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Revision 1

Tank 16 Special Analysis for the Performance Assessment for the H-Tank Farm at the Savannah River Site

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REVISION SUMMARY

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ACRONYMS/ABBREVIATIONS

AFZ	Alternate Fast Zone
ALARA	As Low As Reasonably Achievable
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMCOC	Contaminant Migration Constituent of Concern
CZ	Contaminant Zone
DCF	Dose Conversion Factor
DOE	U.S. Department of Energy
EDE	Effective Dose Equivalent
FFA	Federal Facility Agreement
FTF	F-Tank Farm
GSA	General Separations Area
HTF	H-Tank Farm
ICM	Integrated Conceptual Model
IHI	Inadvertent Human Intruder
K_d	Sorption Coefficient
LHS	Latin Hypercube Sampling
LWTRS-QAPP	Liquid Waste Tank Residuals Sampling-Quality Assurance Program Plan
LWTRSAPP	Liquid Waste Tank Residuals Sampling and Analysis Program Plan
MCL	Maximum Contaminant Level
MOP	Member of the Public
N/A	Not Applicable/Not Available
NBS	National Bureau of Standards
ND	Not Determined
NDAA	Ronald W. Reagan National Defense Authorization Act (NDAA) for Fiscal Year 2005
NRC	U.S. Nuclear Regulatory Commission
PA	Performance Assessment
PCA	Pollution Control Act
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RSL	Regional Screening Level
SA	Special Analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SRS	Savannah River Site
TEDE	Total Effective Dose Equivalent
TER	Technical Evaluation Report
UTR	Upper Three Runs
UTRA	UTR Aquifer
UTRA-LZ	UTRA-Lower Zone

UTRA-UZ	UTRA-Upper Zone
WCS	Waste Characterization System
WIPDCF	Water Ingestion Pathway Dose Conversion Factor

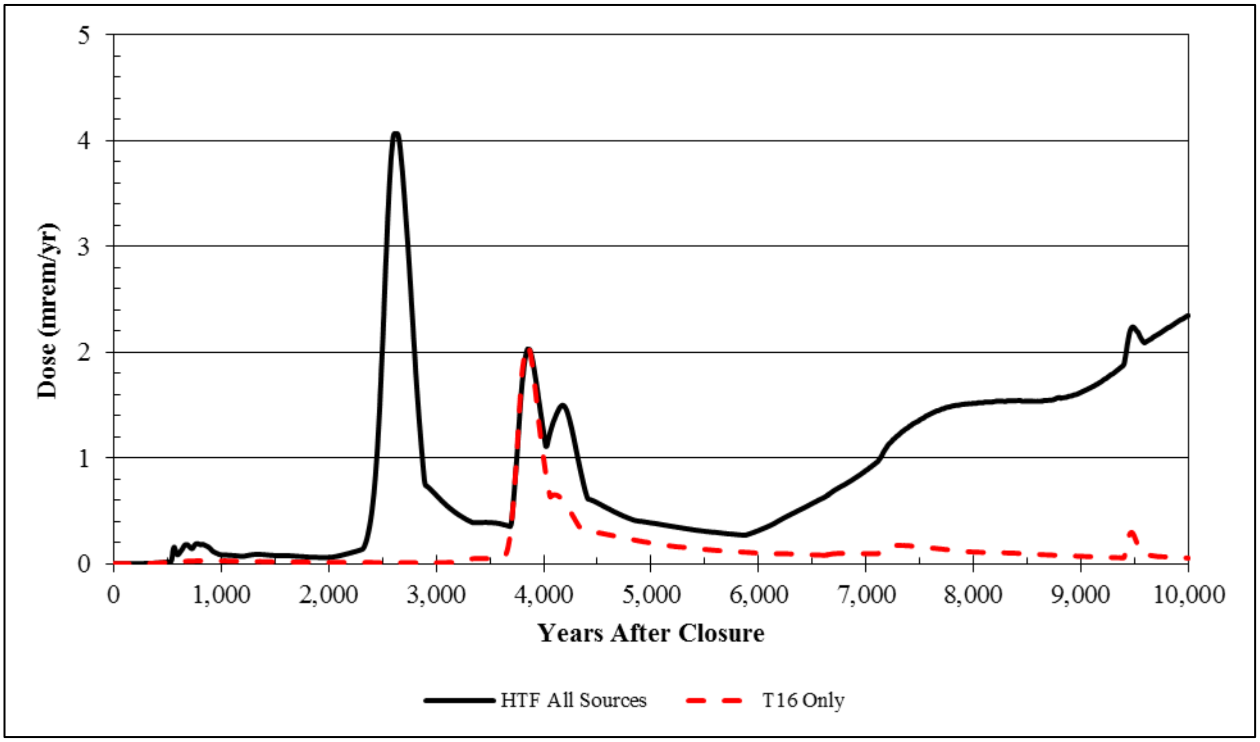
EXECUTIVE SUMMARY

Special Analyses are performed to evaluate the significance of new information or new analytical methods to the results and associated conclusions of a performance assessment (PA). As waste tanks and ancillary equipment are cleaned at the H-Tank Farm (HTF) at the U.S. Department of Energy's (DOE) Savannah River Site (SRS), final residual inventories will be used to update the HTF fate and transport modeling performed as part of the *Performance Assessment for the H-Area Tank Farm at the Savannah River Site* (SRR-CWDA-2010-00128) (hereinafter referred to as HTF PA). This allows for evaluation of the difference between the assigned and final waste tank inventories to determine if the results of the HTF PA and the conclusions reached based on the HTF PA information remain valid. The Tank 16 Special Analysis (SA) uses the HTF PA Base Case (Case A) model to evaluate the impact of the final residuals that are to be grouted in-place in Tank 16 (using final residual characterization data and updates to HTF process knowledge). The SA also includes information used to address some of the observations and recommendations found in the U.S. Nuclear Regulatory Commission (NRC) *Technical Evaluation Report for Draft Waste Determination for Savannah River Site H Area Tank Farm* (ML14094A496). The issuance of the Technical Evaluation Report (TER) culminated a multi-year consultation with NRC under the *Ronald W. Reagan National Defense Authorization Act (NDAA) for Fiscal Year 2005, Section 3116, Defense Site Acceleration Completion, Public Law 108-375*. [NDAA_3116] In particular, sensitivity studies were carried out in response to questions regarding preferential pathways, and these studies showed that the postulated preferential pathway scenarios are not expected to have a significant impact on the HTF PA results.

The results of this SA demonstrate that the conclusions reached based on the HTF PA remain valid. Further, the special analysis process has confirmed that there continues to be reasonable assurance that the Title 10 Code of Federal Regulations (CFR) Part 61 Subpart C performance objectives will be met for HTF during the reasonably foreseeable future.[1] A comparison was made to the peak all-pathways dose within 10,000 years, calculated using updated assigned HTF waste tank inventories plus the final residual inventory for Tank 16 (the only HTF waste tank that has been cleaned and characterized). As shown in Figure ES-1, the maximum peak annual all-pathways dose to a member of the public (MOP) for 10,000 years following HTF closure using the updated inventories (including final Tank 16 inventory) is approximately 4 mrem/yr and occurs at year 2,610. The 4 mrem/yr peak is associated with the assigned Tank 12 inventory, not the final residual inventories for Tank 16, which has only a 2 mrem/yr associated peak at year 3,850. This maximum peak all-pathways dose in 10,000 years is essentially unchanged in magnitude from the peak dose calculated in the HTF PA (SRR-CWDA-2010-00128).

[1] In accordance with DOE Manual 435.1-1 (DOE M 435.1-1), Chapter 4, the performance assessment considers a period of 1,000 years after the disposal facility has been closed, to assess compliance with the performance objectives. The Manual concludes that longer times of assessment are not used to assess compliance because of the inherently large uncertainties in extrapolating such calculations over long periods of time. Nevertheless, DOE considers results for time periods much longer than this in making risk-informed decisions related to the stabilization of waste tanks and ancillary structures.

Figure ES-1: Comparison of the 100-Meter MOP All-Pathways Dose within 10,000 Years



The maximum peak annual dose to a HTF inadvertent human intruder (IHI) is 46 mrem/yr at year 10,000 following HTF closure from a chronic scenario (i.e., drilling through a transfer line and using groundwater maximum concentrations at 1 meter from the HTF). The peak intruder annual dose value is decreased from the HTF PA.

Peak groundwater radionuclide concentrations were also calculated using the HTF inventories and no maximum contaminant levels (MCLs) or preliminary remediation goals (PRGs) were exceeded at 100 meters from the HTF boundary within 1,000 years. All radionuclides were well below the MCL or PRG at the seepline. The peak concentrations for the chemicals of concern were also calculated, and all were less than the MCL or regional screening level (RSL) at a distance of 100 meters from the HTF boundary. These peak chemical concentration conclusions are unchanged from the HTF PA.

In addition to evaluating the impact of the updated waste tank inventory data (including final Tank 16 residual inventories) on peak doses within 10,000 years following HTF closure, additional sensitivity analyses were performed. The results of these sensitivity analyses are used to assess the potential dose impacts of the final Tank 16 inventory, including evaluating out to 100,000 years after closure for the purpose of "chasing the peaks," to further understand system performance, and inform the closure decision process. These additional sensitivity analyses placed emphasis on understanding releases associated with the final residual inventory remaining in Tank 16 at closure, and showed that Tank 16 is a negligible contributor to the peak HTF doses even out 100,000 years (Figure ES-2). These sensitivity studies also showed that a decrease in the Tank 16 annulus inventory would not appreciably impact the Tank 16 peak dose results (Figure ES-3).

Based on the above discussion, the SA results continue to provide reasonable assurance that compliance is maintained with the specific requirements of 10 CFR 61 as referenced in NDAA Section 3116, and DOE Manual 435.1-1 (including the applicable state drinking water regulations). The conclusions that were made based on the HTF PA regarding the stabilization of Tank 16 have not been changed by the new information regarding the final residual inventories that are to be grouted in-place in Tank 16.

Figure ES-2: 100-Meter MOP Groundwater Pathway Dose within 100,000 Years for Each Sector – with Tank 16 Contribution Only

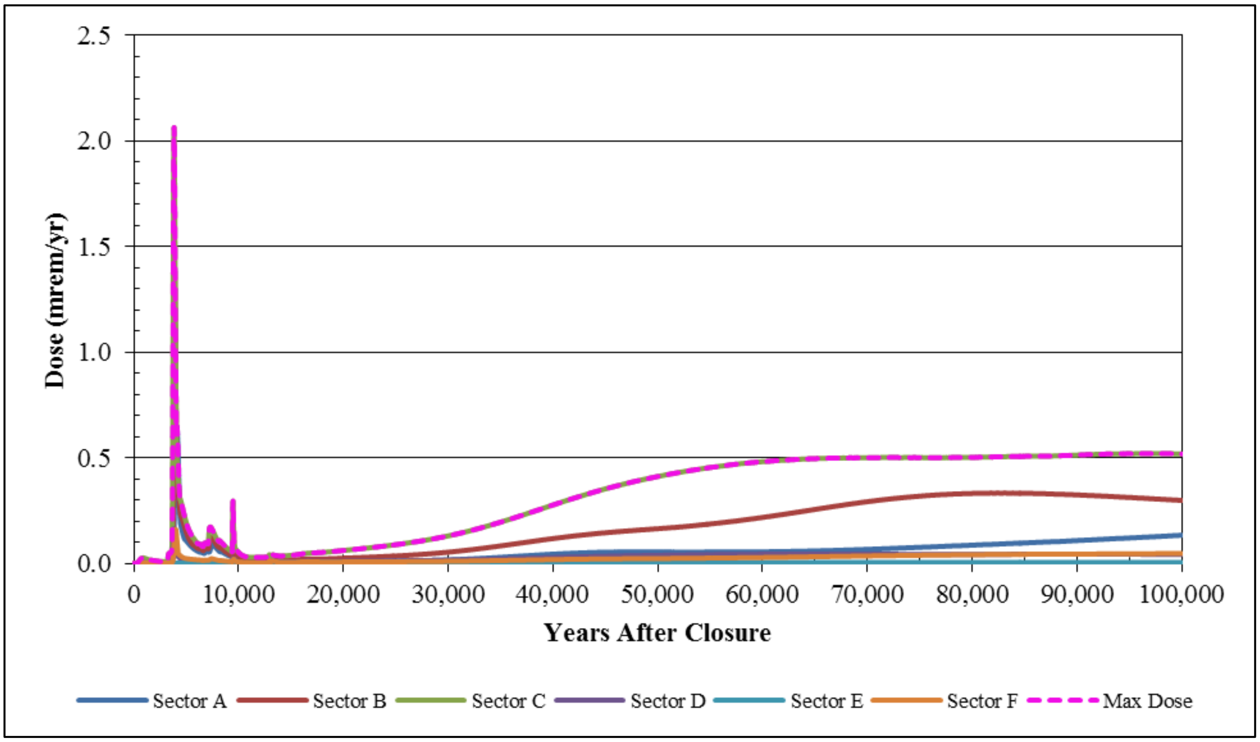
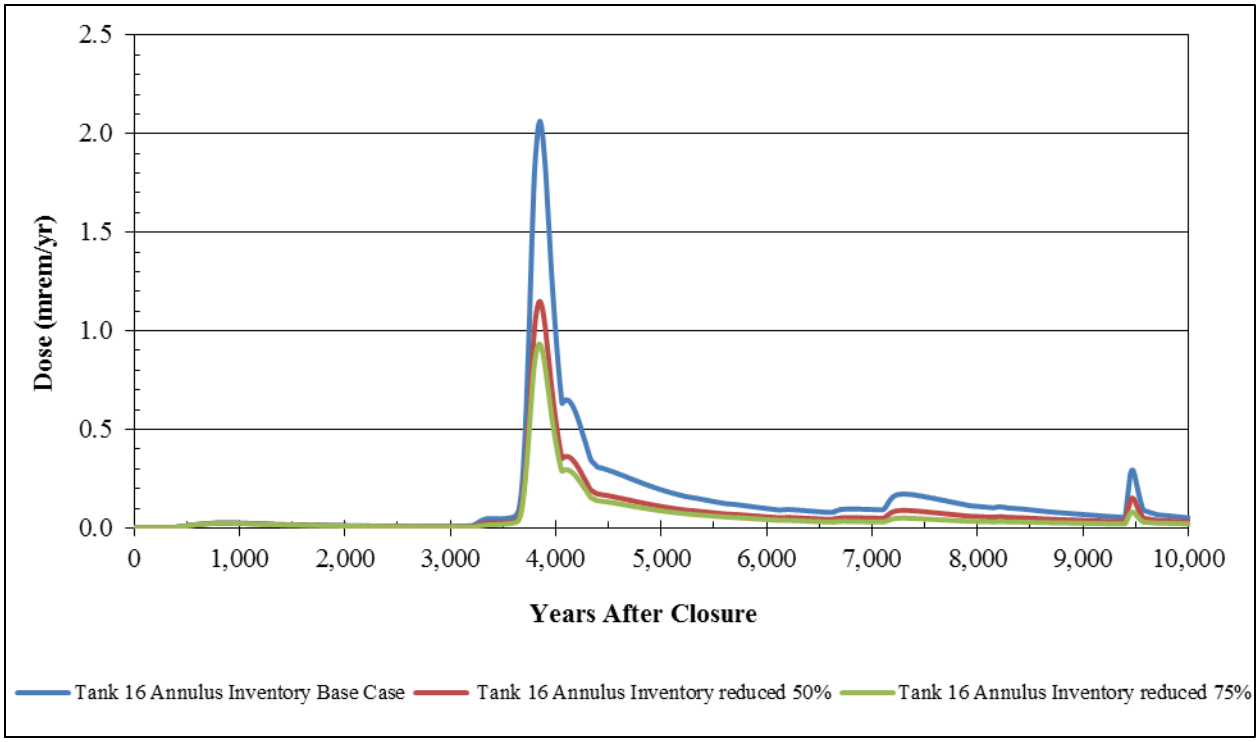


