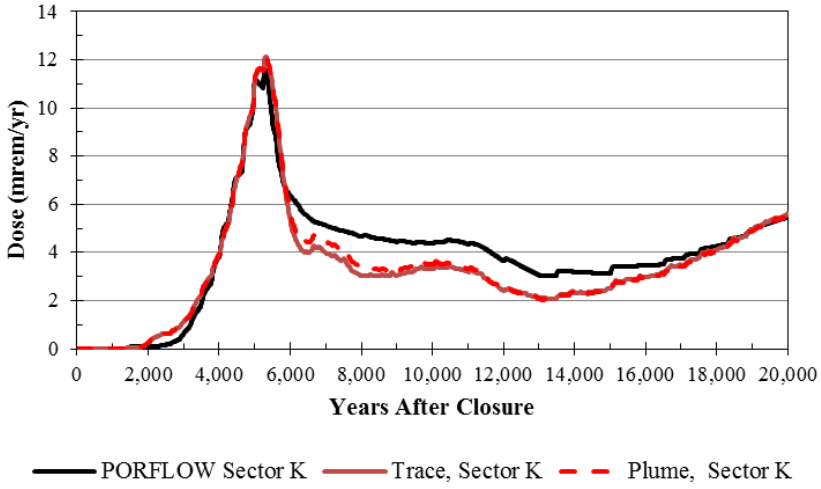
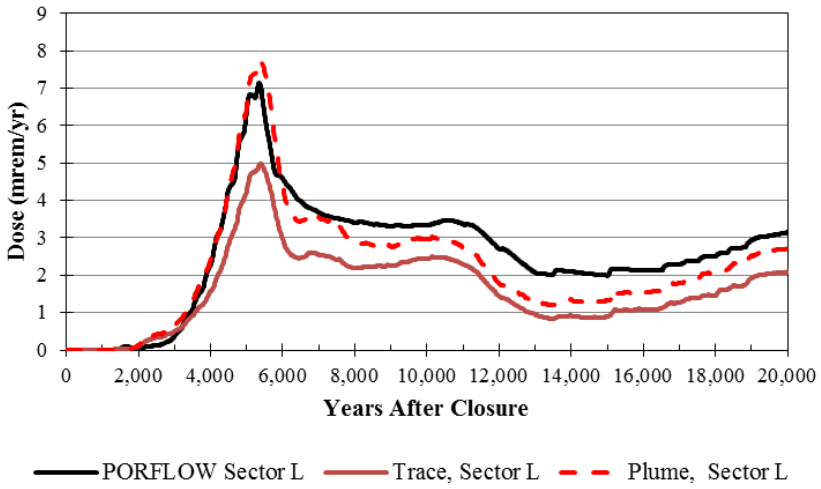


Figure 14: 100-Meter Point of Assessment Development and Comparison for Sector L



Attachment 2:
Instructions for Setting Up and Running the GoldSim Model Supporting the FY2014 SDF Special Analysis

Note: To run the Tc model in probabilistic mode, complete Steps 1 through 7, then see Addendum 1.

Step 1
Copy the PORFLOW data (folder: SDF_FY14Data01) to the root of the C:\ drive
Important: This directory must be located at C:\SDF_FY14Data01, otherwise all of the input files for the DLLs will need to be revised.

Step 2
Create a local run directory (somewhere from which to launch GoldSim) on your desktop (or preferred location) for running the Tc model.

Step 3
Copy the Tc model (Tc99_SDU_V1.006.gsm) and the Tc run files (FY2014_SDF_SA_RunFiles-Tc.zip) to the local run directory for running the Tc model.

Step 4
Unzip all of the Tc run files from FY2014_SDF_SA_RunFiles-Tc.zip to your local directory.

Step 5
Launch GoldSim. Note: The FY2014 SDF SA modeling was performed using GoldSim version 10.5 SP3. The model has not been tested with other versions, so v10.5 SP3 is the recommended version of GoldSim to use.

Step 6
Within GoldSim, open the Tc model (Tc99_SDU_V1.006.gsm).

Step 7
Verify that all of the desired user settings and results are correct as desired. Note that the copy of the model in configuration control has been setup to run probabilistically. If you are performing a deterministic run, you should ensure that the inventory controls are set as follows (otherwise, the model will crash):

\UserInput\InventoryOption_switch = 1
\UserInput\TankToFDCRandomizer_Switch_a = False

Step 8
Run the model. Upon completion, GoldSim will automatically generate the Tc release files that are required as inputs to the All Rad model.

