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Revision 0

Evaluation of Impacts to SDF PA Doses Due to the Update of the GSA Database

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS/ABBREVIATIONS

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
GSA	General Separations Area
IHI	Inadvertent Human Intruder
LFRG	Low-Level Waste Disposal Facility Federal Review Group
MOP	Member of the Public
NRC	U.S. Nuclear Regulatory Commission
PA	Performance Assessment
QA	Quality Assurance
SA	Special Analysis
SDF	Saltstone Disposal Facility
SDU	Saltstone Disposal Unit
SME	Subject Matter Expert
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation, LLC
SRS	Savannah River Site
WDA	Waste Disposal Authority

1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of this report is to present an evaluation of the recent update of the groundwater model known as the General Separations Area (GSA) Database. Specifically, this evaluation focuses on how the updates to the GSA Database impact the resulting doses from the Saltstone Disposal Facility (SDF), as determined within Performance Assessment (PA) modeling.

This evaluation employs the use of two PA modeling platforms: PORFLOW (as developed by Savannah River National Laboratory (SRNL)) and GoldSim (as developed by Savannah River Remediation, LLC (SRR)).

Because dose is used as the primary measure for comparison within this report, Table 1.1-1 provides a summary of the performance objectives required for SDF disposal. These performance objectives are defined in U.S. Department of Energy (DOE) Manual 435.1-1 and 10 Code of Federal Regulations (CFR) 61. [SRR-CWDA-2009-00017]

Table 1.1-1: Performance Objectives and Measures

Exposure Pathway	Objective or Measure, within 1,000 Years of Closure[b]	Point of Assessment
All Pathways[a], Member of the Public	25 mrem/yr	Point of highest concentration, at least 100 meters from disposal units
Air Pathway[a]	10 mrem/yr	Point of highest concentration, at least 100 meters from disposal units
Radon	20 $pCi/m^2/s$	Point of highest concentration at the surface of the disposal facility
All Pathways[a], Chronic Intruder	100 mrem/yr	Point of highest concentration, within 100 meters of disposal units
All Pathways[a], Acute Intruder	500 mrem	Point of highest concentration, within 100 meters of disposal units

a. Excludes radon in air.
b. "Closure" is assumed to begin with emplacement of an engineered closure cap above the disposal units.

This evaluation only compares dose impacts relative to the "All Pathways" exposure pathways for both the member of the public and the chronic intruder. For additional context, readers may refer to the *DOE Standard – Disposal Authorization Statement and Tank Closure Documentation* (DOE-STD-5002-2017).

In addition to identifying the impacts to the magnitude and timing of dose peaks, this evaluation also summarizes the locations of these dose peaks, and describes the changes to the magnitude and direction of the flow rates that influence these dose peaks.

Section 2 of this report describes the models used for performing this evaluation. Section 3 describes the observed impacts. Section 4 provides recommendations for how this information may be used.

1.2 Background

In general, PAs present models which are used to provide understanding of a facilities' capabilities to limit contaminant exposure to the environment and to hypothetical human receptors (member of the public (MOP) and inadvertent human intruder (IHI)). As part of a PA, models are used to simulate the release and transport of radionuclides and chemical contaminants from disposal sites and to estimate exposure and consequence to the MOP and IHI.

At the Savannah River Site (SRS), the 2009 SDF PA was developed to provide the technical basis for demonstrating that the SDF will be compliant with performance objectives as defined in Table 1.1-1. The SDF is a Low-Level Waste disposal facility, where liquid radioactive waste and dry feed materials are mixed and cured into a stable waste form (saltstone) within leak-tested concrete cells known as Saltstone Disposal Units (SDUs).

In FY2013, FY2014, and FY2016, additional modeling was performed to evaluate new information related to the SDF PA. This additional modeling was documented within Special Analysis (SA) reports. [SRR-CWDA-2013-00062, SRR-CWDA-2014-00006, SRR-CWDA-2016-00072] As the latest version of the PA modeling, the models from the *FY2016 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site* (SRR-CWDA-2016-00072) were used as the basis for the evaluation discussed here.

1.3 Site Description

SRS is located approximately 12 miles south of Aiken, South Carolina, and 15 miles southeast of Augusta, Georgia, along the western border of South Carolina (Figure 1.3-1).

Figure 1.3-1: Physical Location of Savannah River Site

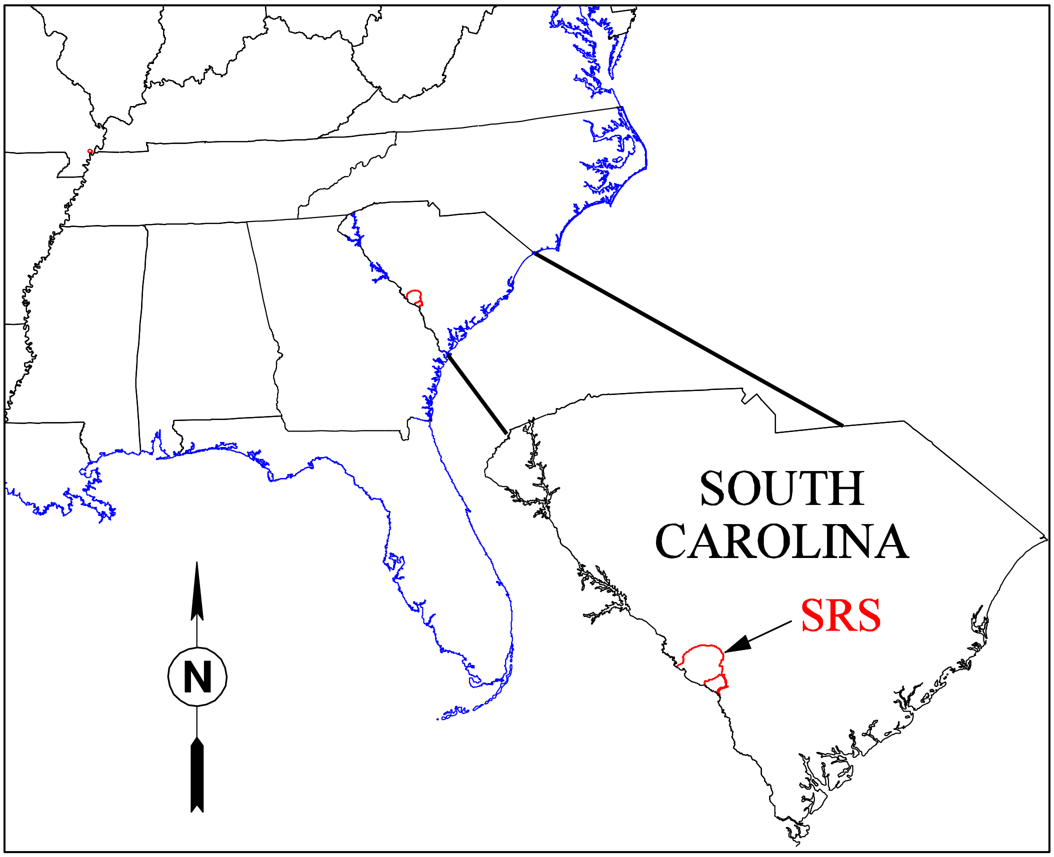


Figure 1.3-2 shows the major operational areas at SRS. The GSA includes E-, F-, H-, J-, S-, and Z-Areas, near the center of the SRS. Figure 1.3-3 provides the general layout of the GSA in more detail. The SDF is located in Z-Area, at the north eastern end of the GSA. Z-Area and the SDF are the primary focus of the evaluation discussed herein. Finally, Figure 1.3-4 shows a recent aerial photograph of the SDF, taken in March of 2017. This photograph looks in a south-west direction over the SDF, such that S-Area appears in the upper left hand side of the image.

Figure 1.3-2: SRS Operational Area Location Map

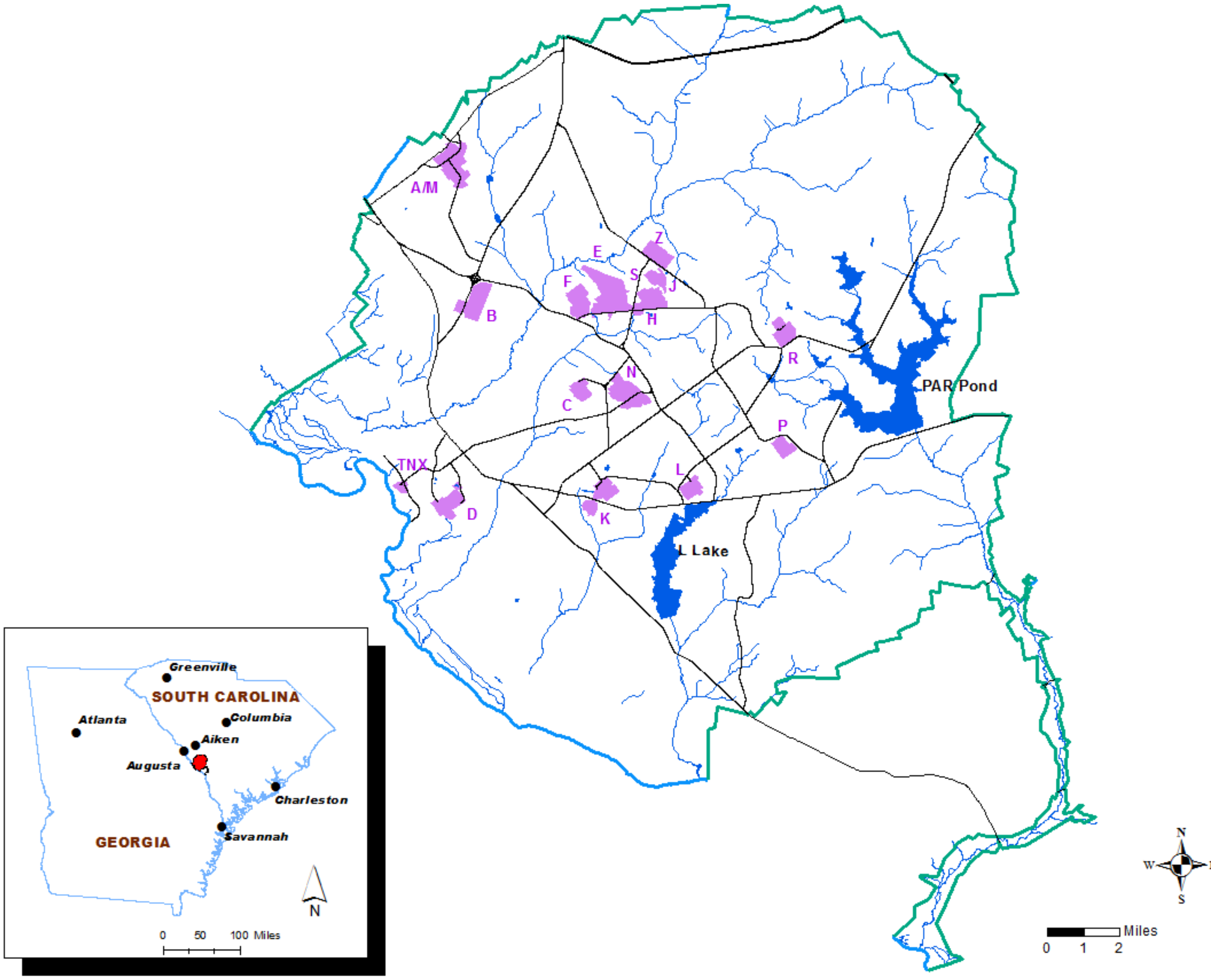


Figure 1.3-3: Layout of the GSA

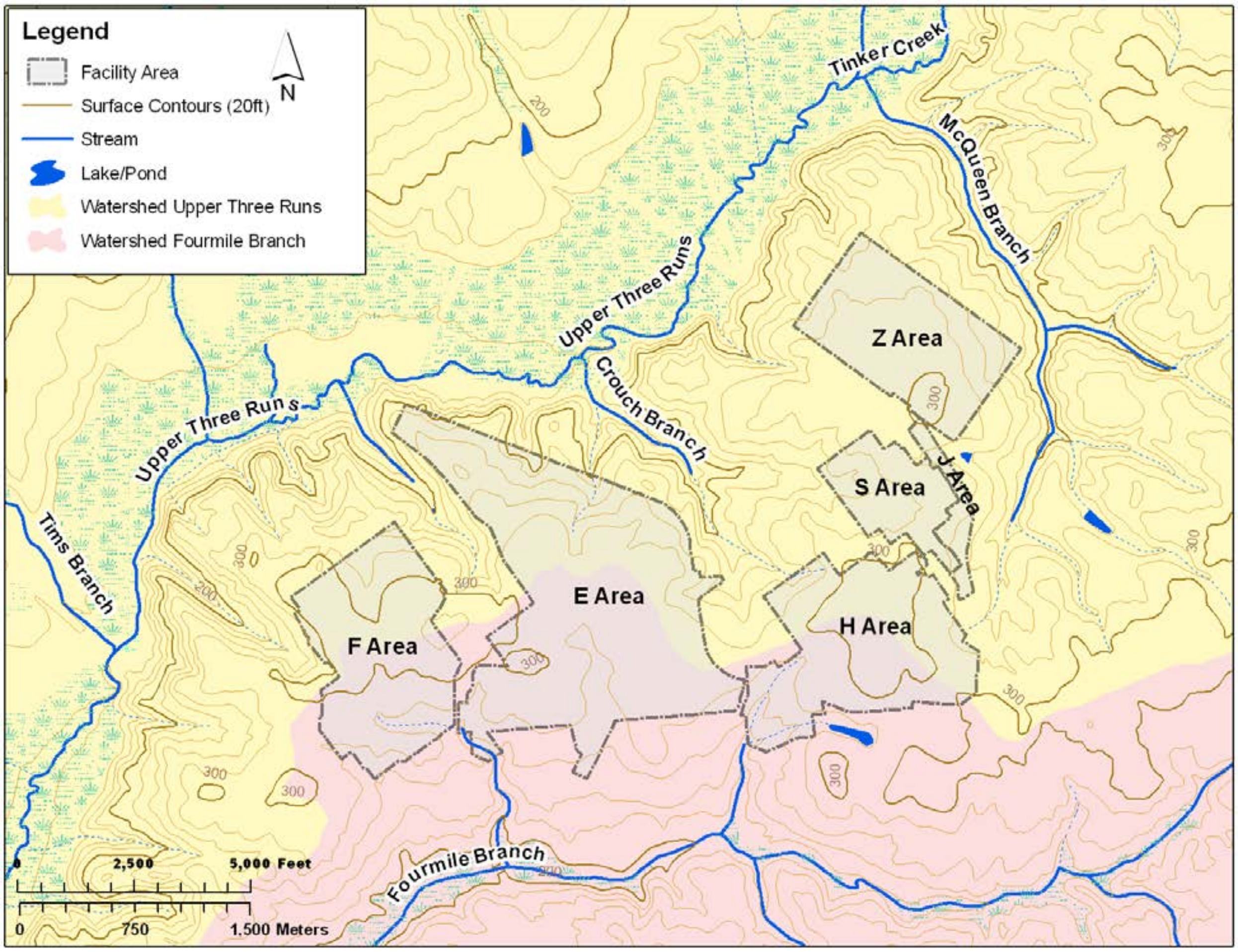


Figure 1.3-4: Aerial Photograph of SDF

[Photograph taken March 16, 2017.]