Figure ES-3: 100-Meter MOP Peak Groundwater Pathway Dose within 10,000 Years with Tank 16 Contribution Only – Variable Tank 16 Annulus Inventory



1.0 SPECIAL ANALYSIS PURPOSE

The purpose of this SA is to evaluate the information regarding the final residual inventory that is to be grouted in-place in Tank 16. This new inventory information was used to update the HTF fate and transport modeling performed in the HTF PA. The potential impacts of the new inventory information on the assumptions from the HTF PA were also considered. Because the HTF PA analyzed assigned inventories for Tank 16, this report focuses on the impact of the final residual waste data on the information previously presented. To further enhance understanding of the HTF PA Base Case, sensitivity and uncertainty analyses were also performed as part of this SA. These analyses demonstrate that the HTF PA Base Case model incorporates conservative approaches/inputs and continues to demonstrate reasonable assurance of meeting performance objectives.

It is not intended that information previously provided in the HTF PA that is unaffected by the new characterization information be duplicated in this SA. These SA results will be used to inform decisions documented in Tank 16 closure documents.

2.0 BASIS

The *Maintenance Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses* (DOE_11-10-1999) recognizes that conduct of a performance assessment is not a static process, and states that, "*Special analyses are expected to be needed as part of the routine maintenance of the performance assessment.*" As described in the maintenance guide, "*special analyses are analyses performed to evaluate the significance of new information or new analytical methods to the results of the performance assessment, or to supplement or amend the analyses performed in the original performance assessment. A special analysis is not the same as a revision to the performance assessment, but the results of the special analysis may be used to determine whether a performance assessment revision is needed.*" As stated in the maintenance guide, a number of different factors may prompt a special analysis, including "*wastes that exceed the concentrations analyzed for performance assessment-significant radionuclides.*"

The guide also states that, "*the purpose of conducting special analyses can be thought of as similar to the process for resolving unreviewed safety questions described in the DOE Order 5480.21, Unreviewed Safety Questions. The intent of the process is to provide flexibility in day-to-day operations and to require those issues with a significant impact on the performance assessment's conclusions, and therefore the projected compliance with performance objectives, to be brought to the proper level for attention.*" [DOE_11-10-1999]

3.0 TANK 16 BACKGROUND INFORMATION

3.1 Savannah River Site Characteristics

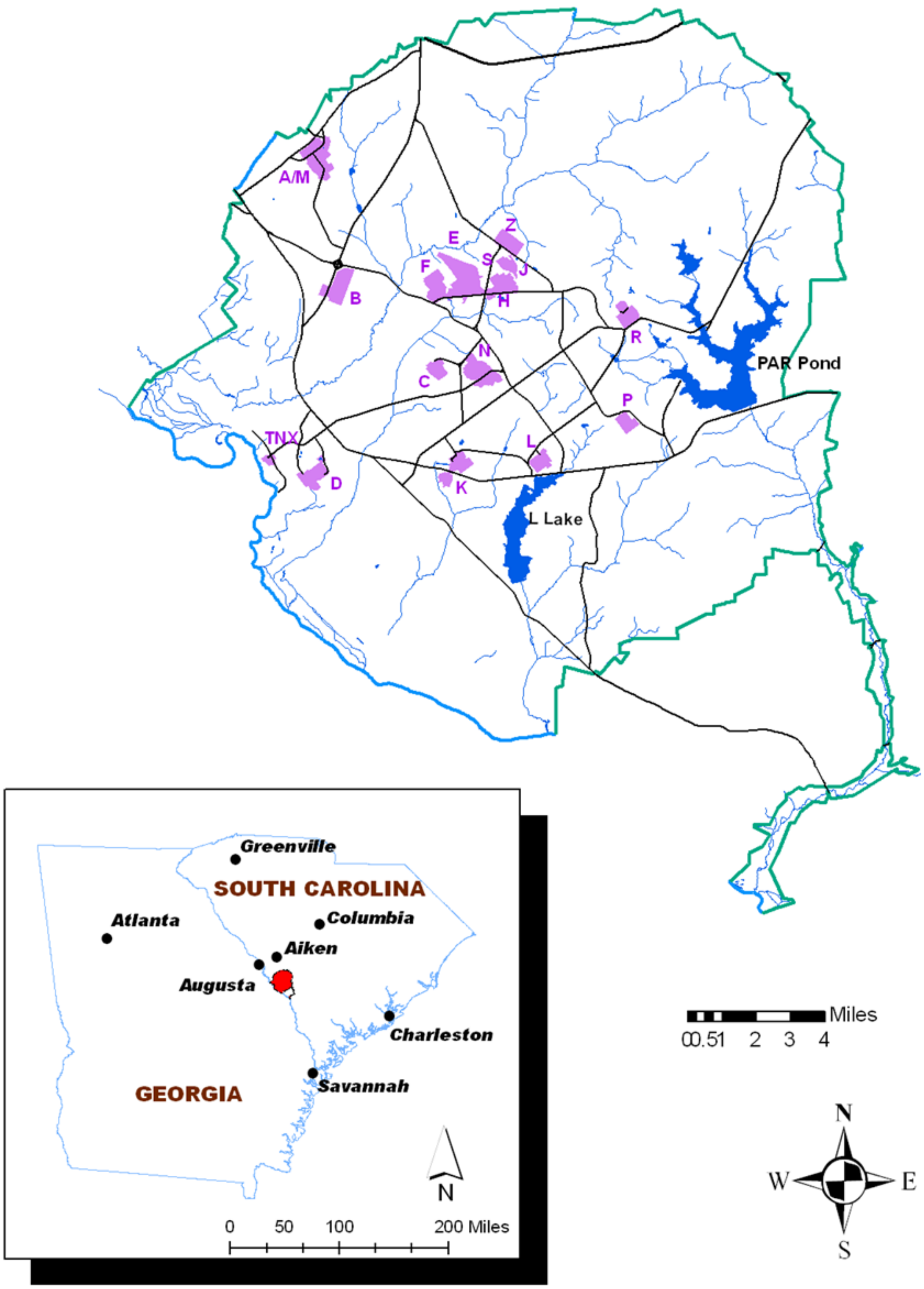
The SRS is located in south-central South Carolina, approximately 100 miles from the Atlantic Coast. The major physical feature at SRS is the Savannah River, approximately 20 miles of which serves as the southwestern boundary of the site and the South Carolina-Georgia border. The SRS encompasses portions of Aiken, Barnwell and Allendale counties in South Carolina. The SRS occupies approximately 310 square miles, or more than 198,000 acres, and contains operations, service and research and development areas. The developed areas occupy less than 10% of the SRS footprint while the remainder of the site is undeveloped forest or wetlands. [SRR-CWDA-2010-00128]

Additional site characteristics are addressed in Section 3.1 of HTF PA. Topics addressed in Section 3.1 of HTF PA include SRS geography, demography, meteorology, climatology, ecology, geology, seismology, hydrogeology, geochemistry and natural resources.

3.2 H-Tank Farm Facility Description

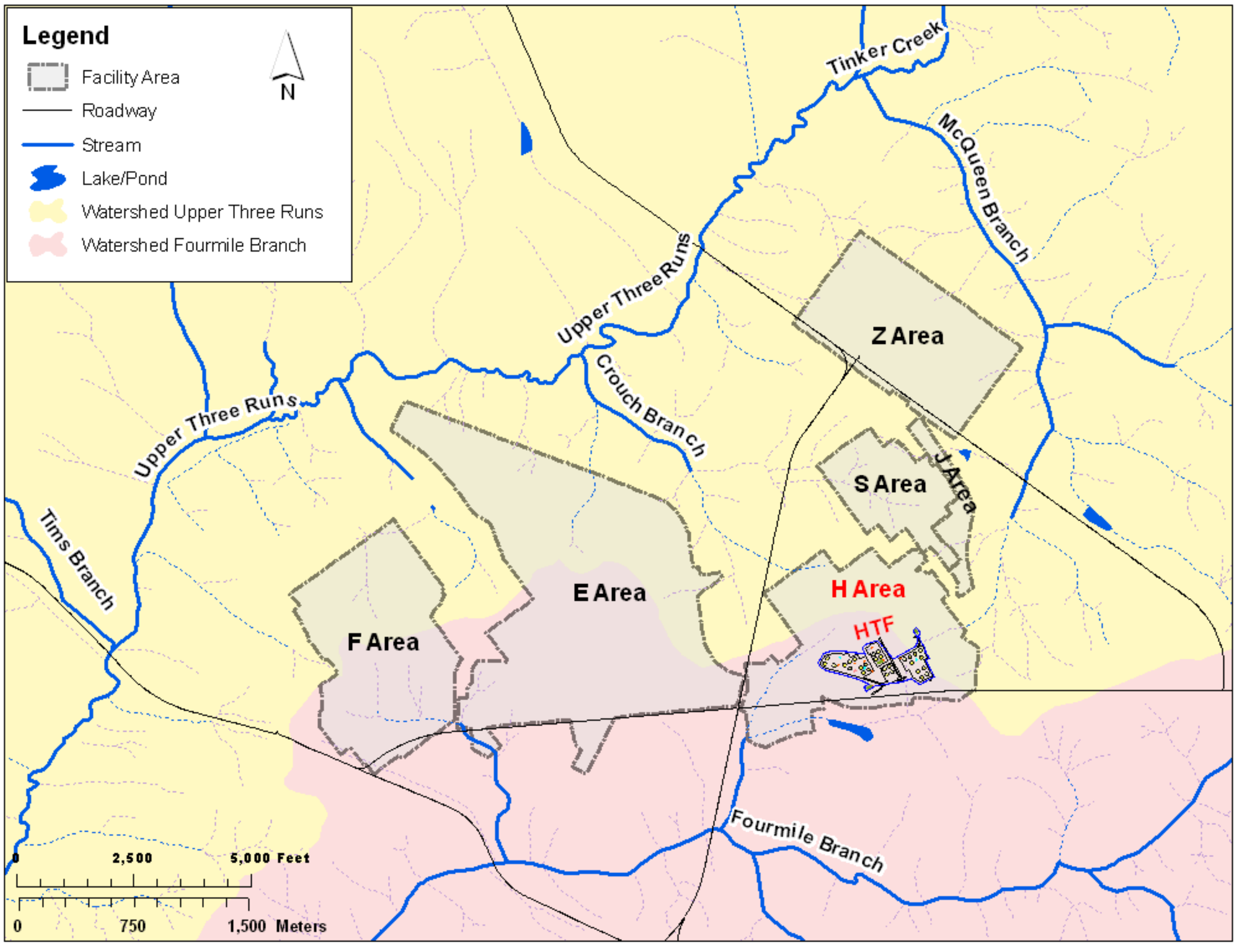
A legacy of the SRS mission was the generation of liquid waste from chemical separations processes in both F and H Areas. Since the beginning of SRS operations, an integrated waste management system has evolved, which consists of several facilities designed for the overall processing of liquid waste. Two of the major components of this system are the F-Tank Farm (FTF) and HTF (located in F Area and H Area, respectively), near the center of the site (Figure 3.2-1). The tank farms, which store and process waste from the chemical separations operations, include waste tanks, evaporators, transfer line systems and other ancillary structures. Additional HTF facility characteristics are addressed in Section 3.2 of HTF PA.

Figure 3.2-1: SRS Operational Area Location Map



The HTF site was chosen because of its favorable terrain, proximity to the H-Canyon Separations Facility (the major waste generation source) and isolation distance from the SRS boundaries. Figure 3.2-1 shows the distance of H Area from the SRS boundary. Figure 3.2-2 shows the setting of H Area and HTF within the General Separations Area (GSA).

Figure 3.2-2: Layout of the GSA



The HTF is a 45-acre site, which consists of 29 carbon steel waste tanks and supporting ancillary structures. There are four major waste tank types in HTF with nominal operating capacities from 750,000 gallons (Type I tanks) to 1.07 million gallons (Type II tanks) and 1.3 million gallons (Type III/IIIA and IV tanks). Figure 3.2-3 shows the general layout of HTF. The waste tanks have varying degrees of secondary containment (liner) and in-tank structural features (e.g., cooling coils and columns). All HTF waste tank types have primary liners constructed of carbon steel. The HTF was constructed to receive waste generated by various SRS production, processing and laboratory facilities. The use of HTF safely isolated these wastes from the environment, SRS workers and the public. The HTF PA provides extensive descriptions of the HTF and waste processing facilities. [SRR-CWDA-2010-00128]

Figure 3.2-3: General Layout of H-Tank Farm

3.3 Tank 16

Tank 16 is a Type II tank. There are four Type II tanks at SRS and are located in HTF (Tanks 13 through 16). The HTF Type II tanks were constructed between 1955 and 1956. Figure 3.3-1 shows a typical Type II tank. These waste tanks have a carbon-steel primary liner and a 5-foot high carbon-steel annulus pan (secondary liner) that forms an annular space approximately 2.5 feet wide between the secondary and primary liners (Figure 3.3-2). There is a 1-inch layer of sand between the top of the basemat and the secondary liner. There is also a 1-inch layer of sand between the secondary liner and primary liner.