Step 9
Create a new local run directory for running the All Rad model. Note: Because both the Tc model and the All Rad model have input/DLL files that use the same filename (but sometimes have different content), running both from the same directory is not possible.

Step 10
Copy the All Rad model (SRS Saltstone v5.006.gsm) and the Tc run files (FY2014_SDF_SA_RunFiles-All.zip) to the local run directory for running the All Rad model.

Step 11
Unzip all of the All Rad run files from FY2014_SDF_SA_RunFiles-All.zip to your local directory.

Step 12
Copy all of the Tc Release files from the Tc run directory into the All Rad run directory. These files are named SDUXXRelease.txt (where XX indicates GoldSim SDU ID values 1 to 15).

Step 13
Launch GoldSim. Note: The FY2014 SDF SA modeling was performed using GoldSim version 10.5 SP3. The model has not been tested with other versions, so v10.5 SP3 is the recommended version of GoldSim to use.

Step 14
Within GoldSim, open the All Rad model (SRS Saltstone v5.006.gsm).

Step 15
Verify that all of the desired user settings and results are correct as desired. Note that the copy of the model in configuration control has been setup to run probabilistically. If you are performing a deterministic run, you should ensure that the inventory controls are set as follows (otherwise, the model will crash):

\User_Input\InventoryChooser_switch = 1
\UserInput\TankToFDCRandomizer_Switch_a = False

Note that the setup should be equivalent to the setup used to generate the Tc release files (e.g., if the Tc model was run for 100 realizations, the All rad model should also be run for 100 realizations).

Step 16
Run the model.

Addendum 1: Running the Tc GoldSim Model in Probabilistic Mode

Due to limitations in the transition time DLL, it has been determined that the probabilistic model cannot be run serially (i.e., using one processor to run each realization in a consecutive sequence). Attempting to do this results in the model crashing during the second realization because the DLL fails to reallocate the resources necessary to populate the release file outputs. Therefore, the probabilistic model can only be run using distributed processing via a master-slave network. Further, the Tc-Run files must be pre-loaded to each slave prior to running. The following provides the necessary instructions for accomplishing this.

Addendum Step 1: Launch Slaves

The following script may be used to launch slaves on a local directory. Copy this text to Notepad and save the file with *.bat as the file extension (instead on *.txt), then double click the batch file.

```
SET iCount=0
SET /P SlaveCount=How many slaves do you want on this computer?
:MyLoop
IF "%iCount%"=="%SlaveCount%" GOTO EndLoop
start "" "C:\Program Files (x86)\GTG\GoldSim 10.5\GSPlayer.exe" -s
SET /A iCount+=1
GOTO MyLoop
:EndLoop
GOTO End
:Error
ECHO Invalid Entry. Try again.
:End
```

You will be prompted to identify how many slaves you want to run on a local network. If you do not have a DP (distributive processing) license for GoldSim, you will be limited to four slaves. You will also be limited by the number of processors available to your slave network.

Addendum Step 2: Load Tc Run Files to Slave Folders

The Tc GoldSim Model does not automatically transfer files to slaves when running probabilistically. Therefore, the run files need to be loaded manually. To do this, go to:
C:\ProgramData\GTG
A folder should be present for each slave that was launched. First, make sure that each folder is empty (i.e., no remnant files for previous runs), then load the Tc Run files by extracting all of the files from FY2014_SDF_SA_RunFiles-Tc.zip into each slave folder.

Addendum Step 3: Launch GoldSim over Network

In the GoldSim Tc model (Tc99_SDU_V1.006.gsm), in the task bar, select Run → Run on Network. In the Master Settings window, identify the computer addresses for the slaves with the pre-loaded run files then update the status. Once the slaves are active, click “Run Simulation”.

Addendum Step 4: Ensure that Release Data was Exported

For probabilistic runs, the GoldSim model does not always export the Tc release results automatically. To verify whether or not the results were correctly exported, check the run directory (where the master GoldSim file is located) to see if the Tc Release files (SDUXX_Release.txt, where XX = 1 through 15) are present. The date on each file should be relatively close to the date and time that the simulation completed.

If the files did not automatically export, this can be done manually. Within the model, go to:
\ModelOutput\SDUReleaseOutputs
Right-click each time history element and select "Properties" from the menu. At the top of the Properties window, select the second tab ("Export to Text File (Table Format)"), then click the "Export Now" button.

Note: To use the exported Tc Release files as inputs to a probabilistic "All Rads" simulation, return to Step 9 of the main document.