1.4 Quality Assurance

Development of this report and supporting analyses are subject to the quality assurance (QA) program and requirements as defined in Manual S4, Procedure ENG.51 – *Verification and Checking of Technical Documents*.

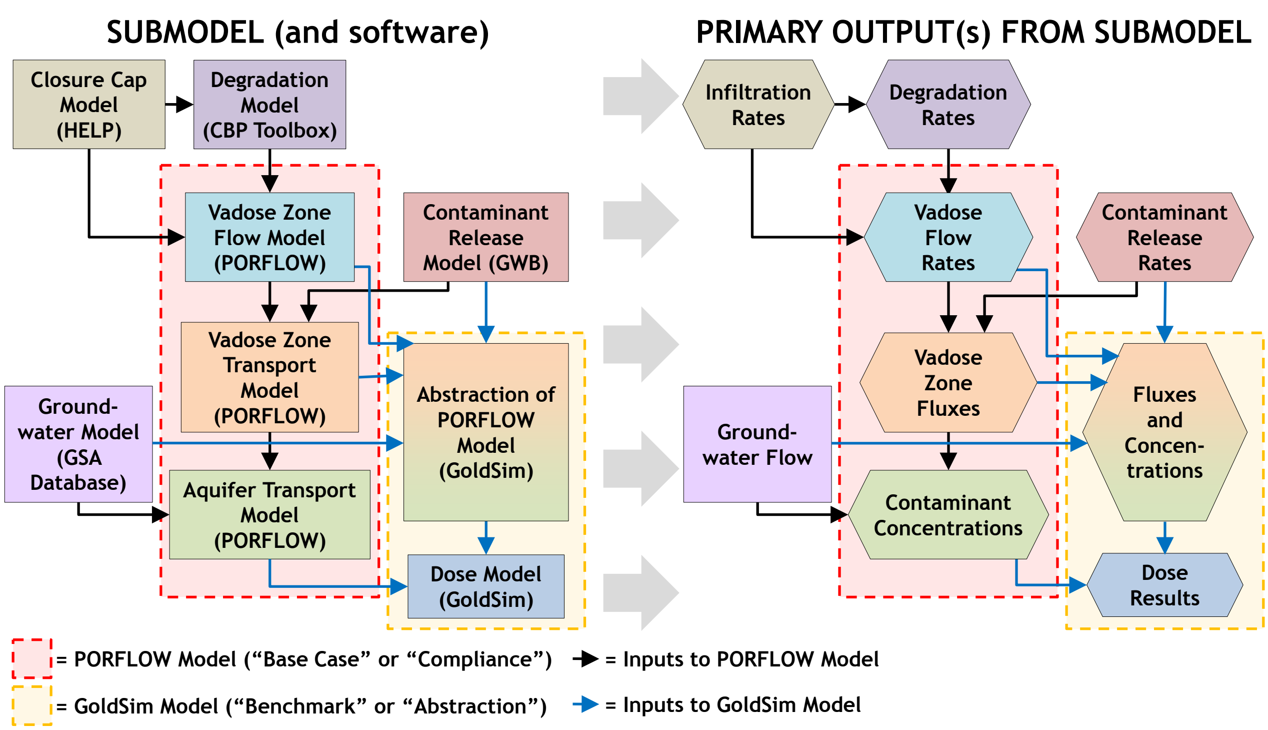
2.0 MODELING

2.1 Model Integration

Three models are discussed herein. All three models were developed in support of SRS PAs, but each have a distinct purpose. The GSA Database Model is used to simulate groundwater flow rates and to estimate flow directions. This information is used as inputs for all SRS PAs within the GSA (see Figure 1.3-3). The SDF PORFLOW Model simulates the release and transport of contaminants (radioactive material and chemicals) from the SDUs to various points of assessment. Finally, the SDF GoldSim Model has two purposes: (1) it can be used as a dose calculator, converting concentration data (from the SDF PORFLOW Model) into doses to the MOP or IHI, or (2) it can be used as a simplified release and transport model (mimicking the SDF PORFLOW Model at a lower resolution) and convert the generated concentrations to dose. Within the context of this report, the SDF GoldSim model is used only as a dose calculator.

Figure 2.1-1 provides a high-level summary of these modeling interactions.

Figure 2.1-1: SDF PA Model Integration



Note that this figure includes other modeling interactions which are not discussed herein; this document focuses exclusively on the interactions relative to impacts from the updates to the GSA Database Model (i.e., predecessors to the groundwater modeling interactions are not considered).

The following provides further discussion of the GSA Database Model, the SDF PORFLOW Model, and the SDF GoldSim Model.

2.2 GSA Database Model

The GSA Database Model, as was used for the 2009 SDF PA, was developed in 2004 by porting an earlier version of the GSA groundwater flow model from the FACT modeling code into the PORFLOW code, which made it more directly compatible with the release and transport modeling. This earlier "GSA/FACT" model was developed in 1997 using characterization and monitoring data through the mid-1990's. When it was ported into PORFLOW to create the 2004 "GSA/PORFLOW" version of the GSA Database Model, the inputs were not updated to incorporate newer data. Both the 1997 GSA/FACT and the 2004 GSA/PORLFOW versions of the GSA Database Model were manually calibrated to field data. Significantly more field data have been acquired since the mid-1990's and model calibration using mathematical optimization software has become routine and recommended practice.

For the recent update to the GSA Database Model, more current field data was used (spanning from the 1980s to 2015). Additionally, the PEST code was used to calibrate the model and quantify parameter uncertainty. This new GSA Database Model flow model is sometimes referred to as "GSA2016" in reference to the year in which most of the development occurred. The GSA2016 model update is intended to address issues raised by DOE's Low-Level Waste Disposal Facility Federal Review Group (LFRG) in a 2008 review of the E-Area PA, and by the U.S. Nuclear Regulatory Commission (NRC) in reviews of tank closure PAs and the SDF PA.

The update process for the GSA Database Model is documented more thoroughly within the report: *Groundwater Flow Simulation of the Savannah River Site General Separations Area* (SRNL-STI-2017-00008). As part of the quantification of parameter uncertainty, the PEST code identified four configurations as "accepted" configurations based on model calibration targets. These four configurations are:

- PEST.47 → Layer-cake *K* field with unweighted optimization parameters (LU)
- PEST.51 → Layer-cake *K* field with weighted optimization parameters (LW)
- PEST.52 → Heterogeneous *K* field with unweighted optimization parameters (HU)
- PEST.53 → Heterogeneous *K* field with weighted optimization parameters (HW)

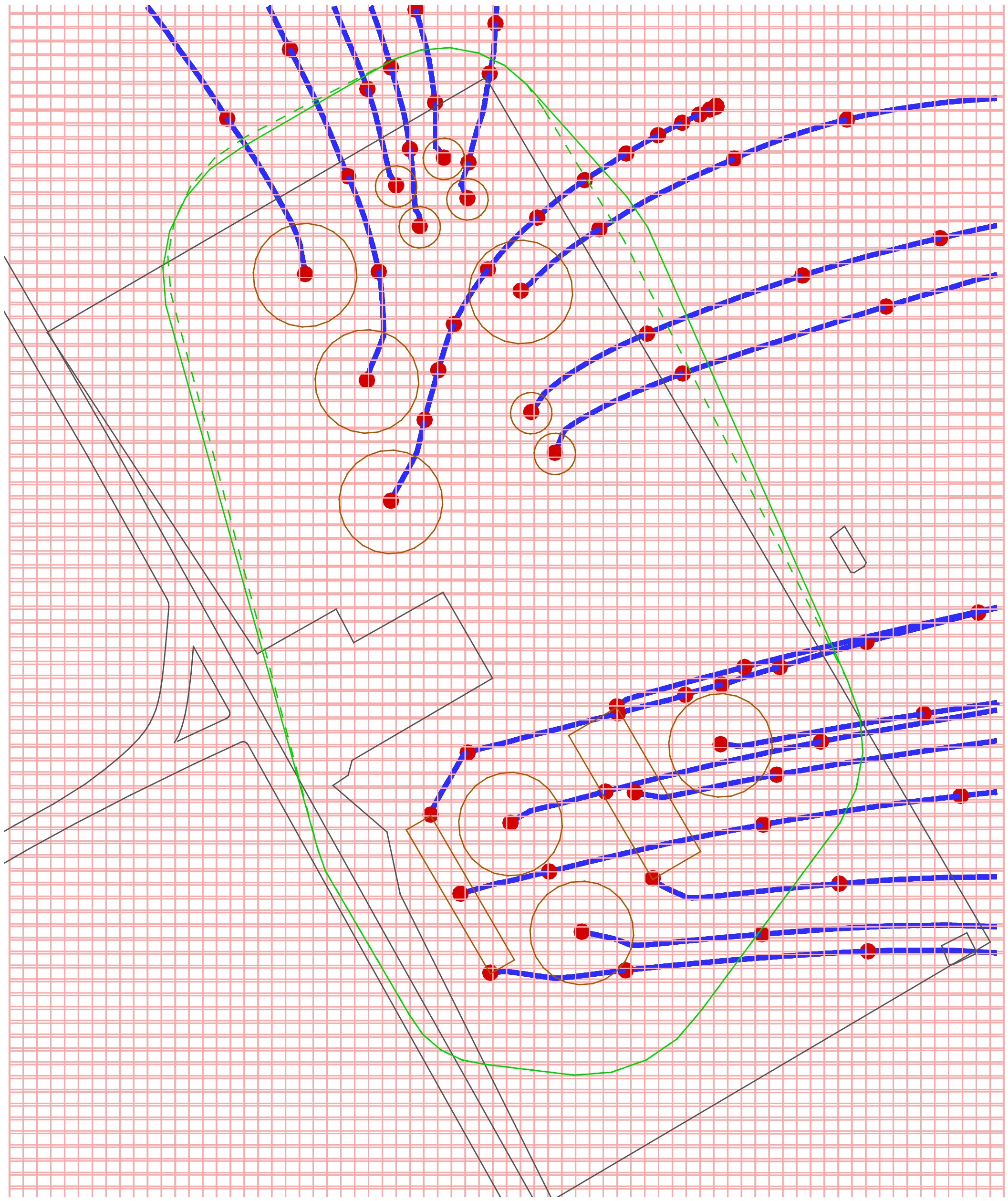
Configuration PEST.51 was recommended as the "base case" groundwater model because its results most closely represent expected conditions. [SRNL-STI-2017-00008] However, all four configurations are considered to be equally viable, such that the impacts for all four will be evaluated in Section 3.

2.3 SDF PORFLOW Model

The latest version of the SDF PORFLOW Model was developed for the FY2016 SDF SA, as described in *Evaluation of Revised Future Saltstone Disposal Unit Locations by PORFLOW Simulations* (SRNL-STI-2016-00534) and in the *FY2016 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site* (SRR-CWDA-2016-00072). This model was modified to incorporate inputs and formulas to reflect new groundwater flow information from the GSA Database Model. The specific changes relative to groundwater flow were applied within the aquifer transport portion of the SDF PORFLOW Model (see Figure 2.1-1). Specifically, flow rates, flow directions, and the thickness of the saturated zone have all been updated to use values from each of the four calibrated flow configurations (PEST.47, PEST.51,