Type II tanks are 85 feet in diameter and 27 feet in height with a nominal operating capacity of approximately 1,000,000 gallons. One central reinforced concrete and steel column supports the roof of a Type II tank. Type II tanks have 40 vertical cooling coil arrays and 4 horizontal cooling coil arrays that extend across the bottom of the waste tanks.

Section 3.2.1.2 of the HTF PA provides additional details of the Type II tanks. [SRR-CWDA-2010-00128]

Figure 3.3-1: Typical Type II Tank Cross Section

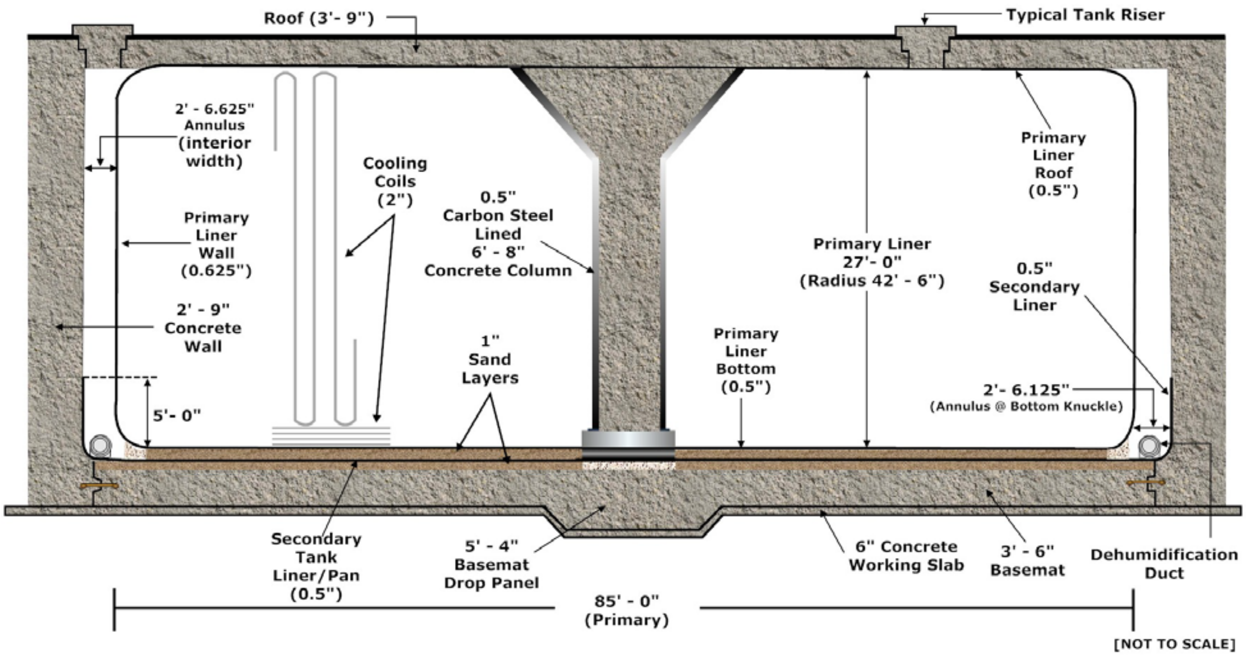
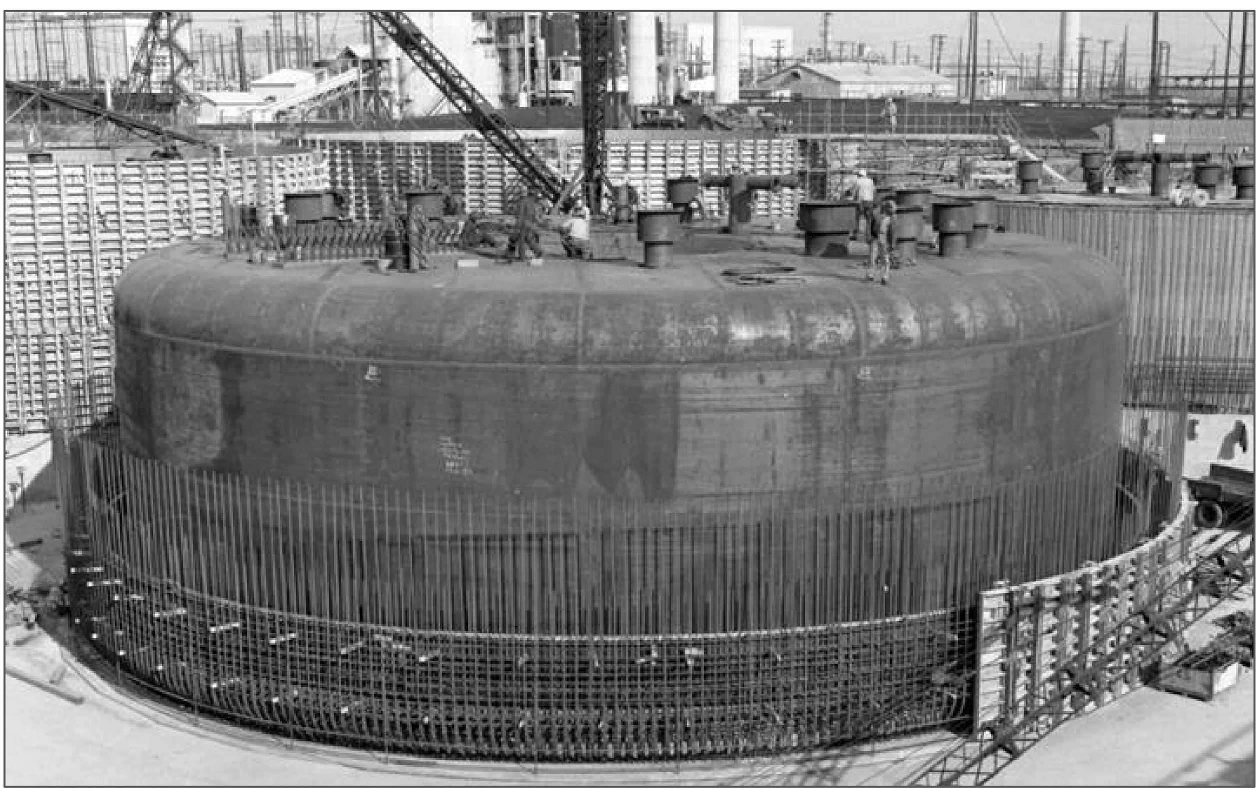


Figure 3.3-2: Type II Tank with Primary and Secondary Liner



4.0 H-TANK FARM PERFORMANCE ASSESSMENT BACKGROUND INFORMATION

This SA is being prepared based on the information presented in the HTF PA. The HTF PA was prepared to support the eventual operational closure of the HTF underground waste tanks and ancillary equipment. The HTF PA provides the technical bases and results to be used in subsequent documents to demonstrate compliance with the pertinent requirements from the documents identified below for final closure of HTF as indicated in Table 4.0-1:

- DOE M 435.1-1
- NDAA Section 3116
- *Bureau of Water Permit to Construct, F and H-Area High-Level Radioactive Waste Tank Farms, Construction Permit #17,424-IW* (DHEC_01-25-1993)
- *Federal Facility Agreement for the Savannah River Site* (WSRC-OS-94-42)

The key requirements from the preceding documents necessitate development and calculation of the following for the HTF: potential radiological doses to a hypothetical MOP; potential radiological doses to a hypothetical inadvertent intruder; radiological dose to a human receptor via the air pathway, radon flux and water concentrations. All of these calculations were performed to provide results over a minimum of 10,000 years. The water concentrations were calculated for both radioactive and non-radioactive contaminants at multiple locations.

Table 4.0-1: Key Performance Objectives

Requirement	All-Pathways Dose	Intruder Dose	Air Pathway Dose	Radon Flux	Groundwater Protection
NDAA Section 3116: 10 CFR 61.41 and 61.42	25 mrem/yr	500 mrem/yr	N/A	N/A	N/A
DOE M 435.1-1	25 mrem/yr	500 mrem – acute 100 mrem/yr – chronic	10 mrem/yr	20 $pCi/m^2/s$ at ground surface	< MCLs and < 4 mrem/yr beta-gamma dose
SCDHEC Primary Drinking Water Regulations (SCDHEC R.61-58)	N/A	N/A	N/A	N/A	< MCLs and < 4 mrem/yr beta-gamma dose

In accordance with the Federal Facility Agreement (FFA) requirements for high-level radioactive waste tank system(s), a construction and operating permit (hereinafter referred to as Construction Permit #17,424-IW) was obtained for the SRS tank farms' waste tank systems from the South Carolina Department of Health and Environmental Control (SCDHEC). [DHEC_01-25-1993] The FFA requires that waste tank system(s) that have been issued an industrial wastewater operating permit under the Pollution Control Act (PCA), shall be removed from service in accordance with S.C. Code Ann., Section 48-1-10, et seq. (1985) and all applicable regulations promulgated pursuant to the PCA. [Title 48_Chapter 1_SC Laws] Applicable regulations include SCDHEC Regulation 61-67, *Standards for Wastewater Facility Construction* and Regulation 61-82, *Proper Closeout of Wastewater Treatment Facilities*. [WSRC-OS-94-42 Section IX.E (4)] The SCDHEC has advised that this process will involve two bureaus (Bureau of Water and Bureau of Land and Waste Management).

The regulatory process to complete closure of the HTF requires the development of multiple detailed technical documents with reviews and approvals by state and federal agencies. The documents involved include DOE's approval of the HTF basis for Section 3116 determination for facility closure, which will be used to demonstrate that the criteria in NDAA Section 3116 are met. [NDAA_3116] DOE's *Basis for Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site* (hereinafter referred to as HTF 3116 Basis Document) provided a basis upon which the Secretary of Energy, in consultation with the NRC, has determined that the criteria in NDAA Section 3116 is met and that the stabilized residual waste at closure is not high-level waste. [DOE/SRS-WD-2014-001] The criteria in NDAA Section 3116 provide that the waste will be disposed of in compliance with the performance objectives in 10 CFR Part 61, Subpart C. The current revision of the HTF PA (SRR-CWDA-2010-00128) provides the technical basis that has been used to demonstrate compliance with 10 CFR 61.41 (*Protection of the General Population from Releases of Radioactivity*) and 10 CFR 61.42 (*Protection of Individuals from Inadvertent Intrusion*) performance objectives, as described in the HTF 3116 Basis Document. [10 CFR 61] These performance objectives are used in concert with the comparable performance objectives from DOE M 435.1-1.

On December 19, 2014, the Secretary of Energy signed the HTF Waste Determination, *Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site* (DOE-WD-2014-001), based on the HTF 3116 Basis Document. Based on issuance of the HTF Waste Determination, DOE then approved the *Tier 1 Closure Plan for the H-Area Waste Tank Systems at the Savannah River Site* (SRR-CWDA-2014-00040) on December 19, 2014. Approval of the HTF Tier 1 Closure Plan also includes DOE approval of the HTF PA.

Compliance with the SCDHEC requirements will be demonstrated using two primary documents that are supported by the HTF PA. The first is the *Industrial Wastewater General Closure Plan for H-Area Waste Tank Systems* (SRR-CWDA-2011-00022) which establishes the general protocols, requirements and processes for operational closure of HTF. The second set of documents are waste tank-specific closure modules that authorize the operational closure and grouting of a specific waste tank, group of waste tanks, or ancillary equipment.

The HTF PA provides the technical information at different points of assessment that can be used in subsequent decision documents (e.g., waste tank-specific closure modules). The HTF PA provides groundwater radionuclide concentrations at one meter, 100 meters and exposure points at the two seeplines. The groundwater concentrations are provided for each of the three aquifers as applicable as a part of the HTF groundwater modeling. HTF PA also provides groundwater concentrations for chemical contaminants at one meter, 100 meters, and the seeplines. In addition to doses determined from these groundwater concentrations, the HTF PA provides inadvertent intruder doses consistent with the requirements for DOE M 435.1-1 and 10 CFR 61.42, as well as analyses for the air pathways and radon ground-surface flux, as required by DOE M 435.1-1.

5.0 TANK 16 RESIDUAL WASTE INFORMATION

As part of the Tank 16 operational closure process, a final residual inventory has been determined for Tank 16 using samples from the tanks after waste removal activities were completed. The waste characterization methodology used to develop the Tank 16 characterization summed the inventory from discrete areas of the waste tank, including the annulus and sand pads. Each area's residual inventory was determined by taking its material concentration and scaling it by the corresponding residual volume. The calculation was repeated for each constituent (radionuclides and chemicals). Tables 5.0-1 and 5.0-2 list Tank 16 final waste tank residual inventories at final facility closure for the HTF radionuclides and chemicals, respectively. Tables 5.0-3 and 5.0-4 list Tank 16 final annulus residual inventories at final facility closure for the HTF radionuclides and chemicals, respectively. Finally, Table 5.0-5 and 5.0-6 list Tank 16 final primary and secondary sand pad residual inventories at final facility closure for the HTF radionuclides and chemicals, respectively. [SRR-CWDA-2014-00071]

Table 5.0-1: Tank 16 Radionuclide Inventory (Ci)

Element	Tank 16 Value in HTF PA	Tank 16 Final (2032)
Ac-227	1.0E+00	ND
Al-26	1.0E+00	ND
Am-241	8.1E+01	1.6E+00
Am-242m	1.0E+00	<2.5E-05
Am-243	1.0E+00	<2.1E-04
Ba-137m	1.2E+02	<1.5E-02
C-14	1.0E+00	<1.6E-03
Cf-249	1.0E+00	<5.0E-05
Cf-251	1.0E+00	<1.3E-04
Cl-36	5.3E-04	<4.7E-06
Cm-243	1.0E+00	<9.9E-05
Cm-244	2.4E+00	<4.3E-03
Cm-245	1.0E+00	<6.2E-06
Cm-247	1.0E+00	<3.0E-09
Cm-248	1.0E+00	<1.4E-07
Co-60	1.0E+00	<8.8E-05
Cs-135	9.9E-04	<5.3E-05
Cs-137	1.3E+02	<1.5E-02
Eu-152	1.0E+00	ND
Eu-154	3.3E+01	ND
H-3	1.0E+00	ND
I-129	5.3E-05	1.3E-03
K-40	2.6E-04	<4.1E-05
Nb-94	2.6E-02	<8.9E-03
Ni-59	1.0E+00	<1.3E-03
Ni-63	1.1E+02	<1.5E-03
Np-237	2.2E-02	<1.5E-03
Pa-231	5.3E-04	<6.2E-03
Pd-107	5.3E-02	ND
Pt-193	5.3E-02	ND
Pu-238	2.9E+02	4.6E+00
Pu-239	7.7E+00	2.2E-01
Pu-240	3.7E+00	9.5E-02
Pu-241	2.0E+01	<3.5E-02
Pu-242	1.0E+00	<2.0E-05
Pu-244	1.0E+00	<2.1E-07
Ra-226	5.3E-03	<7.3E-04
Ra-228	5.3E-01	ND
Se-79	1.0E+00	ND
Sm-151	1.8E+03	ND
Sn-126	1.0E+00	ND
Sr-90	2.2E+03	9.4E+03
Tc-99	1.5E+00	1.7E+00
Th-229	5.3E-04	ND
Th-230	5.3E-03	<2.4E-04
Th-232	5.3E-03	ND
U-232	5.3E-04	ND
U-233	8.7E-02	1.9E-02
U-234	2.4E-02	1.2E-02
U-235	5.3E-03	3.3E-06
U-236	5.3E-03	ND
U-238	5.3E-04	1.2E-05
Y-90	2.2E+03	9.4E+03
Zr-93	6.3E-02	<7.1E-03

[SRR-CWDA-2010-00128, SRR-CWDA-2014-00071]

ND Not determined as denoted in Section 3.2.3 of SRR-CWDA-2014-00071 (based on the radionuclide and chemical constituent screening and selection process described in *Tank 16 Radionuclide and Chemical Screening for Residual Inventory Determination*, SRR-CWDA-2012-00156).

Note: Green indicates that the final values evaluated in this SA are lower than the assigned HTF PA inventory values. Pink indicates that final values evaluated in this SA are higher than the assigned HTF PA inventory values.

Table 5.0-2: Tank 16 Chemical Inventory (kg)

Chemical	Tank 16 Value in HTF PA	Tank 16 Final
Ag	4.5E-01	<2.9E-02
Al	4.6E+02	1.6E+01
As	4.5E-03	1.0E-01
B	9.1E+00	<4.3E-01
Ba	1.7E+00	3.2E-01
Cd	4.7E-01	5.9E-02
Cl	2.6E+00	<1.1E-01
Co	2.1E-02	2.0E-01
Cr	2.1E+00	7.3E+00
Cu	5.9E-01	1.7E+00
F	1.9E+00	<1.1E-01
Fe	1.6E+02	1.4E+03
Hg	5.0E+01	6.1E+00
I	5.0E-02	7.5E-03
Mn	2.6E+01	1.4E+01
Mo	9.1E+00	<1.8E-01
Ni	1.1E-01	6.5E-01
NO_2	1.2E+01	<1.1E-01
NO_3	4.1E+01	1.3E+00
Pb	1.4E+00	2.4E+01
PO_4	1.1E+00	<1.1E-01
Sb	1.9E-01	<6.3E-01
Se	1.0E-03	<1.2E-02
SO_4	5.2E+00	<1.1E-01
Sr	6.8E-01	7.6E-01
U	2.5E-01	<4.8E+00
Zn	5.1E-01	2.0E+00

[SRR-CWDA-2010-00128, SRR-CWDA-2014-00071]

Note: Green indicates that the final values evaluated in this SA are lower than the assigned HTF PA inventory values. Pink indicates that final values evaluated in this SA are higher than the assigned HTF PA inventory values.

Table 5.0-3: Tank 16 Annulus Radionuclide Inventory (Ci)

Element	Tank 16 Value in HTF PA	Tank 16 Final
Ac-227	1.0E+00	ND
Al-26	1.0E+00	ND
Am-241	7.0E+00	7.5E+00
Am-242m	1.0E+00	<3.8E-03
Am-243	1.0E+00	<8.0E-03
Ba-137m	1.6E+04	3.5E+03
C-14	1.0E+00	<4.9E-03
Cf-249	1.0E+00	<6.3E-03
Cf-251	1.0E+00	<1.7E-02
Cl-36	2.5E-03	<3.1E-03
Cm-243	1.0E+00	<1.4E-02
Cm-244	2.1E-01	<3.9E-01
Cm-245	1.0E+00	<7.4E-05
Cm-247	1.0E+00	<4.8E-09
Cm-248	1.0E+00	<5.4E-06
Co-60	1.0E+00	1.9E-03
Cs-135	3.2E-03	2.0E-02
Cs-137	1.7E+04	3.7E+03
Eu-152	1.0E+00	ND
Eu-154	2.9E+00	ND
H-3	1.0E+00	ND
I-129	1.7E-04	7.9E-03
K-40	1.2E-03	<1.7E-04
Nb-94	1.2E-01	<2.6E-03
Ni-59	1.0E+00	<9.3E-03
Ni-63	9.6E+00	<3.6E-01
Np-237	2.6E-02	2.0E-02
Pa-231	2.5E-03	<1.6E-03
Pd-107	2.5E-01	ND
Pt-193	2.5E-01	ND
Pu-238	2.5E+01	3.0E+01
Pu-239	3.6E+00	4.7E+00
Pu-240	4.2E+00	2.1E+00
Pu-241	1.8E+01	5.8E+00
Pu-242	1.0E+00	8.4E-04
Pu-244	1.0E+00	<7.0E-07
Ra-226	2.5E-02	<1.0E-03
Ra-228	2.5E+00	ND
Se-79	1.0E+00	ND
Sm-151	1.5E+02	ND
Sn-126	1.0E+00	ND
Sr-90	7.8E+03	1.0E+04
Tc-99	4.9E+00	1.9E+00
Th-229	2.5E-03	ND
Th-230	2.5E-02	<3.7E-04
Th-232	2.5E-02	ND
U-232	2.5E-03	ND
U-233	1.4E-01	<1.1E-02
U-234	9.1E-02	1.2E-02
U-235	2.6E-04	1.8E-04
U-236	1.2E-03	ND
U-238	1.0E-03	7.9E-04
Y-90	7.8E+03	1.0E+04
Zr-93	5.5E-03	<8.7E-01

[SRR-CWDA-2010-00128, SRR-CWDA-2014-00071]

ND Not determined as denoted in Section 3.2.3 of SRR-CWDA-2014-00071 (based on the radionuclide and chemical constituent screening and selection process described in *Tank 16 Radionuclide and Chemical Screening for Residual Inventory Determination*, SRR-CWDA-2012-00156).

Note: Green indicates that the final values evaluated in this SA are lower than the assigned HTF PA inventory values. Pink indicates that final values evaluated in this SA are higher than the assigned HTF PA inventory values.

Table 5.0-4: Tank 16 Annulus Chemical Inventory (kg)

Chemical	Tank 16 Value in HTF PA	Tank 16 Final
Ag	2.1E+00	<2.3E-01
Al	1.2E+03	5.1E+02
As	1.8E-02	<1.8E-02
B	3.0E-01	<3.3E+00
Ba	1.3E+00	1.5E+00
Cd	1.0E-01	<2.4E-01
Cl	1.0E+01	4.6E+00
Co	1.5E-01	<2.0E+00
Cr	3.7E+00	2.1E+00
Cu	1.6E+01	1.0E+01
F	7.7E+00	<1.9E+00
Fe	6.2E+02	2.3E+02
Hg	4.3E+01	1.7E+01
I	2.0E-01	<2.6E-02
Mn	5.3E+00	2.4E+00
Mo	5.5E-01	<2.5E+00
Ni	1.4E+00	<3.5E+00
NO_2	1.2E+03	4.4E+02
NO_3	2.4E+03	3.8E+02
Pb	2.1E+01	<8.9E+00
PO_4	4.6E+00	<1.9E+00
Sb	1.9E+00	<4.9E+00
Se	4.0E-03	8.7E-02
SO_4	2.1E+01	6.7E+01
Sr	6.6E-01	<4.4E-01
U	3.3E+00	<1.6E+01
Zn	1.9E+01	<3.2E+00

[SRR-CWDA-2010-00128, SRR-CWDA-2014-00071]

Note: Green indicates that the final values evaluated in this SA are lower than the assigned HTF PA inventory values. Pink indicates that final values evaluated in this SA are higher than the assigned HTF PA inventory values.

Table 5.0-5: Tank 16 Sand Pad Radionuclide Inventory (Ci)

Element	Tank 16 Value in HTF PA		Tank 16 Final	
	Primary	Secondary	Primary	Secondary
Ac-227	1.0E+00	1.0E+00	ND	ND
Al-26	1.0E+00	1.0E+00	ND	ND
Am-241	2.8E+00	5.5E-02	5.1E+00	1.0E-01
Am-242m	1.0E+00	1.0E+00	<2.6E-03	<5.1E-05
Am-243	1.0E+00	1.0E+00	<5.4E-03	<1.1E-04
Ba-137m	4.5E+03	9.0E+01	2.4E+03	4.8E+01
C-14	1.0E+00	1.0E+00	<3.3E-03	<6.6E-05
Cf-249	1.0E+00	1.0E+00	<4.3E-03	<8.6E-05
Cf-251	1.0E+00	1.0E+00	<1.2E-02	<2.3E-04
Cl-36	6.9E-04	1.4E-05	<2.1E-03	<4.2E-05
Cm-243	1.0E+00	1.0E+00	<9.4E-03	<1.9E-04
Cm-244	8.3E-02	1.7E-03	<2.6E-01	<5.3E-03
Cm-245	1.0E+00	1.0E+00	<5.0E-05	<1.0E-06
Cm-247	1.0E+00	1.0E+00	<3.2E-09	<6.5E-11
Cm-248	1.0E+00	1.0E+00	<3.7E-06	<7.3E-08
Co-60	1.0E+00	1.0E+00	1.3E-03	2.6E-05
Cs-135	1.3E-03	2.6E-05	1.3E-02	2.7E-04
Cs-137	4.8E+03	9.5E+01	2.5E+03	5.1E+01
Eu-152	1.0E+00	1.0E+00	ND	ND
Eu-154	1.1E+00	2.3E-02	ND	ND
H-3	1.0E+00	1.0E+00	ND	ND
I-129	6.9E-05	1.4E-06	5.4E-03	1.1E-04
K-40	3.4E-04	6.9E-06	<1.2E-04	<2.3E-06
Nb-94	3.4E-02	6.9E-04	<1.8E-03	<3.5E-05
Ni-59	1.0E+00	1.0E+00	<6.3E-03	<1.3E-04
Ni-63	3.8E+00	7.6E-02	<2.4E-01	<4.9E-03
Np-237	1.0E-02	2.1E-04	1.4E-02	2.8E-04
Pa-231	6.9E-04	1.4E-05	<1.1E-03	<2.1E-05
Pd-107	6.9E-02	1.4E-03	ND	ND
Pt-193	6.9E-02	1.4E-03	ND	ND
Pu-238	9.8E+00	2.0E-01	2.0E+01	4.1E-01
Pu-239	1.4E+00	2.9E-02	3.2E+00	6.4E-02
Pu-240	1.7E+00	3.3E-02	1.5E+00	2.9E-02
Pu-241	5.1E+00	1.0E-01	4.0E+00	7.9E-02
Pu-242	1.0E+00	1.0E+00	5.7E-04	1.1E-05
Pu-244	1.0E+00	1.0E+00	<4.8E-07	<9.5E-09

Table 5.0-5: Tank 16 Sand Pad Radionuclide Inventory (Ci) (Continued)

Element	Tank 16 Value in HTF PA		Tank 16 Final	
	Primary	Secondary	Primary	Secondary
Ra-226	6.9E-03	1.4E-04	<7.1E-04	<1.4E-05
Ra-228	6.9E-01	1.4E-02	ND	ND
Se-79	1.0E+00	1.0E+00	ND	ND
Sm-151	6.1E+01	1.2E+00	ND	ND
Sn-126	1.0E+00	1.0E+00	ND	ND
Sr-90	3.1E+03	6.3E+01	6.9E+03	1.4E+02
Tc-99	1.9E+00	3.8E-02	1.3E+00	2.6E-02
Th-229	6.9E-04	1.4E-05	ND	ND
Th-230	6.9E-03	1.4E-04	<2.5E-04	<5.0E-06
Th-232	6.9E-03	1.4E-04	ND	ND
U-232	6.9E-04	1.4E-05	ND	ND
U-233	5.6E-02	1.1E-03	<7.7E-03	<1.5E-04
U-234	3.6E-02	7.2E-04	8.5E-03	1.7E-04
U-235	1.0E-04	2.1E-06	1.2E-04	2.4E-06
U-236	4.7E-04	9.4E-06	ND	ND
U-238	4.1E-04	8.3E-06	5.4E-04	1.1E-05
Y-90	3.1E+03	6.3E+01	6.9E+03	1.4E+02
Zr-93	2.2E-03	4.3E-05	<5.9E-01	<1.2E-02

[SRR-CWDA-2010-00128, SRR-CWDA-2014-00071]

ND Not determined as denoted in Section 3.2.3 of SRR-CWDA-2014-00071 (based on the radionuclide and chemical constituent screening and selection process described in *Tank 16 Radionuclide and Chemical Screening for Residual Inventory Determination*, SRR-CWDA-2012-00156).

Note: Green indicates that the final values evaluated in this SA are lower than the assigned HTF PA inventory values. Pink indicates that final values evaluated in this SA are higher than the assigned HTF PA inventory values.