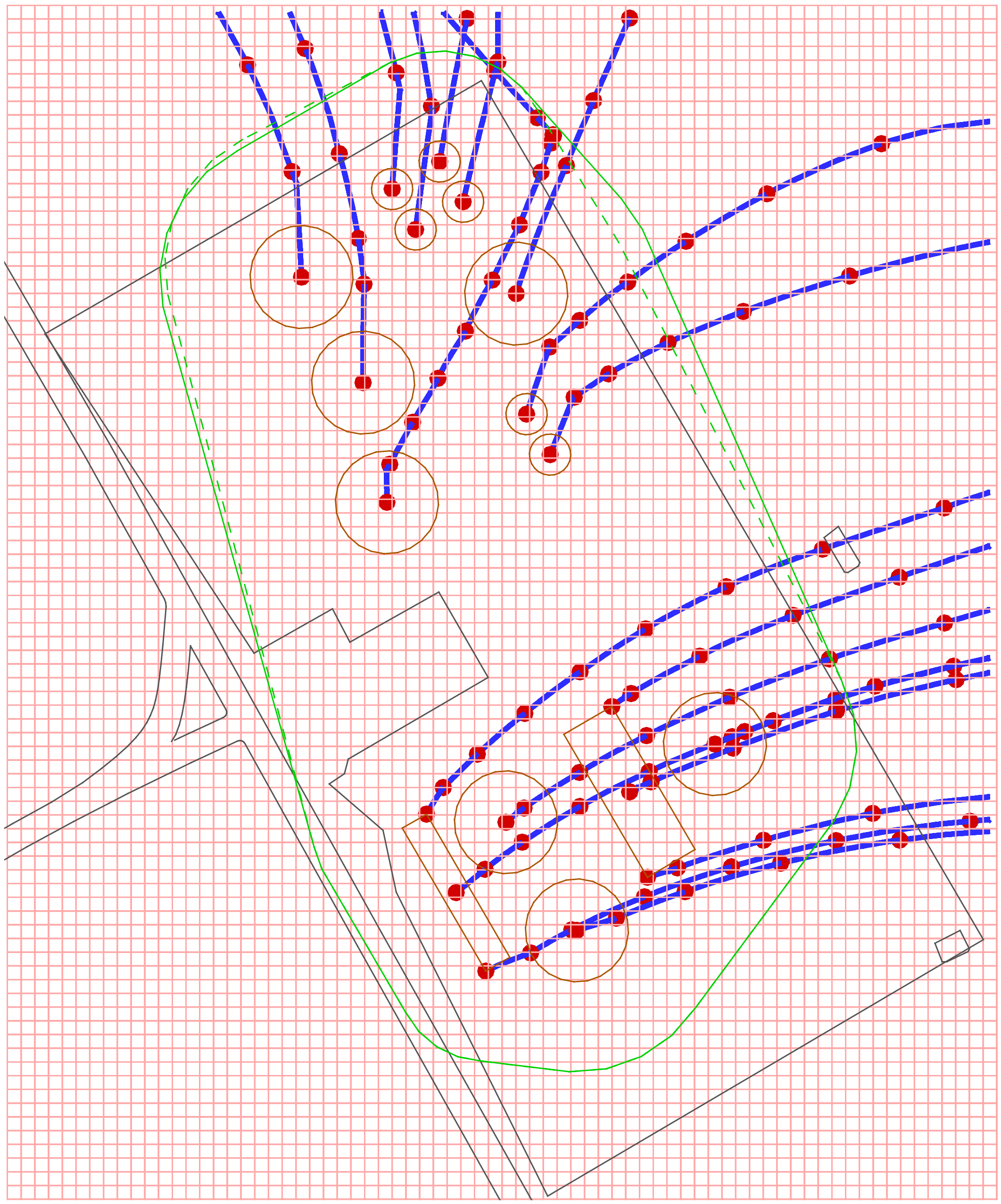
PEST.52, and PEST.53). Figure 2.3-1 shows stream traces (i.e., center of the flow path) based on the flow fields used in the FY2016 SDF SA, while Figures Figure 2.3-2 through Figure 2.3-5 show the stream traces based on the new flow fields. Comparing the new flow fields to those from the FY2016 SDF SA indicates that the new flow fields have slightly different flow directions (with a general shift towards the north), and significantly slower rates of flow.

Figure 2.3-1: SDF Stream Traces Used in the FY2016 SDF SA



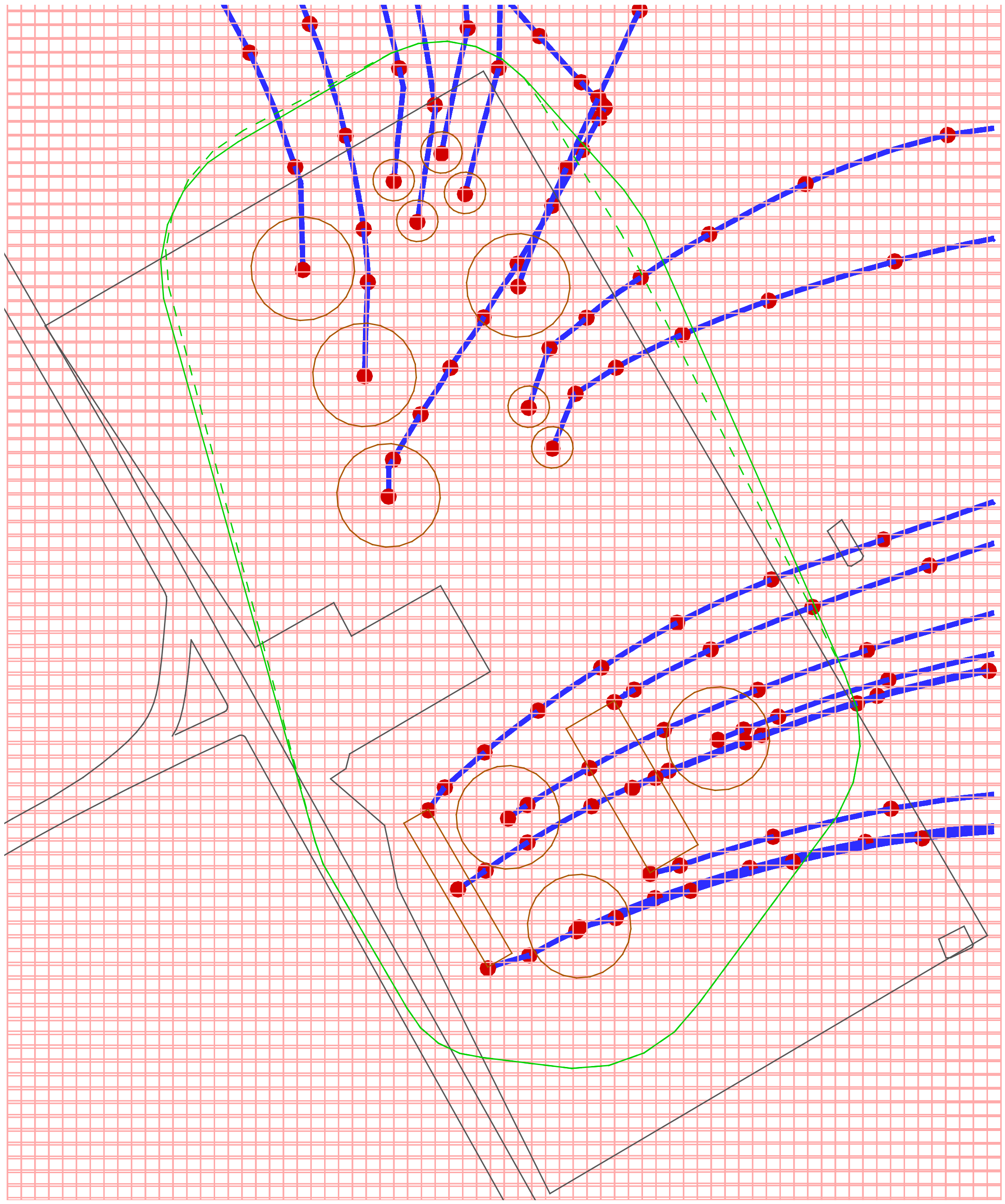
Note: Red dots indicate 5-year travel times (i.e., more dots indicate slower flow rates) while the blue lines indicate the center of flow from each starting point.

Figure 2.3-2: SDF Stream Traces Based on the 2016 GSA Database Model (Configuration = PEST.47)



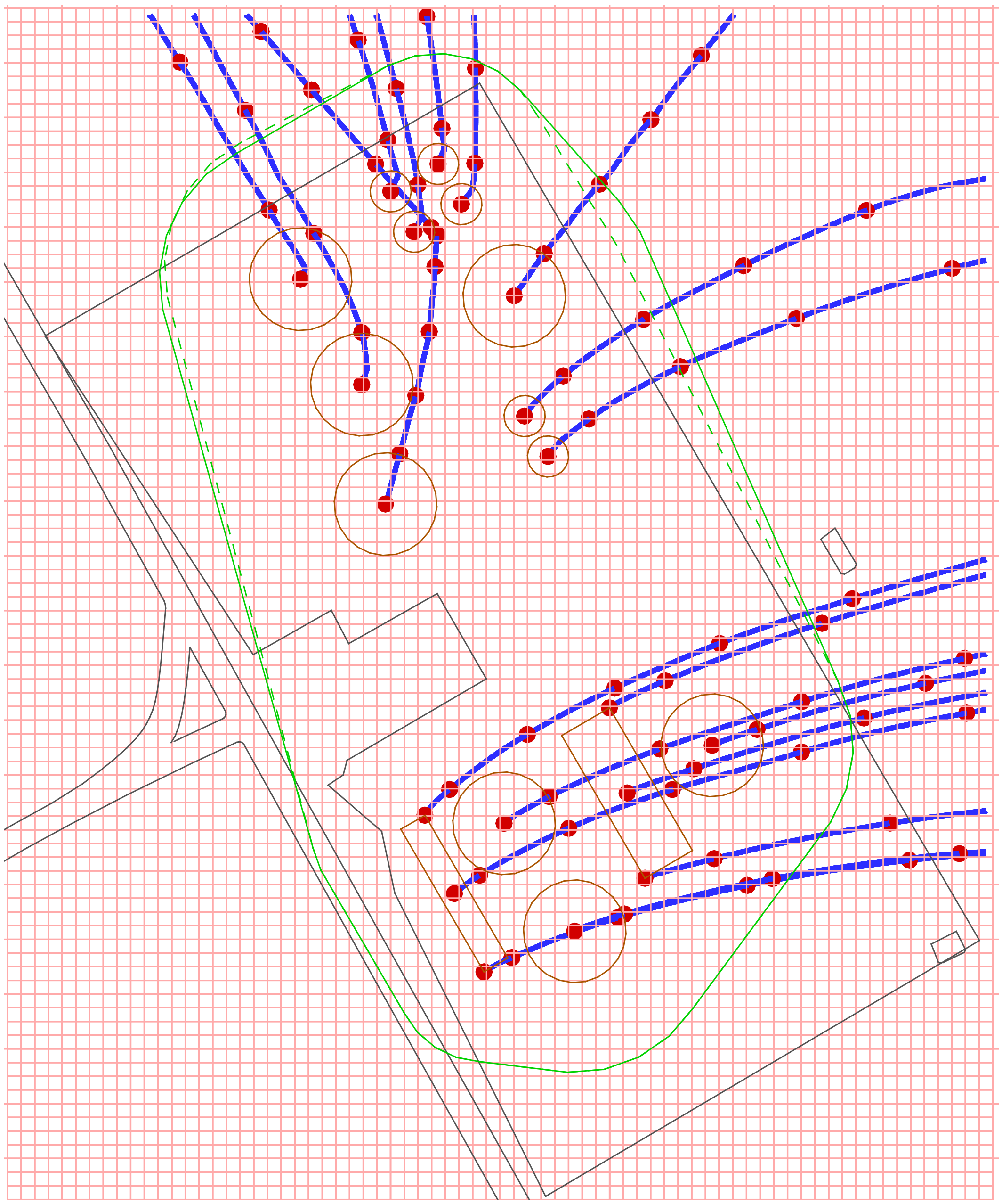
Note: Red dots indicate 5-year travel times (i.e., more dots indicate slower flow rates) while the blue lines indicate the center of flow from each starting point.

Figure 2.3-3: SDF Stream Traces Based on the 2016 GSA Database Model (Configuration = PEST.51)



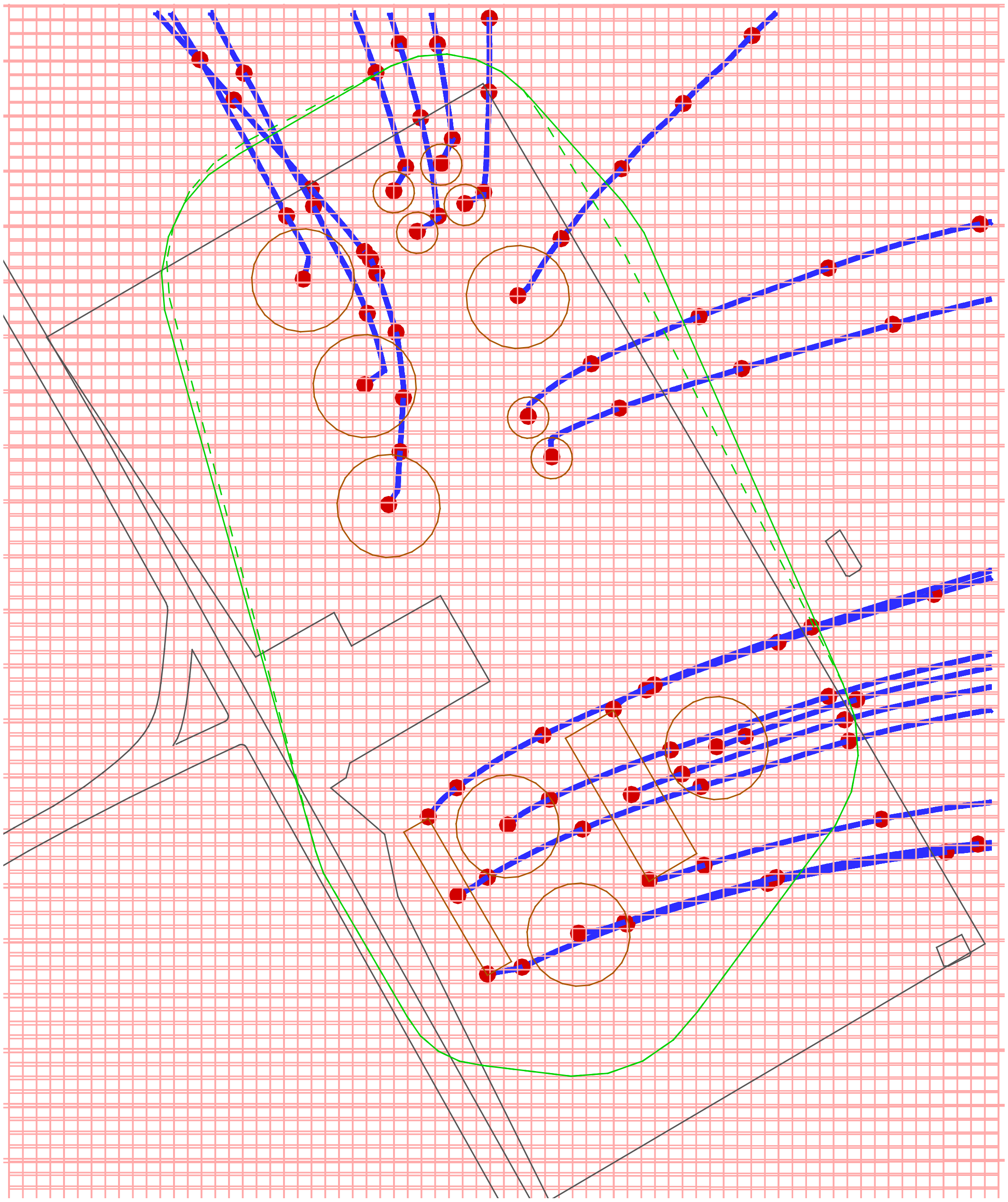
Note: Red dots indicate 5-year travel times (i.e., more dots indicate slower flow rates) while the blue lines indicate the center of flow from each starting point.