Table 5.0-6: Tank 16 Sand Pad Chemical Inventory (kg)

Chemical	Tank 16 Value in HTF PA		Tank 16 Final	
	Primary	Secondary	Primary	Secondary
Ag	8.4E-01	1.7E-02	<1.5E-01	<3.1E-03
Al	4.9E+02	9.8E+00	3.5E+02	6.9E+00
As	7.1E-03	1.4E-04	<1.2E-02	<2.4E-04
B	1.2E-01	2.4E-03	<2.2E+00	<4.5E-02
Ba	5.3E-01	1.1E-02	1.0E+00	2.1E-02
Cd	4.1E-02	8.3E-04	<1.6E-01	<3.2E-03
Cl	4.1E+00	8.1E-02	3.1E+00	6.3E-02
Co	6.0E-02	1.2E-03	<1.3E+00	<2.7E-02
Cr	1.5E+00	2.9E-02	1.4E+00	2.8E-02
Cu	6.4E+00	1.3E-01	7.1E+00	1.4E-01
F	3.0E+00	6.1E-02	<1.3E+00	<2.6E-02
Fe	2.4E+02	4.9E+00	1.6E+02	3.2E+00
Hg	1.7E+01	3.4E-01	1.2E+01	2.3E-01
I	7.9E-02	1.6E-03	<1.8E-02	<3.6E-04
Mn	2.1E+00	4.2E-02	1.6E+00	3.2E-02
Mo	2.2E-01	4.3E-03	<1.7E+00	<3.4E-02
Ni	5.5E-01	1.1E-02	<2.4E+00	<4.8E-02
NO_2	4.9E+02	9.8E+00	3.0E+02	6.0E+00
NO_3	9.5E+02	1.9E+01	2.6E+02	5.2E+00
Pb	8.4E+00	1.7E-01	<6.0E+00	<1.2E-01
PO_4	1.8E+00	3.6E-02	<1.3E+00	<2.6E-02
Sb	7.5E-01	1.5E-02	<3.3E+00	<6.7E-02
Se	1.6E-03	3.1E-05	5.9E-02	1.2E-03
SO_4	8.2E+00	1.6E-01	4.6E+01	9.1E-01
Sr	2.6E-01	5.2E-03	<3.0E-01	<5.9E-03
U	1.3E+00	2.6E-02	<1.1E+01	<2.2E-01
Zn	7.3E+00	1.5E-01	<2.1E+00	<4.3E-02

[SRR-CWDA-2010-00128, SRR-CWDA-2014-00071]

Note: Green indicates that the final values evaluated in this SA are lower than the assigned HTF PA inventory values. Pink indicates that final values evaluated in this SA are higher than the assigned HTF PA inventory values.

6.0 H-TANK FARM PERFORMANCE ASSESSMENT EVALUATION

This section will evaluate the new information (i.e., final characterization) on Tank 16 residual waste presented in Section 5.0, as well as the impact that this new characterization has on the residual waste estimates for other HTF waste tanks. This new inventory information is used to update the HTF fate and transport modeling performed as part of the HTF PA. The potential impacts of the new inventory information on the assumptions from the HTF PA are also considered. As part of this evaluation, the final Tank 16 characterization data was used to update the inventory projection for all of the HTF Type I, II, III/IIIA and IV tanks. [SRR-CWDA-2010-00023]

6.1 H-Tank Farm Facility Characteristics

This section will discuss the impact of the new characterization information on the HTF characteristics information presented in Section 3.0 of the HTF PA.

6.1.1 Site Characteristics

Section 3.1 of HTF PA contains a description of SRS site characteristics. The site characteristics information presented in the HTF PA are not affected by the new characterization information.

6.1.2 Principal Facility Design Features

Section 3.2 of HTF PA contains a description of the HTF facility design features. The HTF facility design features information presented in the HTF PA are not affected by the new characterization information.

6.1.3 Inventory Constituents

Section 3.3 of HTF PA contains a description of the HTF inventory characteristics, which is affected by the new characterization information as detailed below.

6.1.4 Evaluation of Radionuclides

The isotopes evaluated in the HTF PA are identified in Table 6.1-1 and have initial inventory estimates developed along with updated information for Tank 16.

Table 6.1-1: Radionuclides of Concern

Ac-227	Cl-36	Eu-152	Pa-231	Ra-226	Th-232
Al-26	Cm-243	Eu-154	Pd-107	Ra-228	U-232
Am-241	Cm-244	H-3	Pt-193	Se-79	U-233
Am-242m	Cm-245	I-129	Pu-238	Sm-151	U-234
Am-243	Cm-247	K-40	Pu-239	Sn-126	U-235
Ba-137m	Cm-248	Nb-94	Pu-240	Sr-90	U-236
C-14	Co-60	Ni-59	Pu-241	Tc-99	U-238
Cf-249	Cs-135	Ni-63	Pu-242	Th-229	Y-90
Cf-251	Cs-137	Np-237	Pu-244	Th-230	Zr-93

6.1.5 Evaluation of Chemicals

The list of chemical constituents that were included in the HTF PA modeling was derived from a screening process consisting of several steps to arrive at an appropriate list of constituents to be included in the waste tank closure inventory estimates. The approach was developed for use in screening the chemicals of interest in Tanks 18 and 19; since the chemical constituents for FTF and HTF are assumed the same, using the developed list was appropriate. Table 6.1-2 lists the chemical constituents of concern for the HTF PA.

During the closure process for each waste tank, the final tank inventory will be used to determine projected dose and risk impacts for that waste tank

Table 6.1-2: Chemical Inventory of Concern

Ag	Cd	F	Mo	PO_4	U
Al	Cl	Fe	Ni	Sb	Zn
As	Co	Hg	NO_2	Se	
B	Cr	I	NO_3	SO_4	
Ba	Cu	Mn	Pb	Sr	

Further information can be found on evaluation of the radiological and chemical constituents in the *H-Area Tank Farm Closure Inventory for use in Performance Assessment Modeling* (hereinafter referred to as HTF Inventory Document). [SRR-CWDA-2010-00023, Rev. 3]

6.2 H-Tank Farm Inventory Determination

The following general approach was used for assigning radiological and chemical inventories for use in the HTF PA modeling.

- The contaminant screening process discussed in Section 3.3 of the HTF PA consisted of several steps to arrive at an appropriate list of radionuclides and chemicals to be included in the HTF waste tank closure inventory.
- Both residual material concentrations and volumes were estimated to develop initial inventory assignments.
- Adjustments were made to the initial inventory assignments to add reasonable conservatism to the final inventory. These adjustments included grouping the waste

tanks according to use and design; inventory adjustment as applicable within that group; increasing initial individual waste tank inventories by one order of magnitude for the Type I, Type II and Type IV waste tanks; and assigning the maximum concentration of each radiological or chemical constituent from each individual waste tank within a grouping.

- The Type II tank annuli (Tanks 13 through 16) were assumed to contain residual material, including the sand pad beneath the primary liner.
- The sand pad beneath the Tank 16 secondary liner was assumed to contain residual material.

Specific details of the methodology used for assigning radiological and chemical inventories for use in the HTF PA modeling can be found in the HTF Inventory Document (SRR-CWDA-2010-00023).

The residual material that remains in the waste tanks upon removal from service is representatively sampled and characterized to verify that the assessment of long-term performance against the performance objectives remains valid.

To support final waste tank characterization, the SRS *Liquid Waste Tank Residuals Sampling and Analysis Program Plan* (LWTRSAPP) (SRR-CWDA-2011-00050) provides a defensible basis for characterizing the residual material remaining in the system at the time of removal from service. Details of the quality assurance (QA), quality control (QC) and other technical activities necessary to ensure that the data collected is of the correct type and quality to support the characterization are presented in the *Liquid Waste Tank Residuals Sampling-Quality Assurance Program Plan* (LWTRS-QAPP) (SRR-CWDA-2011-00117). Waste tank residuals characterization will include representative sampling of the material remaining in the specific waste tank. In some cases, process knowledge and historical sampling will be used to support residuals characterization. The initial constituents for characterization in the HTF waste tanks are found in Section 3.3 of the HTF PA. [SRR-CWDA-2010-00128]

6.2.1 Initial Waste Tank Inventory Assignments

The initial waste tank inventory estimates were based on Waste Characterization System (WCS) concentrations and volume estimates from waste tank cleaning history.

6.2.1.1 Initial Waste Tank Concentration Estimates

The majority of the radionuclide concentrations and the chemical constituents in the residual material are estimated using data from WCS.

6.2.1.1.1 The Waste Characterization System

The WCS is an electronic information system that tracks waste tank data, including projected radiological and chemical inventories, based on sample analyses, process histories, composition studies and theoretical relationships. The system (initially developed in 1995) tracks the dry sludge concentrations of 40 radiological and of 37 chemical waste compounds in each of the SRS waste tanks. The 40 radionuclides tracked in the WCS were selected primarily based on their impact on waste-tank safety-basis source term, inhalation dose potential, or on the E-Area Vault waste acceptance criteria. Further information concerning the use of the WCS and its maintenance is provided in the HTF Inventory Document (SRR-CWDA-2010-00023).

6.2.1.1.2 Other Constituents Not Addressed in the WCS

6.2.1.1.2.1 Radionuclides and Chemicals

In addition to the nuclides tracked in WCS, updated special analysis methods provided concentration estimates for additional radionuclides. For those radionuclides where special analysis methods could not be used, detection limits based on experience from characterizing the residuals in Tanks 5, 18 and 19 were used to estimate constituent concentrations. Affected constituents and the methods used to estimate their inventories are detailed in the HTF Inventory Document (SRR-CWDA-2010-00023).

6.2.1.1.2.2 Accounting for Zeolite

Certain waste tanks contain zeolite in addition to the sludge material. Liquid overheads from the evaporator systems were treated in the past using cesium removal columns containing zeolite, which functioned as a molecular sieve. In HTF, these columns were located in Tanks 24, 32 and 42. The estimated radiological concentrations in Tanks 24, 32, 38, 40, 42 and 51 have been adjusted to account for the zeolite and corresponding captured cesium.

The solids (sludge and zeolite) concentrations assume that zeolite remains unchanged during the waste removal processes. Experience with Tanks 18 and 19 demonstrated that the only element that accumulated on zeolite under actual in-tank conditions was cesium. The zeolite volume fractions were calculated with the assumption that zeolite weight and volume fractions are the same in residual material. This impacts both Cs-135 and Cs-137 (and its daughter product, Ba-137m) concentrations.

6.2.1.2 Initial Waste Tank Volumes

The initial inventory assignments were based on a conservatively estimated residual solids volume of 4,000 gallons. This initial waste volume was based on waste removal experiences in Tanks 5, 6, 18 and 19. The initial residual volume in Tank 16 was estimated with a different volume (1,000 gallons) based on its waste removal history. A more in depth discussion is available in the HTF Inventory Document.

Inventories inside failed cooling coils, on the surface of waste tank walls, cooling coils and columns are considered encompassed within the total assigned waste tank inventory.

6.2.2 Initial Annulus and Type II Tank Sand Pad Inventories

Wall inspections of the primary tank walls in the HTF Type I and Type II tanks (i.e., Tanks 9 through 12 and Tanks 13 through 16, respectively) have found cracks where material has leaked in the secondary containment (annulus). The amount of material contained in the each waste tank's annulus has been assigned. Based on these assignments, initial inventories within the appropriate annuli were determined.

All Type II tanks have both a primary and secondary sand pad. The 1-inch thick primary sand pad is between the primary and secondary liners and the 1-inch thick secondary sand pad is between the secondary liner and the basemat. Due to the material that leaked from the

Type II tanks, residual material has been assumed present within these primary sand pads and within the secondary sand pad for Tank 16.

6.2.2.1 Initial Annulus Concentrations

Characterization of the material within the various annuli is limited. Few samples have been taken from annulus material and even when taken, constituents analyzed have also been limited. Four samples were collected from the Tank 16 annulus in 2011 and numerous constituents analyzed. These 2011 sample results were used to estimate the annulus constituent concentrations for all Type I and II tanks. Since the sample analysis did not include all constituents of concern, the remaining constituents were estimated using other methods. For a description of the estimate methods, refer to the HTF Inventory Document.

6.2.2.2 Initial Annulus Volumes

Assignments of the amount of material within the waste tank annuli were used to determine the residual volumes at closure. [C-ESR-G-00003] The Type I and II tanks are known to have leaksites and material in their annuli. Table 6.2-1 shows the initial material volume assignments and the initial determined residual material volumes for the annuli inventories. Type IV tanks do not have annuli and because the Type III/IIIA tanks have never leaked they are assumed to have no residual material within their annuli. [C-ESR-G-00003]

Table 6.2-1: Tank Annulus Initial Material Volume

	Current Volume Estimate	Annulus Residual Volume Assignment (gal)
Tank 9	Material depth of 8 to 10 inches	3,300
Tank 10	Material depth of 2 to 3 inches	3,300
Tank 11	trace	100
Tank 12	trace	100
Tank 13	trace	100
Tank 14	Material depth of 12 to 13 inches	3,300
Tank 15	trace	100
Tank 16	3,300 gallons	3,300

The amount of material in the Tank 16 annulus was initially assigned a volume of 3,300 gallons. For other annuli with significant volume, this volume was also used. Except for Tank 16, the material in the annuli is expected to be highly soluble. This is due to the material originally being supernate that leaked into each annulus and dried. Therefore, the 3,300 gallon initial assignment for all other tanks is believed to be conservative. [SRR-LWE-2012-00039] Tank 16 is expected to be an exception due to the insoluble compounds that formed from the mixture of silicon from sand blasting activities. This material limited the quantity of material removed.

For those waste tank annuli with a trace amount of material, a reasonably conservative volume of 100 gallons was assigned.

6.2.2.3 Initial Type II Tank Sand Pad Concentrations

The residual material within the sand pad was assumed to have the same concentrations as determined for the annulus material.