Figure 2.3-4: SDF Stream Traces Based on the 2016 GSA Database Model (Configuration = PEST.52)



Note: Red dots indicate 5-year travel times (i.e., more dots indicate slower flow rates) while the blue lines indicate the center of flow from each starting point.

Figure 2.3-5: SDF Stream Traces Based on the 2016 GSA Database Model (Configuration = PEST.53)



Note: Red dots indicate 5-year travel times (i.e., more dots indicate slower flow rates) while the blue lines indicate the center of flow from each starting point.

Additionally, an alternative numerical algorithm for calculating the impacts of dispersion was applied. In previous PORFLOW modeling, the dispersion terms used harmonic averaging at cell faces and used only diagonal terms in the dispersion tensor. As a change, the dispersion terms now uses an approach called "upwinding" at cell faces and uses the full dispersion tensor (off-diagonal terms were added). The previous approach had been selected because it reduced

oscillations (i.e., numerical artifacts which could result in unreal negative concentration values); however, it slightly over-predicted lateral spreading, which tends to reduce peak concentrations. The changes to the numerical algorithm do not affect the stream traces which reflect advective transport only.

These changes are further discussed within the *Impacts of Updated GSA Groundwater Flow Model on the FTF, HTF and SDF PAs* (SRNL-STI-2017-00445).

2.4 SDF GoldSim Model

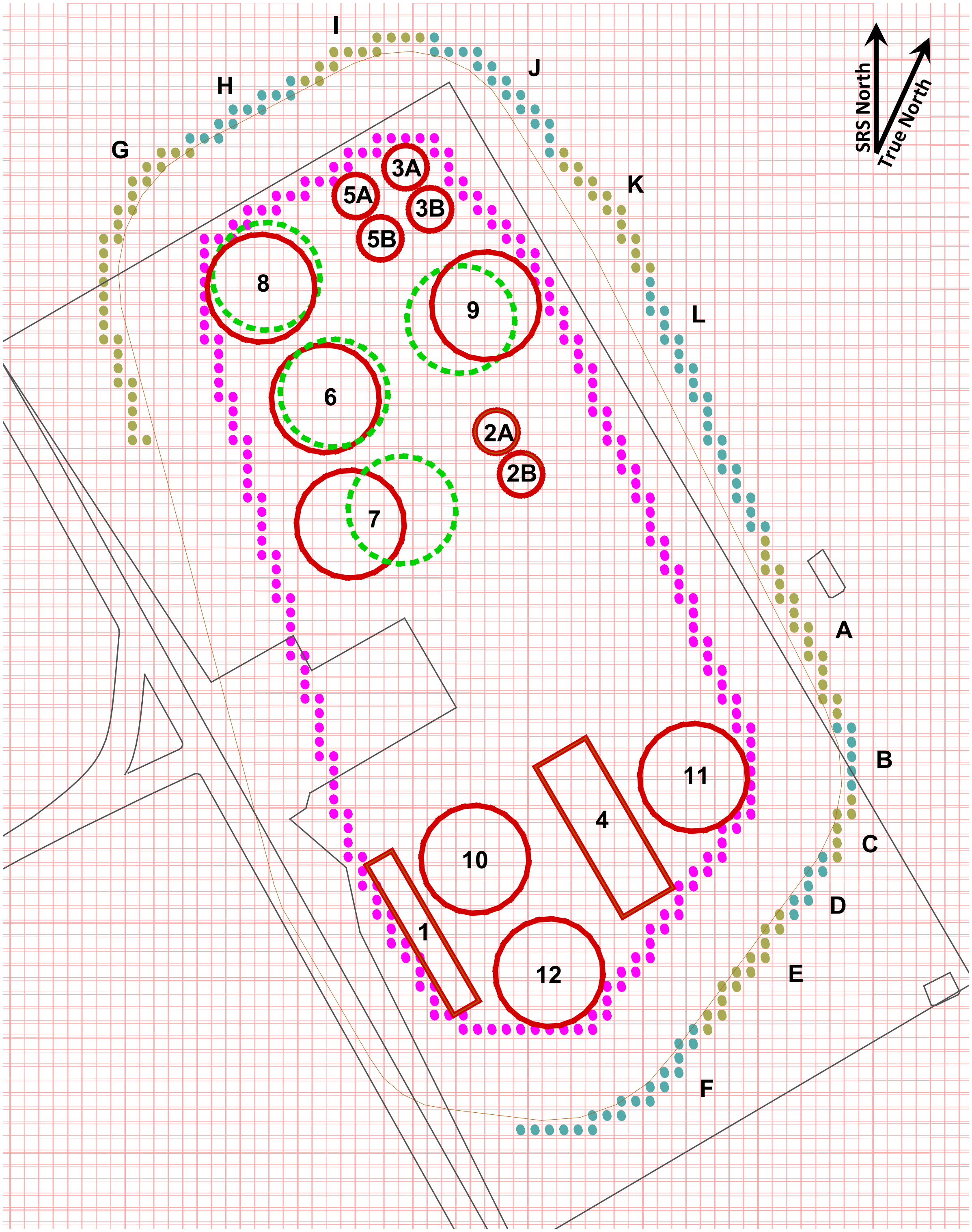
The SDF GoldSim Model was used to calculate potential dose results based on the concentrations from the updated aquifer transport portion of the SDF PORFLOW Model, using each of the four calibrated flow configurations (PEST.47, PEST.51, PEST.52, and PEST.53). Aside from the revised concentrations, no other dose-impacting changes were made to the SDF GoldSim Model (i.e., the dose calculations are unchanged relative to the FY2016 SDF SA). These doses provide a basis for evaluating the degree of influence from the changes to the GSA Database Model, relative to the peak doses.

For this evaluation, doses are calculated for both the MOP and the IHI and are compared to the applicable performance objectives for the two hypothetical human receptors. The simulations were carried out to 1,000 years (for compliance), and to 10,000- and 50,000-years (for long-term performance evaluations).

In addition to the magnitude and timing of the peak doses, the locations of the peak doses are also considered. As with the PA and subsequent Special Analyses, the 100-meter boundary around the SDUs of the SDF are organized into 12 sectors (from A to L), as depicted in Figure 2.4-1. For IHI doses, an assumed 1-meter boundary surrounding the SDUs is also used, but was not organized into multiple sectors. In addition to the 1-meter dose, the IHI results also look at assumed hypothetical wells. Figure 2.4-2 shows the assumed locations for IHI wells (yellow diamonds) and the 1-meter boundary (pink dots). Note that the locations for each of the IHI wells were selected during development of the FY2013 SDF SA, which had a different SDF layout (for the FY2013 SDF SA, all of these wells resided within the 1-meter boundary). However, due to the development of the 375-foot diameter SDUs, IHI Well 1 and IHI Well 2 are now beyond the 1-meter boundary and IHI Well 4 is within the footprint of SDU 9. Note that IHI Well 1 is even outside the 100-meter boundary.

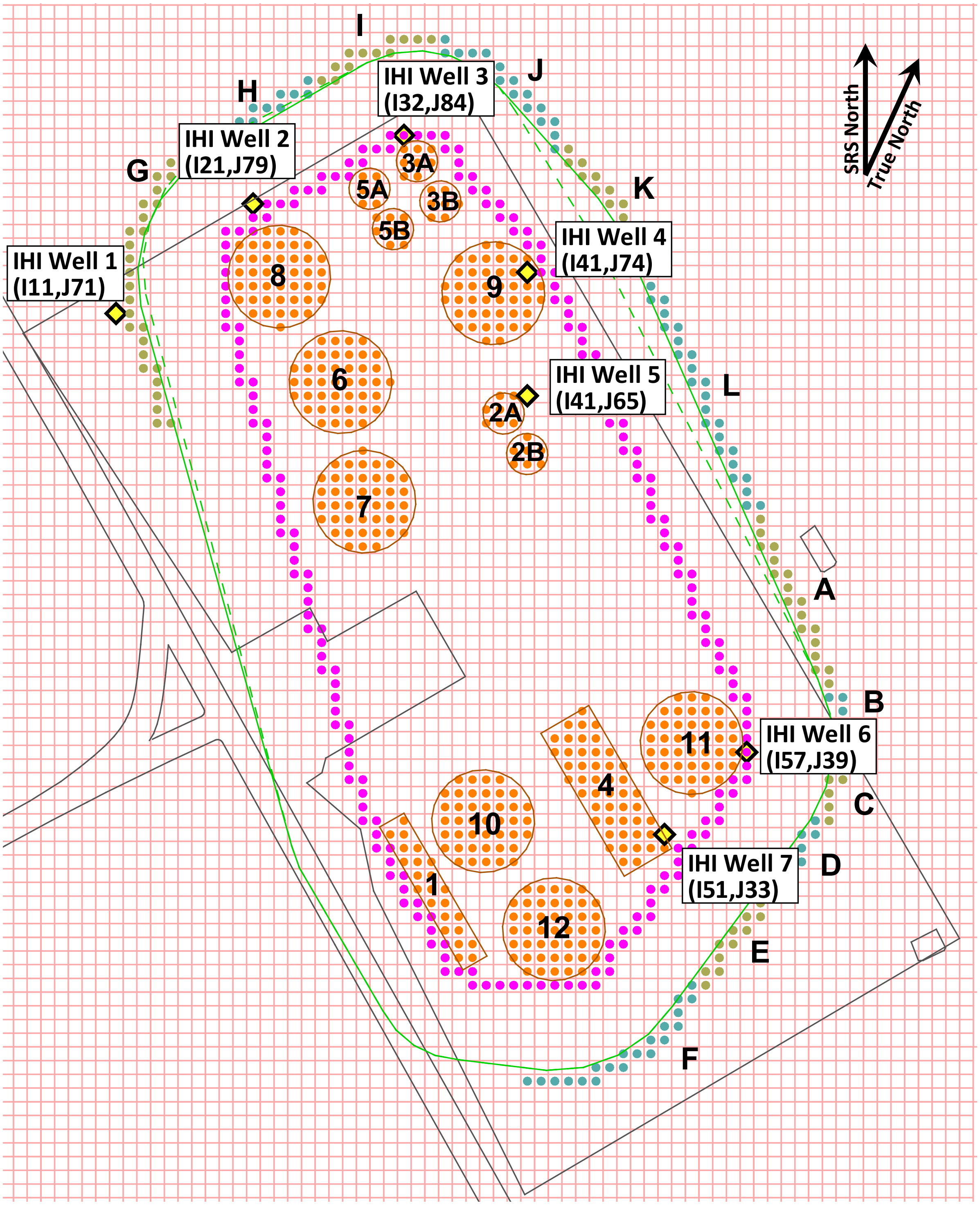
Version 5.014 of the SDF GoldSim Model (as used in the FY2016 SDF SA) is undergoing minor maintenance to improve model transparency. None of the model changes to date impact the dose calculations, relative to the FY2016 SDF SA. The latest modified version of the SDF GoldSim Model (v5.020) was used for this analysis, along with the latest version of GoldSim modeling software (Version 12.0). Section 3 presents the results.

Figure 2.4-1: Current Sector Layout for SDF (as Modeled in this Evaluation)



Note: Green dashed lines show the previous modeling positions of SDU 6, 7, 8 and 9, as modeled in the FY2014 SDF SA while the solid red lines indicate the current assumed positions for all of the SDUs as of the FY2016 SDF SA.

Figure 2.4-2: Current IHI Well Layout for SDF (as Modeled in this Evaluation)



Note: Yellow diamonds indicate node locations for assumed IHI wells, while the pink dots indicate the assumed 1-meter boundary around the SDUs. Labels next to each IHI well include the PORFLOW node location. These locations were selected during the FY2013 SDF SA, which had a different SDF layout, which is why IHI Well 1 is beyond the 100-meter boundary and why IHI Well 4 is within the footprint of SDU 9.

3.0 DOSE IMPACTS

To study the impact that the GSA Database change has on MOP and IHI doses, the SDF GoldSim Model was run using updated concentration inputs from the SDF PORFLOW Aquifer Transport simulation.

3.1 Peak Dose Tables

Table 3.1-1 shows a comparison of the MOP peak dose results and Table 3.1-2 shows a comparison of the IHI peak dose results.

Table 3.1-1: Peak MOP Dose Comparison

	FY2016 SDF SA	PEST.47	PEST.51	PEST.52	PEST.53
1,000-Year Peak Dose Results					
Peak Dose (mrem/yr)	0.04	0.07	0.07	0.06	0.06
Year of Peak Dose	1,000	1,000	1,000	1,000	1,000
Sector of Peak Dose	Sector B	Sector A	Sector A	Sector B	Sector B
10,000-Year Peak Dose Results					
Peak Dose (mrem/yr)	11.2	21.6	21.6	19.7	20.3
Year of Peak Dose	5,300	5,340	5,340	5,320	5,340
Sector of Peak Dose	Sector K	Sector A	Sector B	Sector G	Sector H
50,000-Year Peak Dose Results					
Peak Dose (mrem/yr)	360	443	445	485	465
Year of Peak Dose	30,520	30,520	30,520	30,520	30,520
Sector of Peak Dose	Sector I	Sector I	Sector I	Sector I	Sector I

Table 3.1-2: Peak IHI Dose Comparison

	FY2016 SDF SA	PEST.47	PEST.51	PEST.52	PEST.53
1,000-Year Peak Dose Results					
Peak Dose (mrem/yr)	0.10	0.12	0.13	0.10	0.16
Year of Peak Dose	600	620	620	840	620
IHI Location of Peak Dose	IHI Well 7	IHI Well 7	IHI Well 7	IHI Well 7	IHI Well 7
10,000-Year Peak Dose Results					
Peak Dose (mrem/yr)	28.4	32.7	33.0	38.5	38.4
Year of Peak Dose	5,220	5,300	5,300	5,260	5,280
IHI Location of Peak Dose	IHI Well 4	1-Meter	1-Meter	IHI Well 4	1-Meter
50,000-Year Peak Dose Results					
Peak Dose (mrem/yr)	953	1,229	1,229	1,345	1,507
Year of Peak Dose	30,480	30,500	30,500	30,500	30,500
IHI Location of Peak Dose	1-Meter	1-Meter	1-Meter	1-Meter	1-Meter

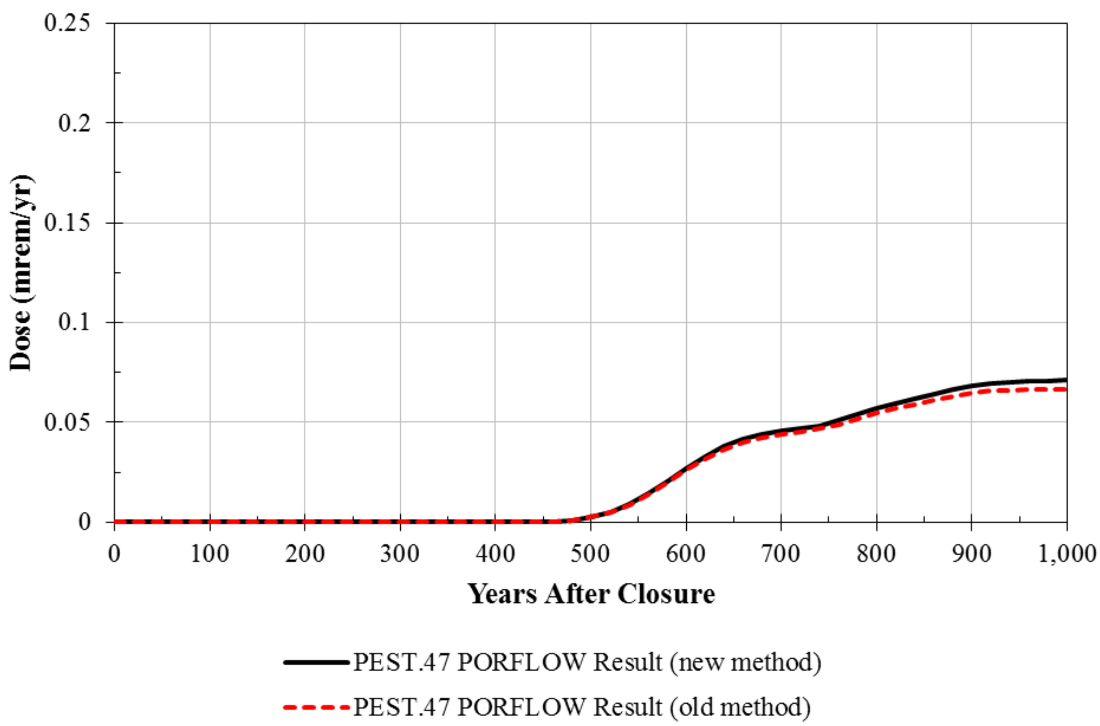
Examination of these doses shows that both the MOP and IHI peak-dose timing was relatively unchanged, but the peak-dose magnitudes have significantly increased within certain time periods.

3.2 Consideration of the Numerical Algorithm for Dispersion

A small part of the increase to the peak doses can be attributed to the change in the approach for determining the influence of dispersivity (see the discussion of the numerical algorithm in Section 2.2). Figure 3.2-1, Figure 3.2-2, and Figure 3.2-3 illustrate the relatively minor impact from using the alternative numerical algorithm for calculating dispersion. The comparison uses the PEST.47 flow configuration and total MOP dose results.

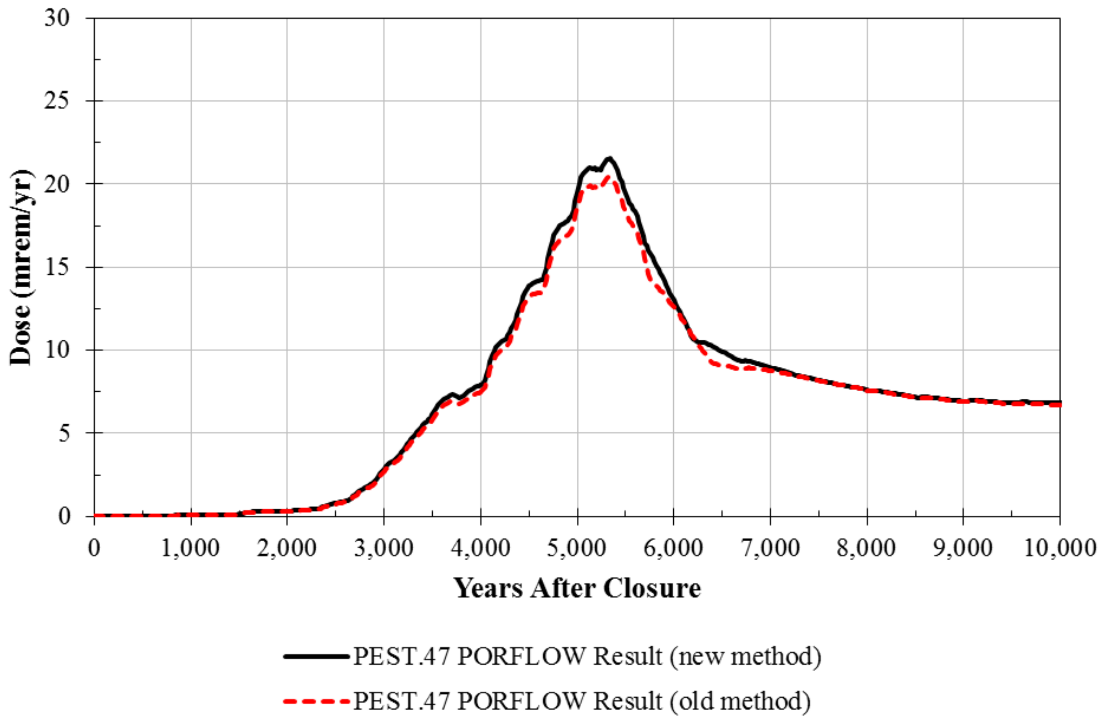
In these figures, the dashed red curves indicate the “old method” which used harmonic averaging at cell faces and only diagonal terms in the dispersion tensor; whereas the solid black curves indicate the “new method”, which uses upwinding of properties at cell faces and the full dispersion tensor (off-diagonal termsincluded).

Figure 3.2-1: Comparison of 1,000-Year MOP Doses from the PEST.47 Flow Configuration, Using Different Numerical Algorithms



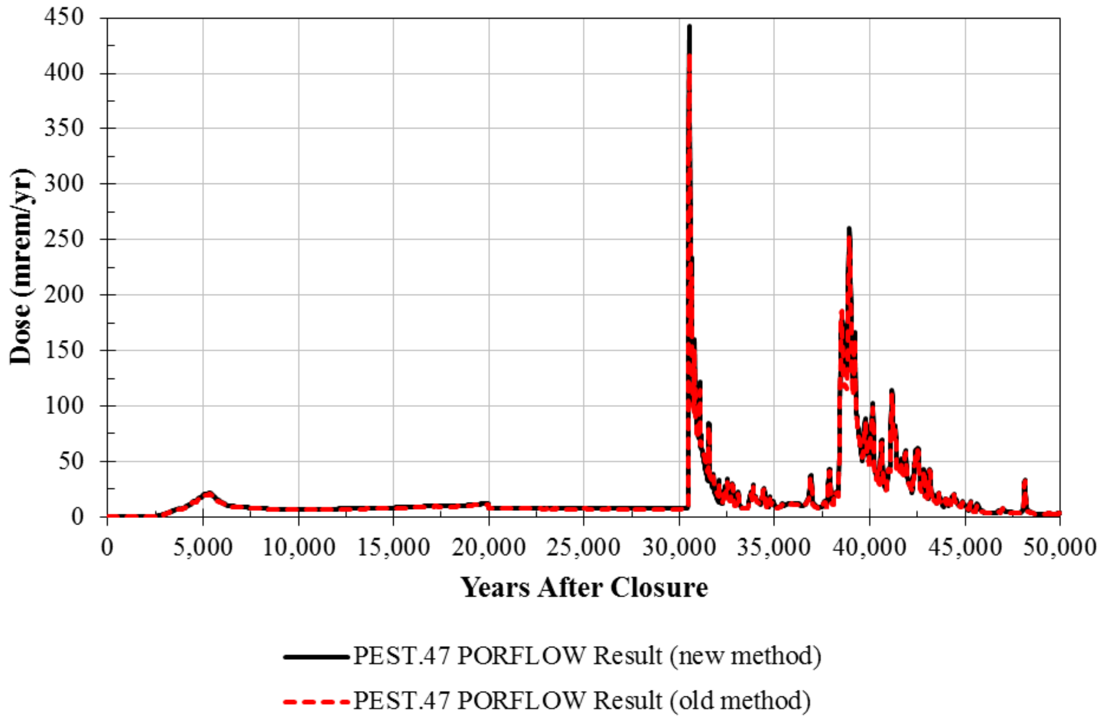
Note: The “new method” indicates results generated by upwinding the diffusion coefficient at cell faces and adding off-diagonal terms to the dispersion tensor, while the “old method” indicates that results were generated using harmonic averaging of the diffusion coefficient at cell faces and only using diagonal terms in the dispersion tensor.

Figure 3.2-2: Comparison of 10,000-Year MOP Doses from the PEST.47 Flow Configuration, Using Different Numerical Algorithms



Note: The "new method" indicates results generated by upwinding the diffusion coefficient at cell faces and adding off-diagonal terms to the dispersion tensor, while the "old method" indicates that results were generated using harmonic averaging of the diffusion coefficient at cell faces and only using diagonal terms in the dispersion tensor.

Figure 3.2-3: Comparison of 50,000-Year MOP Doses from the PEST.47 Flow Configuration, Using Different Numerical Algorithms



Note: The "new method" indicates results generated by upwinding the diffusion coefficient at cell faces and adding off-diagonal terms to the dispersion tensor, while the "old method" indicates that results were generated using harmonic averaging of the diffusion coefficient at cell faces and only using diagonal terms in the dispersion tensor.

3.3 MOP Dose Comparison Figures

Regardless of differences in the numerical algorithm used for dispersivity (Section 3.2), the majority of the increase of the MOP dose is attributed to the updates to the GSA Database Model. Specifically, the GSA Database Model estimated significantly slower flow rates in the groundwater compared to the 2004 GSA Database Model. These slower flow rates result in less dilution and thus higher concentrations at the points of assessment (along the 100-meter boundary). Figure 3.3-1, Figure 3.3-2, and Figure 3.3-3 illustrate the full increase relative to the FY2016 SDF SA dose results for each of the time periods considered.

Figure 3.3-1: Comparison of 1,000-Year MOP Doses from the Four Flow Configurations and the MOP Dose from the FY2016 SDF SA

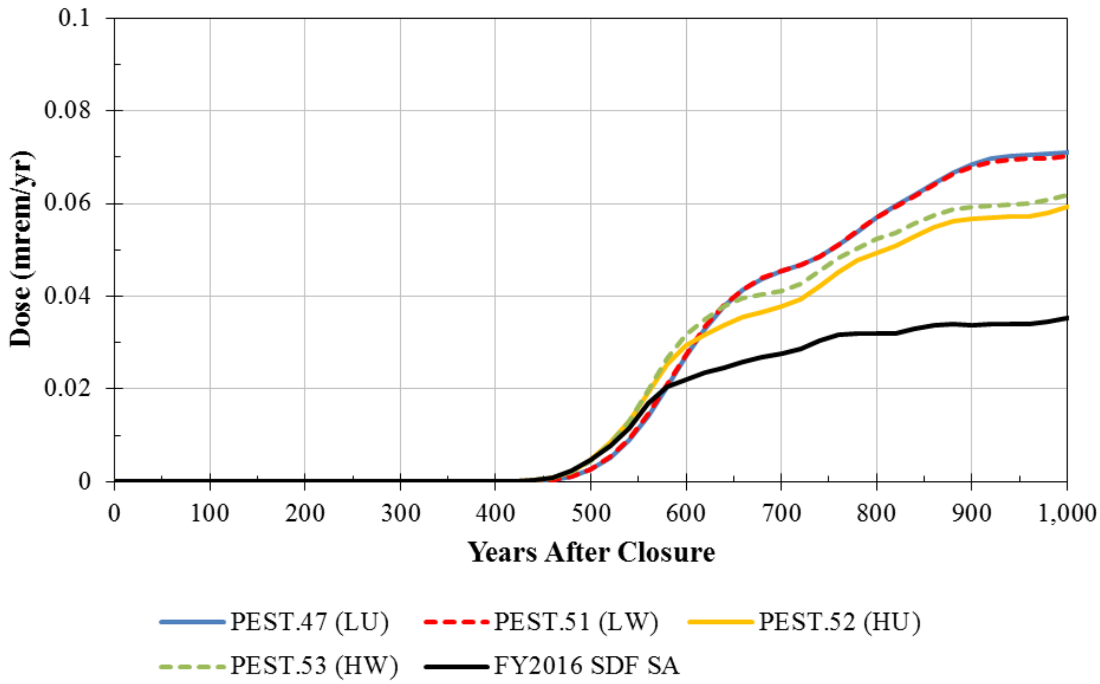


Figure 3.3-2: Comparison of 10,000-Year MOP Doses from the Four Flow Configurations and the MOP Dose from the FY2016 SDF SA