6.2.2.4 Initial Type II Tank Sand Pad Volumes

The quantity estimate within the Type II tank sand pads was based on the operational history of each waste tank. For Tanks 14 and 16, a significant quantity of material leaked from the primary tank into the secondary containment and was sufficient to deposit material at a depth of several inches. Due to the depth of material in the annulus and sand pad construction features, it was reasonably conservative to assume the primary sand pad was saturated with residual material. A reasonably conservative amount of 1,300 gallons was assumed in the primary sand pads for Tanks 14 and 16. For Tanks 13 and 15, a minimal quantity of material has leaked from the primary tank. This is based on the inspections of the annulus floor where negligible quantities of material have been observed. Due to the minimal material amount in Tanks 13, 15 and sand pad construction features, a reasonably conservative amount of 100 gallons was assumed in these primary sand pads. For a more in-depth description, refer to the HTF Inventory Document.

The Type II tanks also have a secondary sand pad that is beneath the secondary liner or annulus. Tank 16 experienced the largest quantity of material leaving the tank and gathering in the annulus. In 1960, enough material filled the annulus that tens of gallons overflowed the annulus pan. For the purpose of this inventory evaluation, it is conservatively assumed that all of the material (26 gallons) that overflowed the annulus pan entered the secondary sand pad below Tank 16. For Tanks 13 through 15, no material has leaked beyond the secondary containment; therefore, it is assumed that the secondary sand pads below these tanks contain no inventory. For a more in-depth description, refer to the HTF Inventory Document.

6.2.3 Waste Tank Inventory Adjustments

Following the development of the initial inventory assignments, adjustments were made to update the initial inventory assignments based on new information about the residual material in the HTF waste tanks. The HTF Inventory Document provides descriptions of the adjustments made to the HTF waste tank inventory. Adjustments made due to waste closure characterization include updating the Tank 16 inventory based on the Tank 16 final residual waste data as provided in the *Tank 16 Inventory Determination* (SRR-CWDA-2014-00071) and adjusting the Tank 12 inventory based on sampling done during waste removal and tank cleaning efforts, processing knowledge and preliminary residual material volume estimates. The adjusted Tank 12 inventory is called the “Tank 12 Forecast” inventory. All Type I and II tank annulus and Type II tank primary sand pad inventories were updated based on the final waste characterization of the Tank 16 annulus. This included updating the residual volumes in the Type I and II tank annulus based on the Tank 16 final residual volume determination and the latest Tank 12 inspections. For a more in-depth description of the adjustments for the Tank 16 inventory determination and the Tank 12 Forecast inventory, refer to the HTF Inventory Document.

The HTF ancillary equipment inventory is also discussed in the HTF Inventory Document. The ancillary equip system inventory is based on the residual inventories at those specific locations (e.g., evaporator vessels, pump tanks). The ancillary equipment inventory is not affected by the new characterization information.

6.2.4 Final Waste Tank Inventory Estimates

The PA assumes that the last HTF waste tank will be grouted at the end of fiscal year 2032. Therefore, all the radiological inventories have been decay corrected to 2032. After all waste inventory adjustments, the initial radionuclide and chemical constituent inventories are provided in Section 3.4.1 of the HTF PA. The updated HTF waste tank radionuclide and chemical inventories per the adjustments discussed in Section 6.2.3 are presented in Tables 6.2-2 and 6.2-3. Tables 6.2-4 through 6.2-7 present the updated Type I and II tank annulus and Type II tank sand pad inventories, which are based on the final characterization of Tank 16 annulus residual material. These tables include the inventories of the individual waste tanks, which are an integral part of the modeling process. The impacts of these new HTF inventories on various performance assessment analyses (e.g., public dose analyses) are presented in Section 6.3 of this SA.

Table 6.2-2: Assigned Radiological Inventory (Ci) at Closure Decayed to Year 2032

Tank	Ac-227	Al-26	Am-241	Am-242m	Am-243	Ba-137m	C-14	Cf-249	Cf-251	Cl-36	Cm-243	Cm-244	Cm-245
9	1.0E+00	1.0E+00	7.0E+02	1.0E+00	3.0E+00	7.4E+02	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.0E+01	1.0E+00
10	1.0E+00	1.0E+00	7.0E+02	1.0E+00	3.0E+00	7.4E+02	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.0E+01	1.0E+00
11	1.0E+00	1.0E+00	7.0E+02	1.0E+00	3.0E+00	7.4E+02	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.0E+01	1.0E+00
12	0.0E+00	0.0E+00	7.0E+02	1.0E+00	3.0E+00	2.4E+03	1.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E+00	2.0E+01	1.0E+00
13	1.0E+00	1.0E+00	7.0E+02	1.0E+00	3.0E+00	7.4E+02	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.0E+01	1.0E+00
14	1.0E+00	1.0E+00	7.0E+02	1.0E+00	3.0E+00	7.4E+02	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.0E+01	1.0E+00
15	1.0E+00	1.0E+00	7.0E+02	1.0E+00	3.0E+00	7.4E+02	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.0E+01	1.0E+00
16	0.0E+00	0.0E+00	1.6E+00	2.5E-05	2.1E-04	1.5E-02	1.6E-03	5.0E-05	1.3E-04	4.7E-06	9.9E-05	4.3E-03	6.2E-06
21	1.0E+00	1.0E+00	5.0E+00	1.0E+00	1.0E+00	2.3E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	4.6E+00	1.0E+00
22	1.0E+00	1.0E+00	5.0E+00	1.0E+00	1.0E+00	2.3E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	4.6E+00	1.0E+00
23	1.0E+00	1.0E+00	5.0E+00	1.0E+00	1.0E+00	2.3E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	4.6E+00	1.0E+00
24	1.0E+00	1.0E+00	5.0E+00	1.0E+00	1.0E+00	2.3E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	4.6E+00	1.0E+00
29	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
30	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
31	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
32	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
35	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
36	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
37	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
38	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
39	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
40	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
41	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
42	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
43	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
48	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
49	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
50	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00
51	1.0E+00	1.0E+00	1.1E+03	1.0E+00	1.0E+00	5.2E+03	1.0E+00	1.0E+00	1.0E+00	2.1E-03	1.0E+00	2.2E+03	1.0E+00

Table 6.2-2: Assigned Radiological Inventory (Ci) at Closure Decayed to Year 2032 (Continued)

Tank	Cm-247	Cm-248	Co-60	Cs-135	Cs-137	Eu-152	Eu-154	H-3	I-129	K-40	Nb-94	Ni-59	Ni-63	Np-237
9	1.0E+00	1.0E+00	1.0E+00	5.4E-03	7.9E+02	2.1E+01	2.9E+02	1.0E+00	2.8E-04	1.1E-03	1.1E-01	8.6E+00	6.3E+02	2.1E-01
10	1.0E+00	1.0E+00	1.0E+00	5.4E-03	7.9E+02	2.1E+01	2.9E+02	1.0E+00	2.8E-04	1.1E-03	1.1E-01	8.6E+00	6.3E+02	2.1E-01
11	1.0E+00	1.0E+00	1.0E+00	5.4E-03	7.9E+02	2.1E+01	2.9E+02	1.0E+00	2.8E-04	1.1E-03	1.1E-01	8.6E+00	6.3E+02	2.1E-01
12	0.0E+00	0.0E+00	0.0E+00	5.4E-03	2.5E+03	0.0E+00	0.0E+00	0.0E+00	2.6E-02	0.0E+00	1.1E-01	8.6E+00	6.3E+02	7.2E-01
13	1.0E+00	1.0E+00	1.0E+00	5.4E-03	7.9E+02	2.1E+01	2.9E+02	1.0E+00	2.8E-04	1.1E-03	1.1E-01	8.6E+00	6.3E+02	2.1E-01
14	1.0E+00	1.0E+00	1.0E+00	5.4E-03	7.9E+02	2.1E+01	2.9E+02	1.0E+00	2.8E-04	1.1E-03	1.1E-01	8.6E+00	6.3E+02	2.1E-01
15	1.0E+00	1.0E+00	1.0E+00	5.4E-03	7.9E+02	2.1E+01	2.9E+02	1.0E+00	2.8E-04	1.1E-03	1.1E-01	8.6E+00	6.3E+02	2.1E-01
16	3.0E-09	1.4E-07	8.8E-05	5.3E-05	1.5E-02	0.0E+00	0.0E+00	0.0E+00	1.3E-03	4.1E-05	8.9E-03	1.3E-03	1.5E-03	1.5E-03
21	1.0E+00	1.0E+00	1.0E+00	2.3E-02	2.4E+03	1.0E+00	8.3E+00	1.0E+00	2.1E-04	1.1E-03	1.1E-01	1.0E+00	9.1E+00	1.3E-02
22	1.0E+00	1.0E+00	1.0E+00	2.3E-02	2.4E+03	1.0E+00	8.3E+00	1.0E+00	2.1E-04	1.1E-03	1.1E-01	1.0E+00	9.1E+00	1.3E-02
23	1.0E+00	1.0E+00	1.0E+00	2.3E-02	2.4E+03	1.0E+00	8.3E+00	1.0E+00	2.1E-04	1.1E-03	1.1E-01	1.0E+00	9.1E+00	1.3E-02
24	1.0E+00	1.0E+00	1.0E+00	2.3E-02	2.4E+03	1.0E+00	8.3E+00	1.0E+00	2.1E-04	1.1E-03	1.1E-01	1.0E+00	9.1E+00	1.3E-02
29	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
30	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
31	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
32	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
35	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
36	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
37	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
38	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
39	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
40	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
41	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
42	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
43	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
48	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
49	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
50	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01
51	1.0E+00	1.0E+00	1.0E+00	7.1E-03	5.5E+03	3.8E+01	9.2E+02	1.0E+00	6.7E-03	1.1E-03	1.1E-01	1.0E+00	7.9E+02	4.0E-01

Table 6.2-2: Assigned Radiological Inventory (Ci) at Closure Decayed to Year 2032 (Continued)

Tank	Pa-231	Pd-107	Pt-193	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242	Pu-244	Ra-226	Ra-228	Se-79	Sm-151	Sn-126
9	2.1E-03	2.1E-01	2.1E-01	6.5E+03	8.0E+01	5.0E+01	7.6E+02	1.0E+00	1.0E+00	2.1E-02	2.1E+00	4.8E+00	1.1E+04	4.6E+00
10	2.1E-03	2.1E-01	2.1E-01	6.5E+03	8.0E+01	5.0E+01	7.6E+02	1.0E+00	1.0E+00	2.1E-02	2.1E+00	4.8E+00	1.1E+04	4.6E+00
11	2.1E-03	2.1E-01	2.1E-01	6.5E+03	8.0E+01	5.0E+01	7.6E+02	1.0E+00	1.0E+00	2.1E-02	2.1E+00	4.8E+00	1.1E+04	4.6E+00
12	2.1E-03	0.0E+00	0.0E+00	9.8E+03	3.9E+02	3.9E+02	2.5E+03	0.0E+00	0.0E+00	2.1E-02	2.1E+00	0.0E+00	0.0E+00	4.6E+00
13	2.1E-03	2.1E-01	2.1E-01	6.5E+03	8.0E+01	5.0E+01	7.6E+02	1.0E+00	1.0E+00	2.1E-02	2.1E+00	4.8E+00	1.1E+04	4.6E+00
14	2.1E-03	2.1E-01	2.1E-01	6.5E+03	8.0E+01	5.0E+01	7.6E+02	1.0E+00	1.0E+00	2.1E-02	2.1E+00	4.8E+00	1.1E+04	4.6E+00
15	2.1E-03	2.1E-01	2.1E-01	6.5E+03	8.0E+01	5.0E+01	7.6E+02	1.0E+00	1.0E+00	2.1E-02	2.1E+00	4.8E+00	1.1E+04	4.6E+00
16	6.2E-03	0.0E+00	0.0E+00	4.6E+00	2.2E-01	9.5E-02	3.5E-02	2.0E-05	2.1E-07	7.3E-04	0.0E+00	0.0E+00	0.0E00	0.0E+00
21	2.1E-03	2.1E-01	2.1E-01	7.2E+01	1.0E+00	3.6E-01	2.1E+00	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	2.4E+02	1.0E+00
22	2.1E-03	2.1E-01	2.1E-01	7.2E+01	1.0E+00	3.6E-01	2.1E+00	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	2.4E+02	1.0E+00
23	2.1E-03	2.1E-01	2.1E-01	7.2E+01	1.0E+00	3.6E-01	2.1E+00	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	2.4E+02	1.0E+00
24	2.1E-03	2.1E-01	2.1E-01	7.2E+01	1.0E+00	3.6E-01	2.1E+00	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	2.4E+02	1.0E+00
29	2.1E-03	2.1E-01	2.1E-01	2.8E+03	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
30	2.1E-03	2.1E-01	2.1E-01	2.8E+03	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
31	2.1E-03	2.1E-01	2.1E-01	2.8E+03	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
32	2.1E-03	2.1E-01	2.1E-01	1.5E+04	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
35	2.1E-03	2.1E-01	2.1E-01	1.5E+04	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
36	2.1E-03	2.1E-01	2.1E-01	2.8E+03	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
37	2.1E-03	2.1E-01	2.1E-01	2.8E+03	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
38	2.1E-03	2.1E-01	2.1E-01	2.8E+03	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
39	2.1E-03	2.1E-01	2.1E-01	1.5E+04	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
40	2.1E-03	2.1E-01	2.1E-01	1.5E+04	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
41	2.1E-03	2.1E-01	2.1E-01	2.8E+03	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
42	2.1E-03	2.1E-01	2.1E-01	1.5E+04	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
43	2.1E-03	2.1E-01	2.1E-01	1.5E+04	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
48	2.1E-03	2.1E-01	2.1E-01	2.8E+03	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
49	2.1E-03	2.1E-01	2.1E-01	2.8E+03	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
50	2.1E-03	2.1E-01	2.1E-01	1.5E+04	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00
51	2.1E-03	2.1E-01	2.1E-01	1.5E+04	2.4E+02	1.5E+02	4.6E+03	1.0E+00	1.0E+00	2.1E-02	2.1E+00	1.0E+00	7.7E+04	1.0E+00

Table 6.2-2: Assigned Radiological Inventory (Ci) at Closure Decayed to Year 2032 (Continued)

Tank	Sr-90	Tc-99	Th-229	Th-230	Th-232	U-232	U-233	U-234	U-235	U-236	U-238	Y-90	Zr-93
9	1.4E+04	8.1E+00	2.1E-03	2.1E-02	2.9E-02	2.1E-03	5.9E-01	9.6E-02	2.1E-02	2.1E-02	2.9E-02	1.4E+04	4.0E-01
10	1.4E+04	8.1E+00	2.1E-03	2.1E-02	2.9E-02	2.1E-03	5.9E-01	9.6E-02	2.1E-02	2.1E-02	2.9E-02	1.4E+04	4.0E-01
11	1.4E+04	8.1E+00	2.1E-03	2.1E-02	2.9E-02	2.1E-03	5.9E-01	9.6E-02	2.1E-02	2.1E-02	2.9E-02	1.4E+04	4.0E-01
12	1.3E+05	1.2E+01	2.1E-03	2.1E-02	5.5E-02	2.1E-02	3.3E+00	1.7E+00	2.1E-02	0.0E+00	1.8E-01	1.3E+05	4.0E-01
13	1.4E+04	8.1E+00	2.1E-03	2.1E-02	2.9E-02	2.1E-03	5.9E-01	9.6E-02	2.1E-02	2.1E-02	2.9E-02	1.4E+04	4.0E-01
14	1.4E+04	8.1E+00	2.1E-03	2.1E-02	2.9E-02	2.1E-03	5.9E-01	9.6E-02	2.1E-02	2.1E-02	2.9E-02	1.4E+04	4.0E-01
15	1.4E+04	8.1E+00	2.1E-03	2.1E-02	2.9E-02	2.1E-03	5.9E-01	9.6E-02	2.1E-02	2.1E-02	2.9E-02	1.4E+04	4.0E-01
16	9.4E+03	1.7E+00	0.0E+00	2.4E-04	0.0E+00	0.0E+00	1.9E-02	1.2E-02	3.3E-06	0.0E+00	1.2E-05	9.4E+03	7.1E-03
21	3.1E+02	1.6E-01	2.1E-03	2.1E-02	2.1E-02	2.1E-03	6.0E-02	2.2E-02	2.1E-02	2.1E-02	7.4E-03	3.1E+02	8.8E-03
22	3.1E+02	1.6E-01	2.1E-03	2.1E-02	2.1E-02	2.1E-03	6.0E-02	2.2E-02	2.1E-02	2.1E-02	7.4E-03	3.1E+02	8.8E-03
23	3.1E+02	1.6E-01	2.1E-03	2.1E-02	2.1E-02	2.1E-03	6.0E-02	2.2E-02	2.1E-02	2.1E-02	7.4E-03	3.1E+02	8.8E-03
24	3.1E+02	1.6E-01	2.1E-03	2.1E-02	2.1E-02	2.1E-03	6.0E-02	2.2E-02	2.1E-02	2.1E-02	7.4E-03	3.1E+02	8.8E-03
29	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
30	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
31	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
32	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
35	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
36	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
37	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
38	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
39	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
40	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
41	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
42	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
43	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
48	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
49	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
50	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01
51	2.0E+04	9.7E+00	2.1E-03	2.1E-02	2.7E-02	2.1E-03	1.3E+00	6.6E-01	2.1E-02	1.1E-01	8.4E-02	2.0E+04	5.7E-01

[SRR-CWDA-2010-00023]

Table 6.2-3: Assigned Chemical Inventory (kg) at Closure

Tank	Ag	Al	As	B	Ba	Cd	Cl	Co	Cr	Cu	F	Fe	Hg	I
9	5.3E+00	2.5E+03	1.4E-01	3.6E+01	2.0E+01	1.5E+01	1.0E+02	2.1E-01	1.7E+01	5.1E+00	1.4E+01	3.0E+03	4.2E+02	5.0E-01
10	5.3E+00	2.5E+03	1.4E-01	3.6E+01	2.0E+01	1.5E+01	1.0E+02	2.1E-01	1.7E+01	5.1E+00	1.4E+01	3.0E+03	4.2E+02	5.0E-01
11	5.3E+00	2.5E+03	1.4E-01	3.6E+01	2.0E+01	1.5E+01	1.0E+02	2.1E-01	1.7E+01	5.1E+00	1.4E+01	3.0E+03	4.2E+02	5.0E-01
12	5.3E+00	2.5E+03	1.4E-01	3.6E+01	2.3E+01	1.5E+01	1.0E+02	2.1E-01	2.4E+01	1.6E+01	1.4E+01	3.0E+03	4.5E+03	5.0E-01
13	5.3E+00	2.5E+03	1.4E-01	3.6E+01	2.0E+01	1.5E+01	1.0E+02	2.1E-01	1.7E+01	5.1E+00	1.4E+01	3.0E+03	4.2E+02	5.0E-01
14	5.3E+00	2.5E+03	1.4E-01	3.6E+01	2.0E+01	1.5E+01	1.0E+02	2.1E-01	1.7E+01	5.1E+00	1.4E+01	3.0E+03	4.2E+02	5.0E-01
15	5.3E+00	2.5E+03	1.4E-01	3.6E+01	2.0E+01	1.5E+01	1.0E+02	2.1E-01	1.7E+01	5.1E+00	1.4E+01	3.0E+03	4.2E+02	5.0E-01
16	2.9E-02	1.6E+01	1.0E-01	4.3E-01	3.2E-01	5.9E-02	1.1E-01	2.0E-01	7.3E+00	1.7E+00	1.1E-01	1.4E+03	6.1E+00	7.5E-03
21	1.8E+00	3.8E+01	2.5E-02	3.6E+01	3.0E+00	2.7E+00	2.0E+01	8.5E-02	4.3E+00	6.0E-01	9.0E-01	6.2E+02	4.6E+01	2.0E-01
22	1.8E+00	3.8E+01	2.5E-02	3.6E+01	3.0E+00	2.7E+00	2.0E+01	8.5E-02	4.3E+00	6.0E-01	9.0E-01	6.2E+02	4.6E+01	2.0E-01
23	1.8E+00	3.8E+01	2.5E-02	3.6E+01	3.0E+00	2.7E+00	2.0E+01	8.5E-02	4.3E+00	6.0E-01	9.0E-01	6.2E+02	4.6E+01	2.0E-01
24	1.8E+00	3.8E+01	2.9E-03	3.6E+01	3.0E+00	2.7E+00	2.0E+01	8.5E-02	4.3E+00	6.0E-01	9.0E-01	6.2E+02	4.6E+01	2.0E-01
29	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
30	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
31	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
32	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
35	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
36	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
37	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
38	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
39	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
40	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
41	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
42	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
43	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
48	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
49	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
50	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00
51	8.2E+00	2.3E+03	1.5E-01	3.6E+01	2.1E+01	1.6E+01	6.8E+01	3.7E-01	2.8E+01	8.0E+00	2.8E+01	1.7E+03	6.9E+02	1.2E+00

Table 6.2-3: Assigned Chemical Inventory (kg) at Closure (Continued)

Tank	Mn	Mo	Ni	NO_2	NO_3	Pb	PO_4	Sb	Se	SO_4	Sr	U	Zn
9	5.7E+02	3.6E+01	6.3E+01	3.5E+03	3.2E+02	5.0E+01	8.8E+00	6.0E+00	1.1E-02	4.4E+01	5.6E+00	8.8E+01	6.0E+00
10	5.7E+02	3.6E+01	6.3E+01	3.5E+03	3.2E+02	5.0E+01	8.8E+00	6.0E+00	1.1E-02	4.4E+01	5.6E+00	8.8E+01	6.0E+00
11	5.7E+02	3.6E+01	6.3E+01	3.5E+03	3.2E+02	5.0E+01	8.8E+00	6.0E+00	1.1E-02	4.4E+01	5.6E+00	8.8E+01	6.0E+00
12	3.2E+03	3.6E+01	3.9E+02	3.5E+03	3.2E+02	5.0E+01	8.8E+00	6.0E+00	1.1E-02	4.4E+01	1.1E+01	4.0E+02	6.0E+00
13	5.7E+02	3.6E+01	6.3E+01	3.5E+03	3.2E+02	5.0E+01	8.8E+00	6.0E+00	1.1E-02	4.4E+01	5.6E+00	8.8E+01	6.0E+00
14	5.7E+02	3.6E+01	6.3E+01	3.5E+03	3.2E+02	5.0E+01	8.8E+00	6.0E+00	1.1E-02	4.4E+01	5.6E+00	8.8E+01	6.0E+00
15	5.7E+02	3.6E+01	6.3E+01	3.5E+03	3.2E+02	5.0E+01	8.8E+00	6.0E+00	1.1E-02	4.4E+01	5.6E+00	8.8E+01	6.0E+00
16	1.4E+01	1.8E-01	6.5E-01	1.1E-01	1.3E+00	2.4E+01	1.1E-01	6.3E-01	1.2E-02	1.1E-01	7.6E-01	4.8E+00	2.0E+00
21	8.5E+00	3.6E+01	4.6E+01	7.2E+02	2.6E+01	1.0E+01	4.8E+01	1.1E+00	2.0E-03	3.4E+01	6.0E-01	2.2E+01	1.5E+01
22	8.5E+00	3.6E+01	4.6E+01	7.2E+02	2.6E+01	1.0E+01	4.8E+01	1.1E+00	2.0E-03	3.4E+01	6.0E-01	2.2E+01	1.5E+01
23	8.5E+00	3.6E+01	4.6E+01	7.2E+02	2.6E+01	1.0E+01	4.8E+01	1.1E+00	2.0E-03	3.4E+01	6.0E-01	2.2E+01	1.5E+01
24	8.5E+00	3.6E+01	4.6E+01	7.2E+02	2.6E+01	1.0E+01	4.8E+01	1.1E+00	2.0E-03	3.4E+01	6.0E-01	2.2E+01	1.5E+01
29	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
30	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
31	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
32	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
35	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
36	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
37	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
38	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
39	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
40	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
41	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
42	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
43	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
48	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
49	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
50	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01
51	3.6E+02	3.6E+01	1.3E+02	1.3E+03	6.1E+02	3.2E+01	1.7E+01	6.5E+00	1.2E-02	7.0E+01	9.4E+00	2.3E+02	1.0E+01

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Table 6.2-4: Assigned Annulus Radiological Inventory at Closure Decayed to Year 2032

Radionuclide	Tank 9 (Ci)	Tank 10 (Ci)	Tank 11 (Ci)	Tank 12 (Ci)	Tank 13 (Ci)	Tank 14 (Ci)	Tank 15 (Ci)	Tank 16 (Ci)
Ac-227	1.0E+00	1.0E+00	1.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	0.0E+00
Al-26	1.0E+00	1.0E+00	1.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	0.0E+00
Am-241	7.5E+00	7.5E+00	3.9E-01	9.8E-02	3.9E-01	7.5E+00	3.9E-01	7.5E+00
Am-242m	3.8E-03	3.8E-03	2.0E-04	4.9E-05	2.0E-04	3.8E-03	2.0E-04	3.8E-03
Am-243	8.0E-03	8.0E-03	4.2E-04	1.0E-04	4.2E-04	8.0E-03	4.2E-04	8.0E-03
Ba-137m	3.5E+03	3.5E+03	1.8E+02	4.6E+01	1.8E+02	3.5E+03	1.8E+02	3.5E+03
C-14	4.9E-03	4.9E-03	2.6E-04	6.4E-05	2.6E-04	4.9E-03	2.6E-04	4.9E-03
Cf-249	6.3E-03	6.3E-03	3.3E-04	0.0E+00	3.3E-04	6.3E-03	3.3E-04	6.3E-03
Cf-251	1.7E-02	1.7E-02	8.9E-04	0.0E+00	8.9E-04	1.7E-02	8.9E-04	1.7E-02
Cl-36	3.1E-03	3.1E-03	1.6E-04	0.0E+00	1.6E-04	3.1E-03	1.6E-04	3.1E-03
Cm-243	1.4E-02	1.4E-02	7.2E-04	1.8E-04	7.2E-04	1.4E-02	7.2E-04	1.4E-02
Cm-244	3.9E-01	3.9E-01	2.0E-02	5.1E-03	2.0E-02	3.9E-01	2.0E-02	3.9E-01
Cm-245	7.4E-05	7.4E-05	3.9E-06	9.7E-07	3.9E-06	7.4E-05	3.9E-06	7.4E-05
Cm-247	4.8E-09	4.8E-09	2.5E-10	0.0E+00	2.5E-10	4.8E-09	2.5E-10	4.8E-09
Cm-248	5.4E-06	5.4E-06	2.8E-07	0.0E+00	2.8E-07	5.4E-06	2.8E-07	5.4E-06
Co-60	1.9E-03	1.9E-03	9.8E-05	0.0E+00	9.8E-05	1.9E-03	9.8E-05	1.9E-03
Cs-135	2.0E-02	2.0E-02	1.0E-03	2.6E-04	1.0E-03	2.0E-02	1.0E-03	2.0E-02
Cs-137	3.7E+03	3.7E+03	2.0E+02	4.9E+01	2.0E+02	3.7E+03	2.0E+02	3.7E+03
Eu-152	2.1E+01	2.1E+01	2.1E+01	0.0E+00	2.1E+01	2.1E+01	2.1E+01	0.0E+00
Eu-154	2.9E+00	2.9E+00	8.8E-02	0.0E+00	8.8E-02	2.9E+00	8.8E-02	0.0E+00
H-3	1.0E+00	1.0E+00	1.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	0.0E+00
I-129	7.9E-03	7.9E-03	4.1E-04	1.0E-04	4.1E-04	7.9E-03	4.1E-04	7.9E-03
K-40	1.7E-04	1.7E-04	8.9E-06	0.0E+00	8.9E-06	1.7E-04	8.9E-06	1.7E-04
Nb-94	2.6E-03	2.6E-03	1.4E-04	3.4E-05	1.4E-04	2.6E-03	1.4E-04	2.6E-03
Ni-59	9.3E-03	9.3E-03	4.9E-04	1.2E-04	4.9E-04	9.3E-03	4.9E-04	9.3E-03
Ni-63	3.6E-01	3.6E-01	1.9E-02	4.7E-03	1.9E-02	3.6E-01	1.9E-02	3.6E-01
Np-237	2.0E-02	2.0E-02	1.1E-03	2.7E-04	1.1E-03	2.0E-02	1.1E-03	2.0E-02

Table 6.2-4: Assigned Annulus Radiological Inventory at Closure Decayed to Year 2032 (Continued)