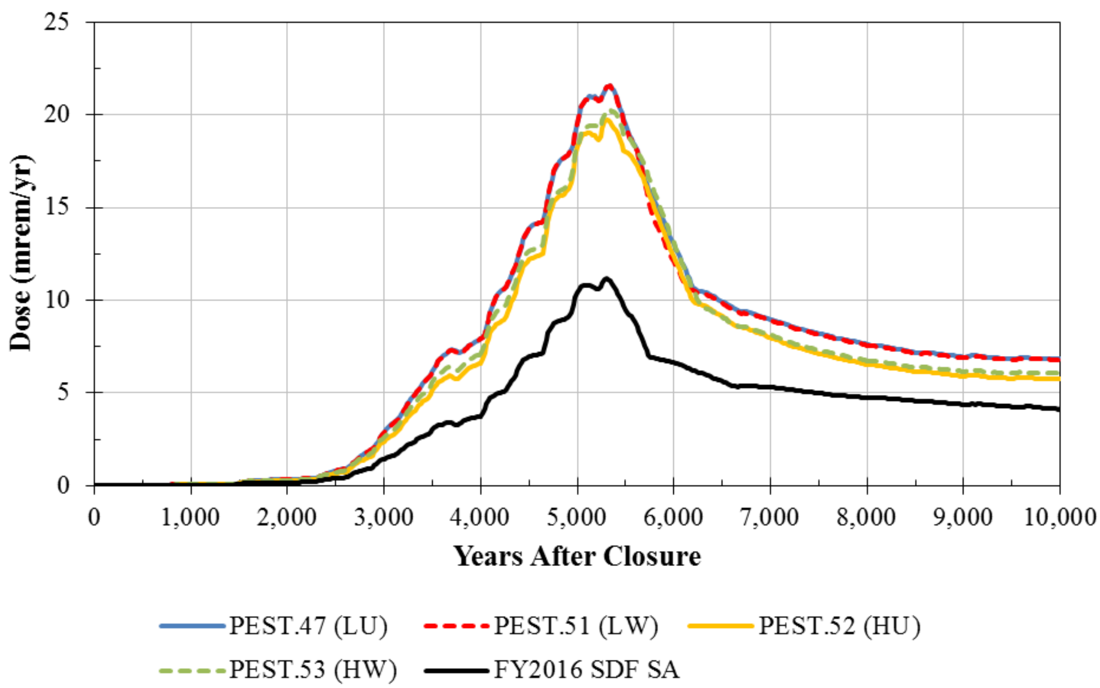
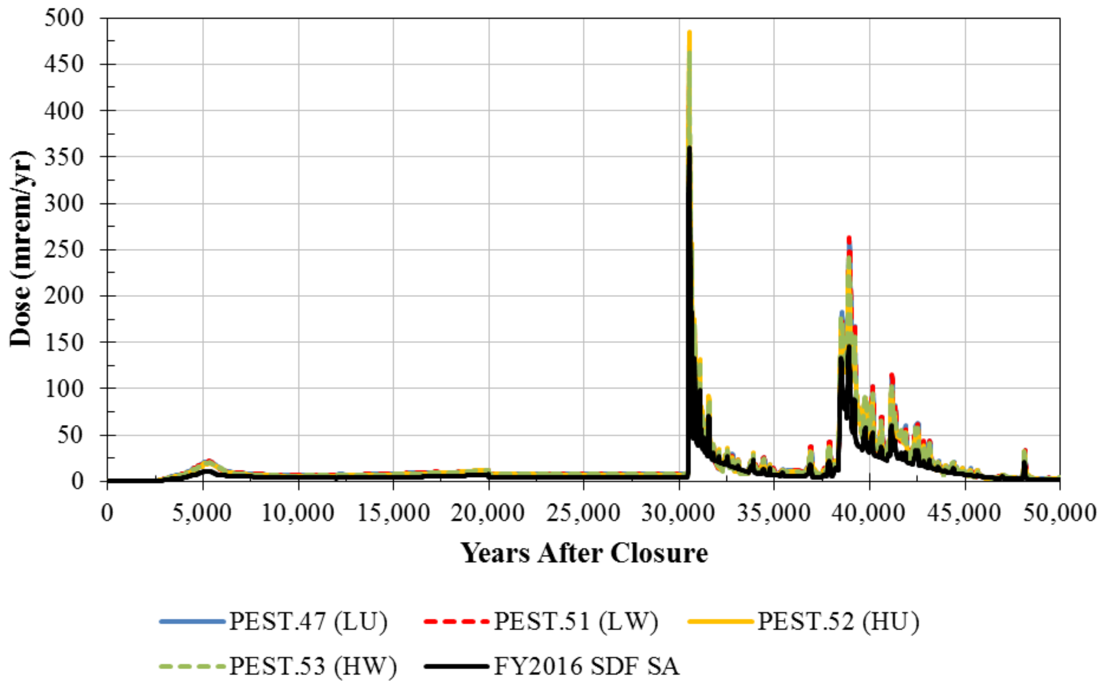


Figure 3.3-3: Comparison of 50,000-Year MOP Doses from the Four Flow Configurations and the MOP Dose from the FY2016 SDF SA



3.4 IHI Dose Comparison Figures

Similar to the MOP dose comparison, the majority of the increase to the IHI dose is also attributed to the slower flow rates from the GSA Database Model. These slower flow rates result in higher concentrations at the points of assessment (along the 1-meter boundary and at the IHI wells). Figure 3.4-1, Figure 3.4-2, and Figure 3.4-3 illustrate the full increase relative to the FY2016 SDF SA dose results for each of the time periods considered.

Figure 3.4-1: Comparison of 1,000-Year IHI Doses from the Four Flow Configurations and the IHI Dose from the FY2016 SDF SA

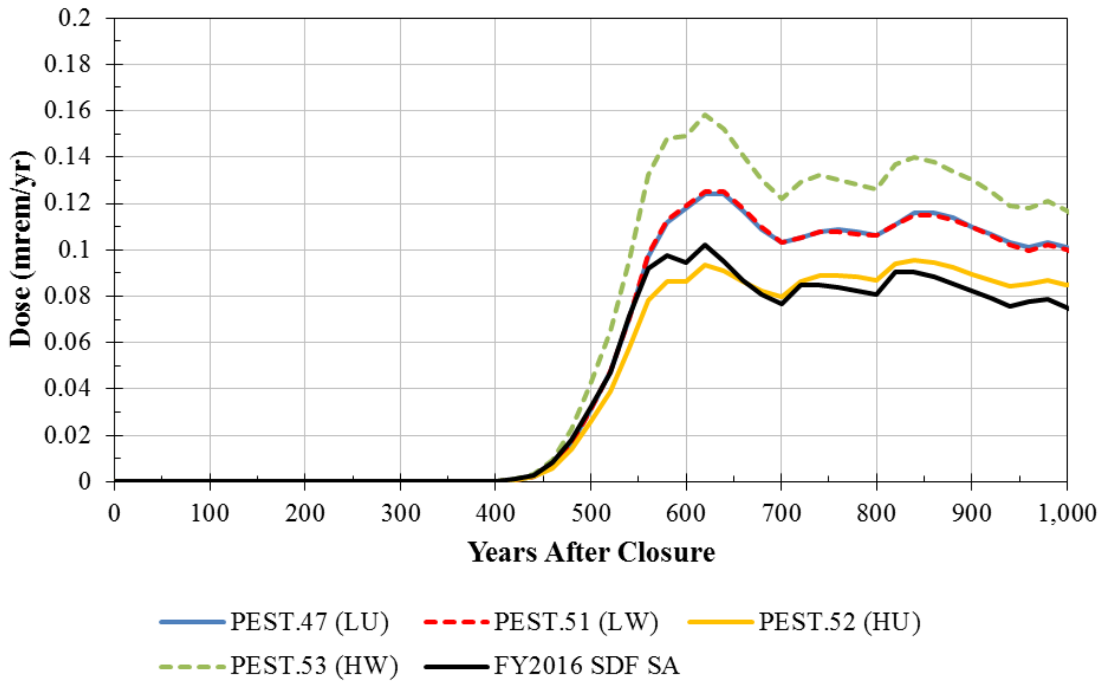


Figure 3.4-2: Comparison of 10,000-Year IHI Doses from the Four Flow Configurations and the IHI Dose from the FY2016 SDF SA

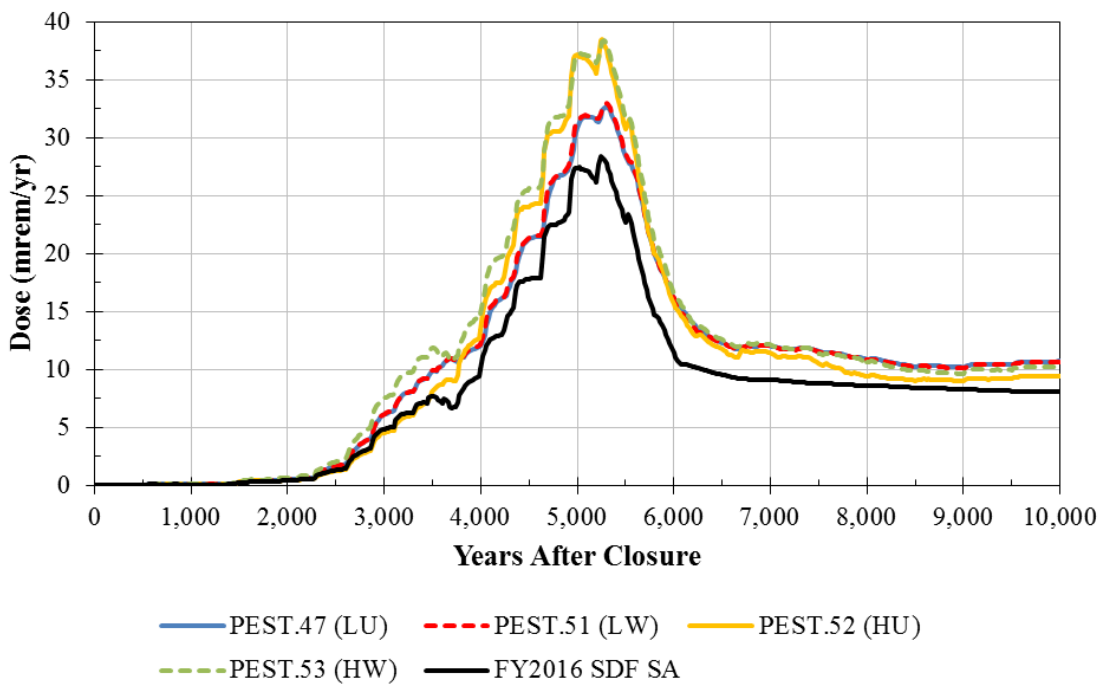
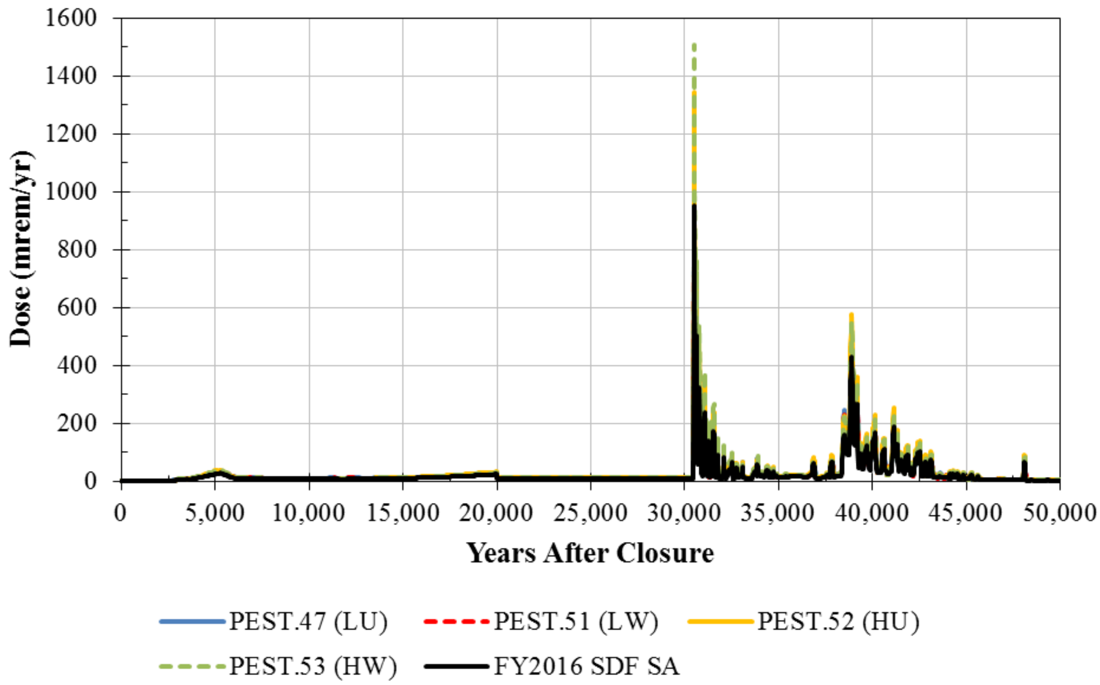


Figure 3.4-3: Comparison of 50,000-Year IHI Doses from the Four Flow Configurations and the IHI Dose from the FY2016 SDF SA



3.5 Sector-Specific MOP Dose Results

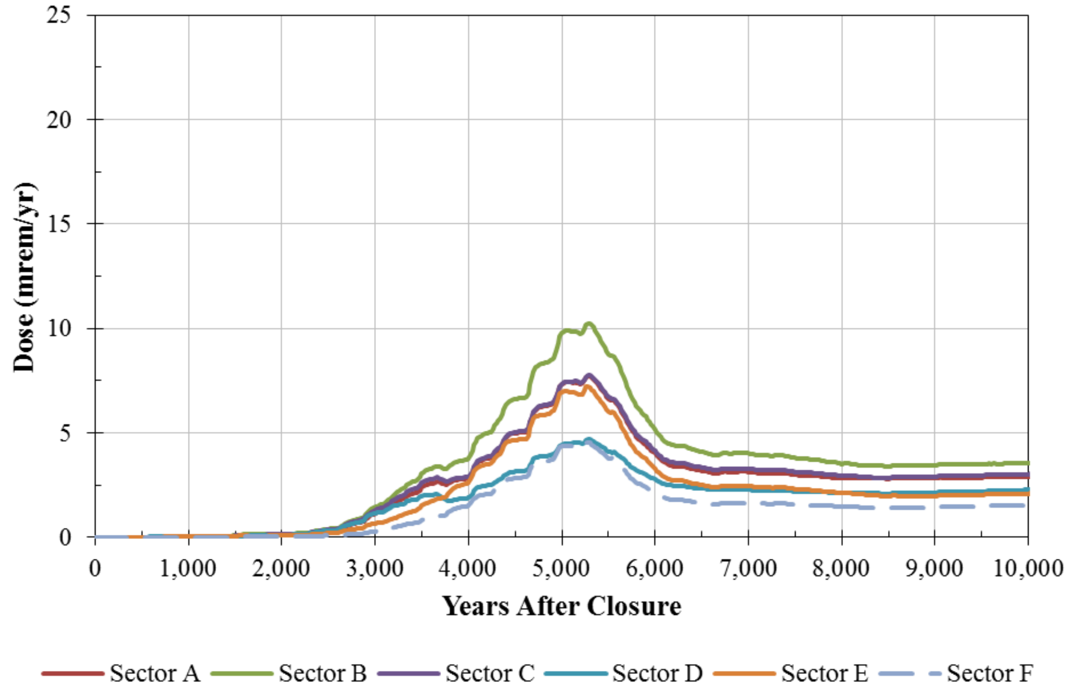
In addition to the magnitude and timing of the dose peaks, the locations of where these dose peaks occur may also play a role in planning for disposal operations. Because doses within the first 1,000 years were all well within the performance objectives required for compliance, and because peak doses is 50,000 years occur much later than the 1,000-year compliance period, this section focuses only on dose results within the 10,000-year performance period.

Note that Sectors A through F are collectively referred to as the “Southern Sectors”, while Sectors G through L are collectively referred to as the “Northern Sectors.” Refer to Figure 2.4-1 to observe the location of each Sector. To make the results easier to read, the following figures presented the Northern Sectors and Southern Sectors separately (as parts “a” and “b” of each figure).

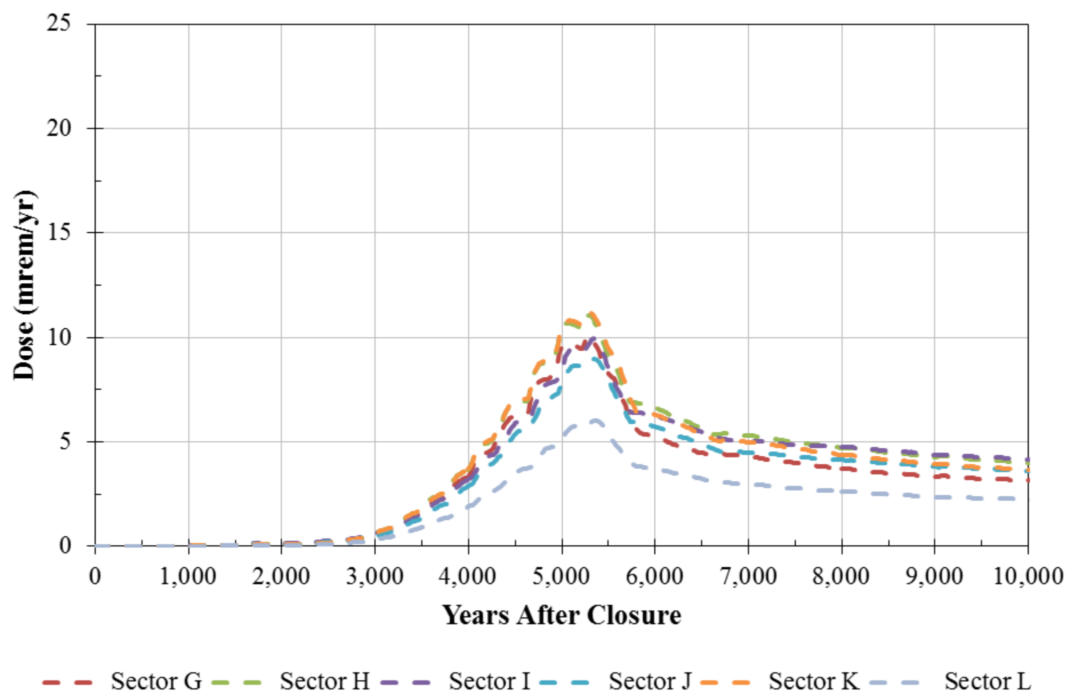
Figure 3.5-1 provides the sector-specific dose results from the FY2016 SDF SA, while the following figures present the equivalent results from each of the four flow configurations.

Figure 3.5-1: Sector-Specific Doses to MOP within 10,000 Years from the FY2016 SDF SA

(a)



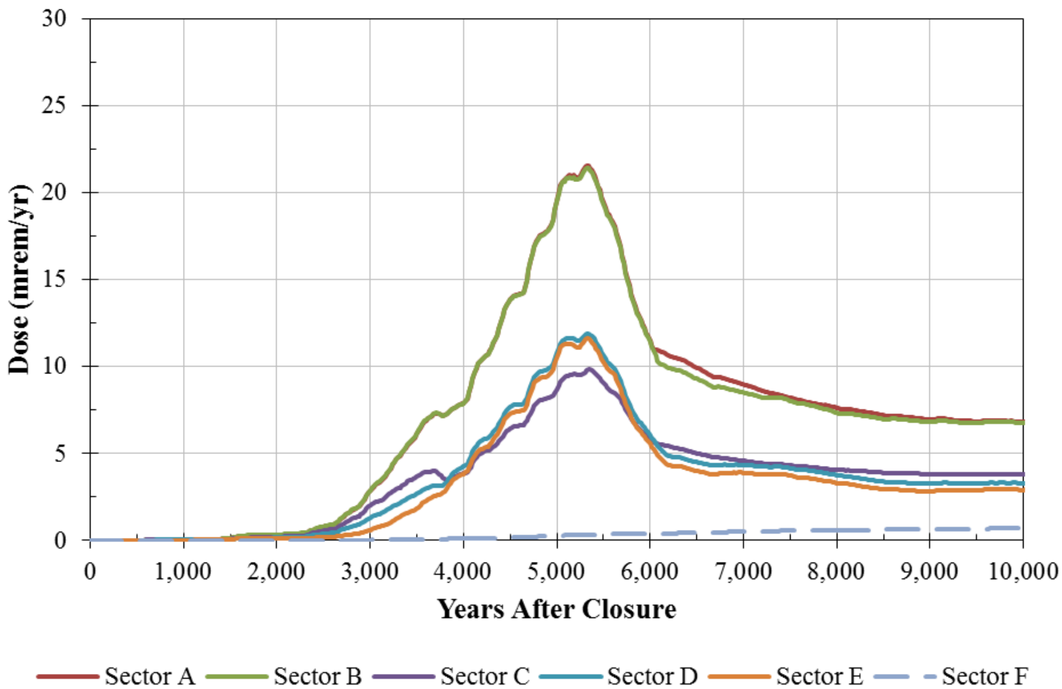
(b)



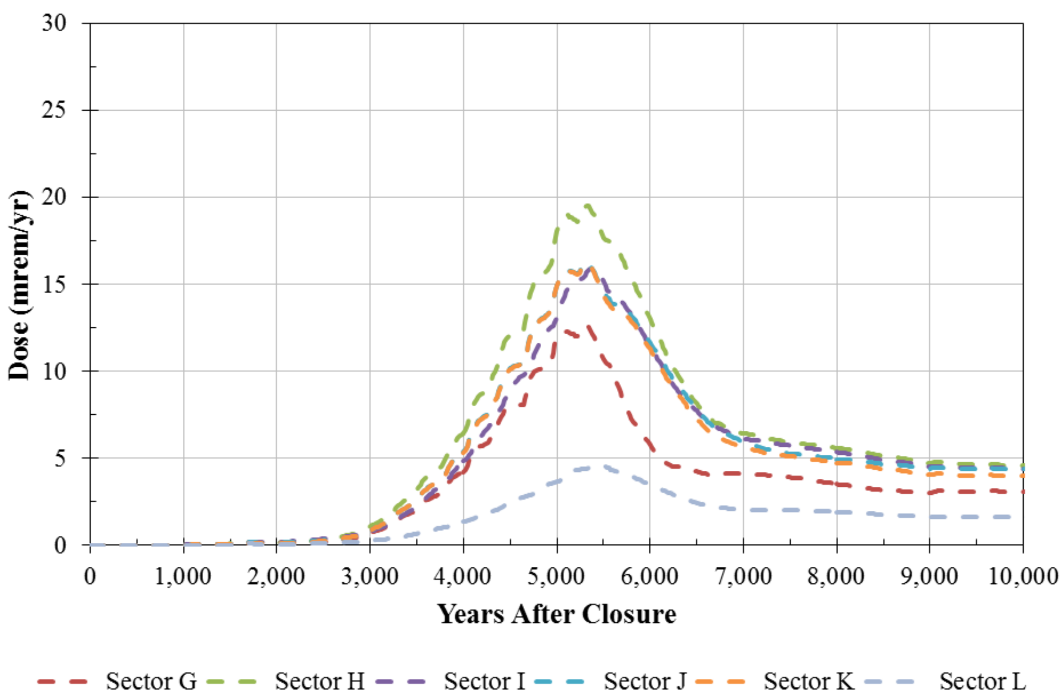
(a) Doses to Southern Sectors (A through F).
(b) Doses to Northern Sectors (G through L).

Figure 3.5-2: Sector-Specific Doses to MOP within 10,000 Years from the Flow Configuration PEST.47

(a)



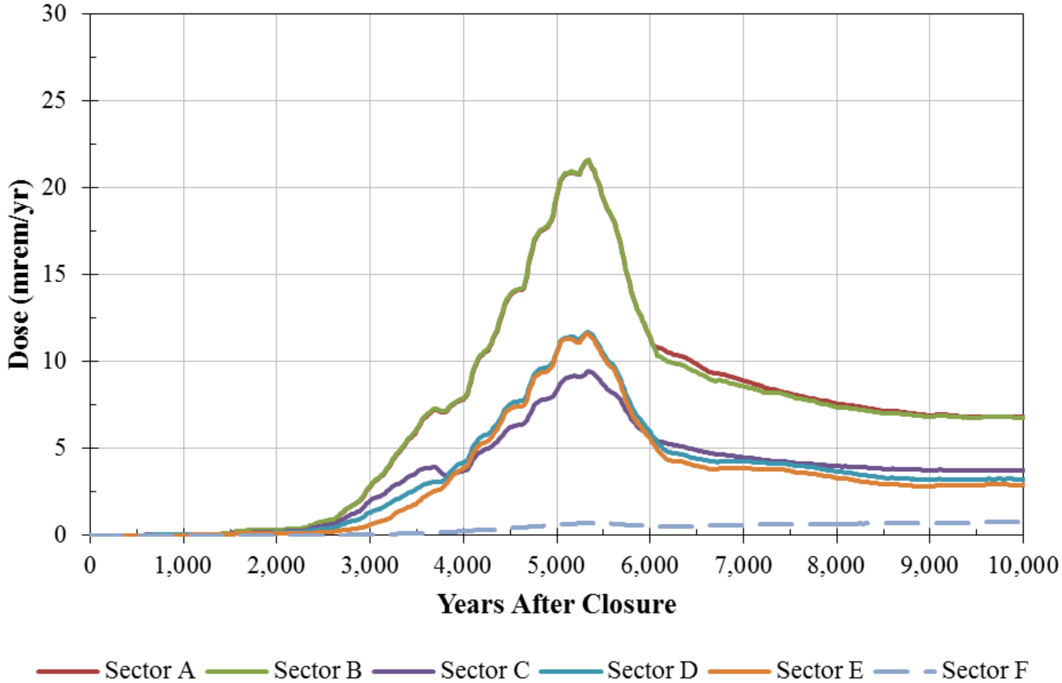
(b)



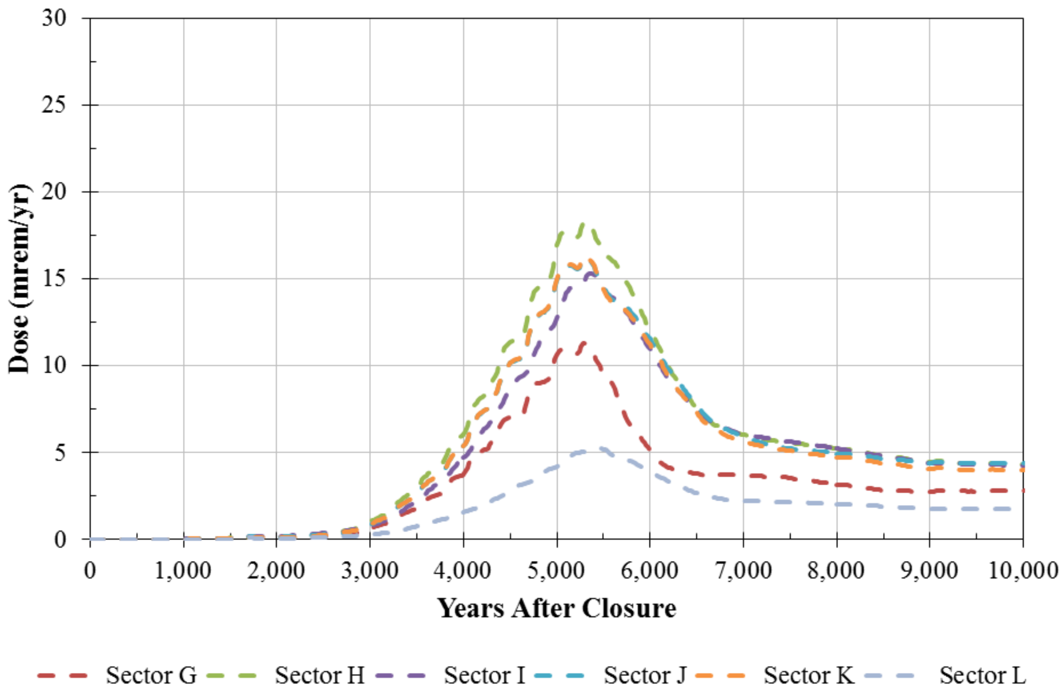
(a) Doses to Southern Sectors (A through F).
(b) Doses to Northern Sectors (G through L).

Figure 3.5-3: Sector-Specific Doses to MOP within 10,000 Years from the Flow Configuration PEST.51

(a)



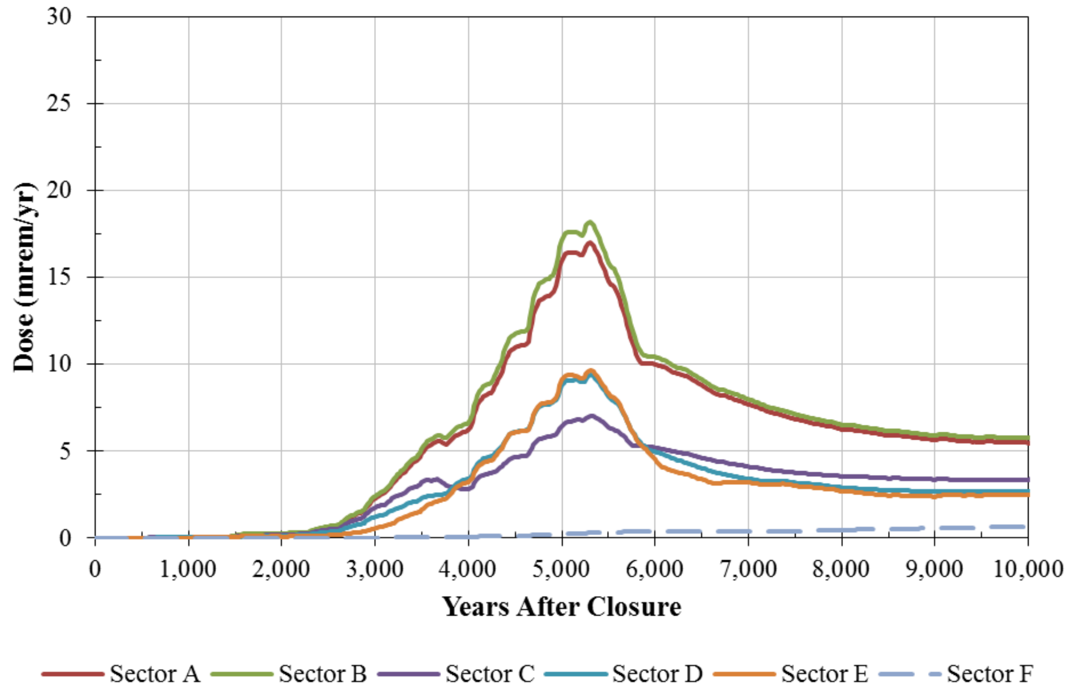
(b)



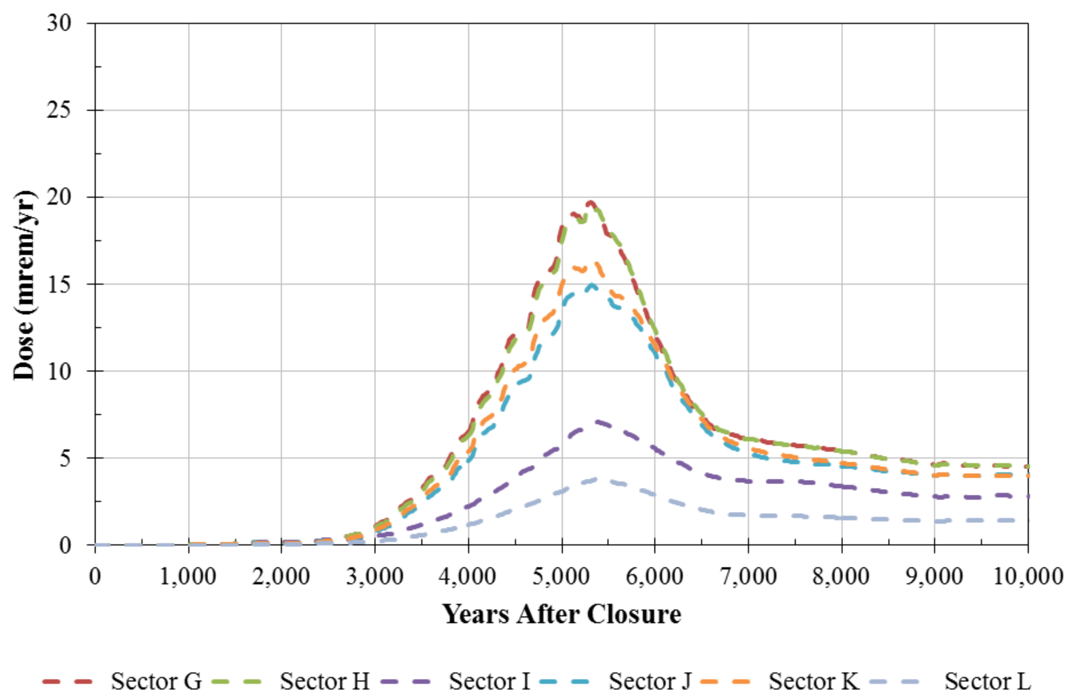
(a) Doses to Southern Sectors (A through F).
(b) Doses to Northern Sectors (G through L).

Figure 3.5-4: Sector-Specific Doses to MOP within 10,000 Years from the Flow Configuration PEST.52

(a)



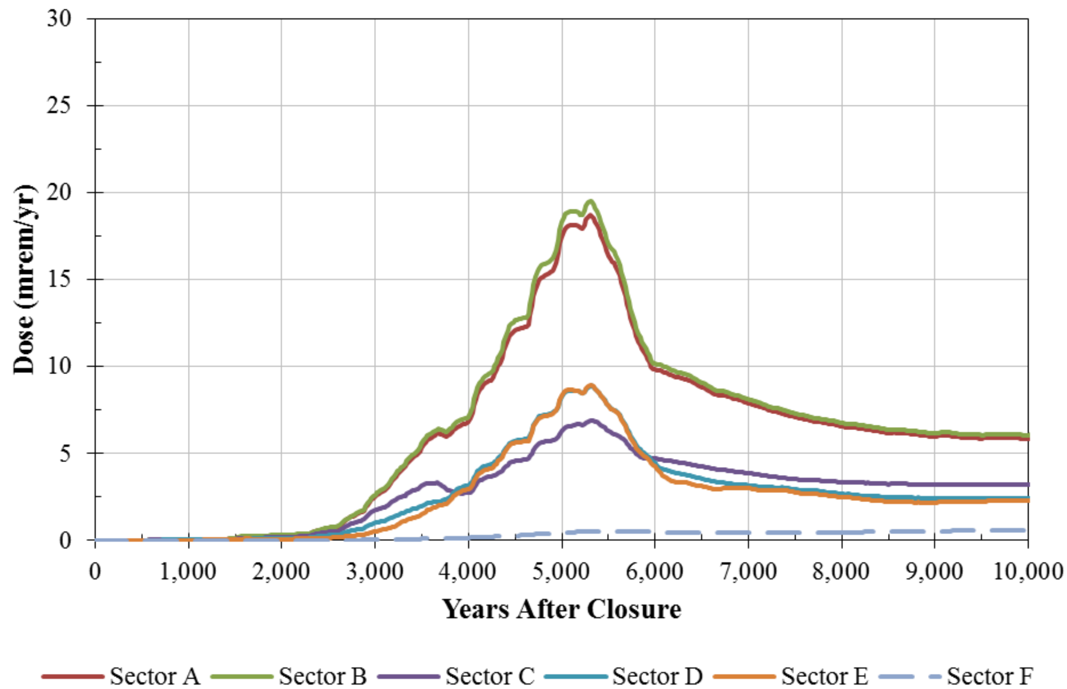
(b)



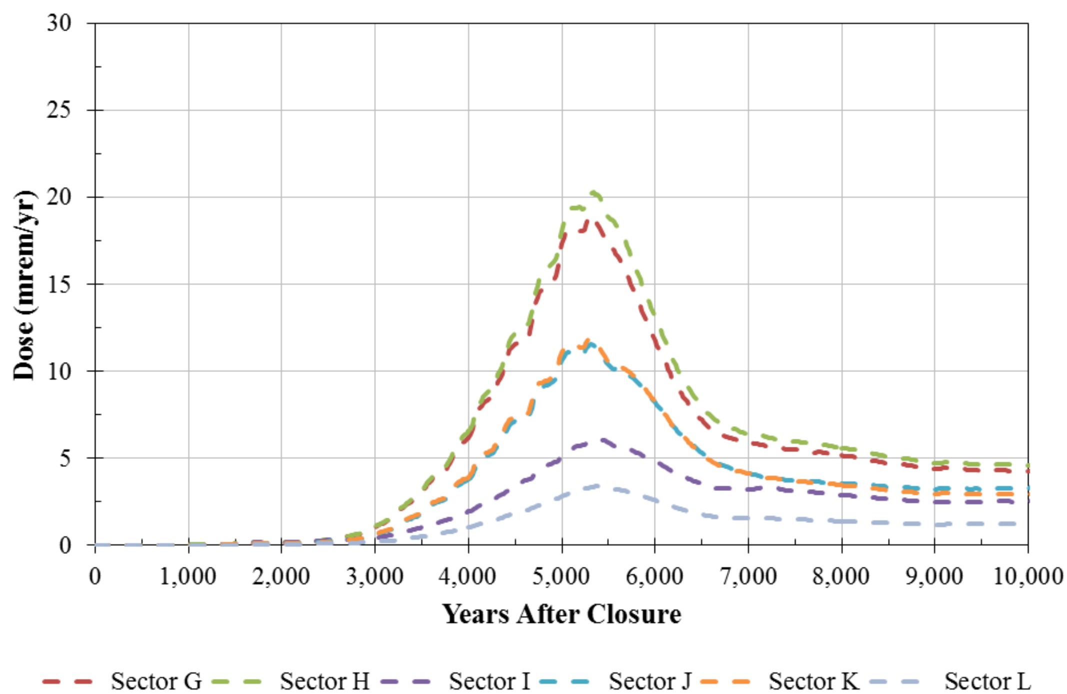
(a) Doses to Southern Sectors (A through F).
(b) Doses to Northern Sectors (G through L).

Figure 3.5-5: Sector-Specific Doses to MOP within 10,000 Years from the Flow Configuration PEST.53

(a)



(b)



(a) Doses to Southern Sectors (A through F).
(b) Doses to Northern Sectors (G through L).

These results show that for flow configurations PEST.47 and PEST.51, the doses to Sectors A and B (Southern Sectors) exhibit the highest doses to the MOP. Alternatively, for flow configurations PEST.52 and PEST.53, the doses to Sector G and H (Northern Sectors) exhibit the highest doses to the MOP. In general, the peak doses from PEST.47 and PEST.51 are slightly higher than the peak doses from PEST.52 and PEST.53. As such, the greatest risk is associated with doses to the Southern Sectors for flow configurations PEST.47 and PEST.51.

Note that the next SDUs that are expected to be placed into operation are SDUs 6 and 7. Regardless of flow configuration, the stream traces from these SDUs only contribute to the doses along the Northern Sectors. Further, among the SDUs in the Northern Sectors, releases from SDUs 6 and 7 have the longest travel paths between the SDUs and the points of assessment along the 100-meter boundary. Accordingly, these SDUs are not expected to contribute significantly to any one sector, rather the releases from these SDUs are expected to undergo significant plume spreading prior to reaching the points of assessment. Therefore, waste disposed within SDUs 6 and 7 are not expected to introduce significant risk with respect to meeting performance objectives.

4.0 RECOMMENDATIONS

Because the dose results from this evaluation are all within the performance objectives required for compliance (i.e., less than 25 mrem/yr during the first 1,000 years post-closure for the MOP and less than 100 mrem/yr during the first 1,000 years post-closure for the IHI), no immediate action is recommended relative to disposal operations at the SDF facility. However, because the peak doses during the 10,000-year performance period are considerably higher than the peak doses from the FY2016 SDF SA, it is recommended that a revision to the 2009 SDF PA, or new Special Analysis, be developed to provide a more comprehensive look at how the updates to the GSA Database Model may couple with new data from other research and development activities to fully assess the collective impacts to doses. Such an update would be valuable for informing decision-making relative to on-going SDF disposal operations.

Additionally, it may be noted that the analysis of the sector-specific dose results (Section 3.5) indicates that using SDUs 6 and 7 for disposal operations is unlikely to adversely impact performance objectives.

It is also recommended that future SDF modeling use the flow field data from the PEST.51 configurations of the GSA Database Model to be consistent with findings from the *Groundwater Flow Simulation of the Savannah River Site General Separations Area* and the *Impacts of Updated GSA Groundwater Flow Model on the FTF, HTF and SDF PAs*. [SRNL-STI-2017-00008; SRNL-STI-2017-00445] The other flow field configurations may be used for probabilistic simulations or sensitivity runs, as each of them are also viable future conditions for groundwater within the GSA. Further, the numerical approach for dispersion should apply the new approach (i.e., using the full dispersion tensor and upwinding the diffusivity at cell faces) because it provides results which better reflect expected conditions (by reducing the influence of modeling artifacts associated with grid orientation and neglecting the off-diagonal terms in the dispersion tensor while increasing the stability with the upwind weighting) and provides slightly more conservative peak doses than the former approach (i.e., harmonic averaging at cell faces and diagonal dispersion tensor).

Finally, future SDF modeling should also revise the locations for the assumed IHI wells such that all of the wells lie within the 1-meter boundary, but outside the footprint of any specific SDU.

5.0 REFERENCES

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