Radionuclide	Tank 9 (Ci)	Tank 10 (Ci)	Tank 11 (Ci)	Tank 12 (Ci)	Tank 13 (Ci)	Tank 14 (Ci)	Tank 15 (Ci)	Tank 16 (Ci)
Pa-231	1.6E-03	1.6E-03	8.2E-05	2.0E-05	8.2E-05	1.6E-03	8.2E-05	1.6E-03
Pd-107	1.7E-01	1.7E-01	5.3E-03	0.0E+00	5.3E-03	1.7E-01	5.3E-03	0.0E+00
Pt-193	1.7E-01	1.7E-01	5.3E-03	0.0E+00	5.3E-03	1.7E-01	5.3E-03	0.0E+00
Pu-238	3.0E+01	3.0E+01	1.6E+00	3.9E-01	1.6E+00	3.0E+01	1.6E+00	3.0E+01
Pu-239	4.7E+00	4.7E+00	2.5E-01	6.2E-02	2.5E-01	4.7E+00	2.5E-01	4.7E+00
Pu-240	2.1E+00	2.1E+00	1.1E-01	2.8E-02	1.1E-01	2.1E+00	1.1E-01	2.1E+00
Pu-241	5.8E+00	5.8E+00	3.0E-01	7.6E-02	3.0E-01	5.8E+00	3.0E-01	5.8E+00
Pu-242	8.4E-04	8.4E-04	4.4E-05	0.0E+00	4.4E-05	8.4E-04	4.4E-05	8.4E-04
Pu-244	7.0E-07	7.0E-07	3.7E-08	0.0E+00	3.7E-08	7.0E-07	3.7E-08	7.0E-07
Ra-226	1.0E-03	1.0E-03	5.5E-05	1.4E-05	5.5E-05	1.0E-03	5.5E-05	1.0E-03
Ra-228	1.7E+00	1.7E+00	5.3E-02	5.3E-02	5.3E-02	1.7E+00	5.3E-02	0.0E+00
Se-79	4.8E+00	4.8E+00	4.8E+00	0.0E+00	4.8E+00	4.8E+00	4.8E+00	0.0E+00
Sm-151	1.5E+02	1.5E+02	4.7E+00	0.0E+00	4.7E+00	1.5E+02	4.7E+00	0.0E+00
Sn-126	4.6E+00	4.6E+00	4.6E+00	4.6E+00	4.6E+00	4.6E+00	4.6E+00	0.0E+00
Sr-90	1.0E+04	1.0E+04	5.3E+02	1.3E+02	5.3E+02	1.0E+04	5.3E+02	1.0E+04
Tc-99	1.9E+00	1.9E+00	1.0E-01	2.5E-02	1.0E-01	1.9E+00	1.0E-01	1.9E+00
Th-229	1.7E-03	1.7E-03	5.3E-05	5.3E-05	5.3E-05	1.7E-03	5.3E-05	0.0E+00
Th-230	3.7E-04	3.7E-04	1.9E-05	4.8E-06	1.9E-05	3.7E-04	1.9E-05	3.7E-04
Th-232	2.4E-02	2.4E-02	7.1E-04	7.1E-04	7.1E-04	2.4E-02	7.1E-04	0.0E+00
U-232	1.7E-03	1.7E-03	5.3E-05	5.3E-05	5.3E-05	1.7E-03	5.3E-05	0.0E+00
U-233	1.1E-02	1.1E-02	5.9E-04	1.5E-04	5.9E-04	1.1E-02	5.9E-04	1.1E-02
U-234	1.2E-02	1.2E-02	6.5E-04	1.6E-04	6.5E-04	1.2E-02	6.5E-04	1.2E-02
U-235	1.8E-04	1.8E-04	9.2E-06	2.3E-06	9.2E-06	1.8E-04	9.2E-06	1.8E-04
U-236	1.2E-03	1.2E-03	3.6E-05	0.0E+00	3.6E-05	1.2E-03	3.6E-05	0.0E+00
U-238	7.9E-04	7.9E-04	4.1E-05	1.0E-05	4.1E-05	7.9E-04	4.1E-05	7.9E-04
Y-90	1.0E+04	1.0E+04	5.3E+02	1.3E+02	5.3E+02	1.0E+04	5.3E+02	1.0E+04
Zr-93	8.7E-01	8.7E-01	4.5E-02	1.1E-02	4.5E-02	8.7E-01	4.5E-02	8.7E-01

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Table 6.2-5: Assigned Annulus Chemical Inventory at Closure

Chemical	Tank 9 (kg)	Tank 10 (kg)	Tank 11 (kg)	Tank 12 (kg)	Tank 13 (kg)	Tank 14 (kg)	Tank 15 (kg)	Tank 16 (kg)
Ag	2.3E-01	2.3E-01	1.2E-02	3.0E-03	1.2E-02	2.3E-01	1.2E-02	2.3E-01
Al	5.1E+02	5.1E+02	2.7E+01	6.6E+00	2.7E+01	5.1E+02	2.7E+01	5.1E+02
As	1.8E-02	1.8E-02	9.3E-04	2.3E-04	9.3E-04	1.8E-02	9.3E-04	1.8E-02
B	3.3E+00	3.3E+00	1.7E-01	4.3E-02	1.7E-01	3.3E+00	1.7E-01	3.3E+00
Ba	1.5E+00	1.5E+00	7.9E-02	2.0E-02	7.9E-02	1.5E+00	7.9E-02	1.5E+00
Cd	2.4E-01	2.4E-01	1.2E-02	3.1E-03	1.2E-02	2.4E-01	1.2E-02	2.4E-01
Cl	4.6E+00	4.6E+00	2.4E-01	6.1E-02	2.4E-01	4.6E+00	2.4E-01	4.6E+00
Co	2.0E+00	2.0E+00	1.0E-01	2.6E-02	1.0E-01	2.0E+00	1.0E-01	2.0E+00
Cr	2.1E+00	2.1E+00	1.1E-01	2.7E-02	1.1E-01	2.1E+00	1.1E-01	2.1E+00
Cu	1.0E+01	1.0E+01	5.5E-01	1.4E-01	5.5E-01	1.0E+01	5.5E-01	1.0E+01
F	1.9E+00	1.9E+00	9.9E-02	2.5E-02	9.9E-02	1.9E+00	9.9E-02	1.9E+00
Fe	2.3E+02	2.3E+02	1.2E+01	3.0E+00	1.2E+01	2.3E+02	1.2E+01	2.3E+02
Hg	1.7E+01	1.7E+01	8.9E-01	2.2E-01	8.9E-01	1.7E+01	8.9E-01	1.7E+01
I	2.6E-02	2.6E-02	1.4E-03	3.5E-04	1.4E-03	2.6E-02	1.4E-03	2.6E-02
Mn	2.4E+00	2.4E+00	1.2E-01	3.1E-02	1.2E-01	2.4E+00	1.2E-01	2.4E+00
Mo	2.5E+00	2.5E+00	1.3E-01	3.3E-02	1.3E-01	2.5E+00	1.3E-01	2.5E+00
Ni	3.5E+00	3.5E+00	1.8E-01	4.6E-02	1.8E-01	3.5E+00	1.8E-01	3.5E+00
NO_2	4.4E+02	4.4E+02	2.3E+01	5.8E+00	2.3E+01	4.4E+02	2.3E+01	4.4E+02
NO_3	3.8E+02	3.8E+02	2.0E+01	5.0E+00	2.0E+01	3.8E+02	2.0E+01	3.8E+02
Pb	8.9E+00	8.9E+00	4.7E-01	1.2E-01	4.7E-01	8.9E+00	4.7E-01	8.9E+00
PO_4	1.9E+00	1.9E+00	9.9E-02	2.5E-02	9.9E-02	1.9E+00	9.9E-02	1.9E+00
Sb	4.9E+00	4.9E+00	2.6E-01	6.4E-02	2.6E-01	4.9E+00	2.6E-01	4.9E+00
Se	8.7E-02	8.7E-02	4.5E-03	1.1E-03	4.5E-03	8.7E-02	4.5E-03	8.7E-02
SO_4	6.7E+01	6.7E+01	3.5E+00	8.8E-01	3.5E+00	6.7E+01	3.5E+00	6.7E+01
Sr	4.4E-01	4.4E-01	2.3E-02	5.7E-03	2.3E-02	4.4E-01	2.3E-02	4.4E-01
U	1.6E+01	1.6E+01	8.6E-01	2.1E-01	8.6E-01	1.6E+01	8.6E-01	1.6E+01
Zn	3.2E+00	3.2E+00	1.6E-01	4.1E-02	1.6E-01	3.2E+00	1.6E-01	3.2E+00

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Table 6.2-6: Assigned Type II Sand Pad Radiological Inventory at Closure Decayed to Year 2032

Radionuclide	Tank 13 (Ci)	Tank 14 (Ci)	Tank 15 (Ci)	Tank 16 (Ci)	
	Primary	Primary	Primary	Primary	Secondary
Ac-227	1.0E+00	1.0E+00	1.0E+00	0.0E+00	0.0E+00
Al-26	1.0E+00	1.0E+00	1.0E+00	0.0E+00	0.0E+00
Am-241	3.9E-01	5.1E+00	3.9E-01	5.1E+00	1.0E-01
Am-242m	2.0E-04	2.6E-03	2.0E-04	2.6E-03	5.1E-05
Am-243	4.2E-04	5.4E-03	4.2E-04	5.4E-03	1.1E-04
Ba-137m	1.8E+02	2.4E+03	1.8E+02	2.4E+03	4.8E+01
C-14	2.6E-04	3.3E-03	2.6E-04	3.3E-03	6.6E-05
Cf-249	3.3E-04	4.3E-03	3.3E-04	4.3E-03	8.6E-05
Cf-251	8.9E-04	1.2E-02	8.9E-04	1.2E-02	2.3E-04
Cl-36	1.6E-04	2.1E-03	1.6E-04	2.1E-03	4.2E-05
Cm-243	7.2E-04	9.4E-03	7.2E-04	9.4E-03	1.9E-04
Cm-244	2.0E-02	2.6E-01	2.0E-02	2.6E-01	5.3E-03
Cm-245	3.9E-06	5.0E-05	3.9E-06	5.0E-05	1.0E-06
Cm-247	2.5E-10	3.2E-09	2.5E-10	3.2E-09	6.5E-11
Cm-248	2.8E-07	3.7E-06	2.8E-07	3.7E-06	7.3E-08
Co-60	9.8E-05	1.3E-03	9.8E-05	1.3E-03	2.6E-05
Cs-135	1.0E-03	1.3E-02	1.0E-03	1.3E-02	2.7E-04
Cs-137	2.0E+02	2.5E+03	2.0E+02	2.5E+03	5.1E+01
Eu-152	2.1E+01	2.1E+01	2.1E+01	0.0E+00	0.0E+00
Eu-154	8.8E-02	1.1E+00	8.8E-02	0.0E+00	0.0E+00
H-3	1.0E+00	1.0E+00	1.0E+00	0.0E+00	0.0E+00
I-129	4.1E-04	5.4E-03	4.1E-04	5.4E-03	1.1E-04
K-40	8.9E-06	1.2E-04	8.9E-06	1.2E-04	2.3E-06
Nb-94	1.4E-04	1.8E-03	1.4E-04	1.8E-03	3.5E-05
Ni-59	4.9E-04	6.3E-03	4.9E-04	6.3E-03	1.3E-04
Ni-63	1.9E-02	2.4E-01	1.9E-02	2.4E-01	4.9E-03
Np-237	1.1E-03	1.4E-02	1.1E-03	1.4E-02	2.8E-04

Table 6.2-6: Assigned Type II Sand Pad Radiological Inventory at Closure Decayed to Year 2032 (Continued)

Radionuclide	Tank 13 (Ci)	Tank 14 (Ci)	Tank 15 (Ci)	Tank 16 (Ci)	
	Primary	Primary	Primary	Primary	Secondary
Pa-231	8.2E-05	1.1E-03	8.2E-05	1.1E-03	2.1E-05
Pd-107	5.3E-03	6.9E-02	5.3E-03	0.0E+00	0.0E+00
Pt-193	5.3E-03	6.9E-02	5.3E-03	0.0E+00	0.0E+00
Pu-238	1.6E+00	2.0E+01	1.6E+00	2.0E+01	4.1E-01
Pu-239	2.5E-01	3.2E+00	2.5E-01	3.2E+00	6.4E-02
Pu-240	1.1E-01	1.5E+00	1.1E-01	1.5E+00	2.9E-02
Pu-241	3.0E-01	4.0E+00	3.0E-01	4.0E+00	7.9E-02
Pu-242	4.4E-05	5.7E-04	4.4E-05	5.7E-04	1.1E-05
Pu-244	3.7E-08	4.8E-07	3.7E-08	4.8E-07	9.5E-09
Ra-226	5.5E-05	7.1E-04	5.5E-05	7.1E-04	1.4E-05
Ra-228	5.3E-02	6.9E-01	5.3E-02	0.0E+00	0.0E+00
Se-79	4.8E+00	4.8E+00	4.8E+00	0.0E+00	0.0E+00
Sm-151	4.7E+00	6.1E+01	4.7E+00	0.0E+00	0.0E+00
Sn-126	4.6E+00	4.6E+00	4.6E+00	0.0E+00	0.0E+00
Sr-90	5.3E+02	6.9E+03	5.3E+02	6.9E+03	1.4E+02
Tc-99	1.0E-01	1.3E+00	1.0E-01	1.3E+00	2.6E-02
Th-229	5.3E-05	6.9E-04	5.3E-05	0.0E+00	0.0E+00
Th-230	1.9E-05	2.5E-04	1.9E-05	2.5E-04	5.0E-06
Th-232	7.1E-04	9.3E-03	7.1E-04	0.0E+00	0.0E+00
U-232	5.3E-05	6.9E-04	5.3E-05	0.0E+00	0.0E+00
U-233	5.9E-04	7.7E-03	5.9E-04	7.7E-03	1.5E-04
U-234	6.5E-04	8.5E-03	6.5E-04	8.5E-03	1.7E-04
U-235	9.2E-06	1.2E-04	9.2E-06	1.2E-04	2.4E-06
U-236	3.6E-05	4.7E-04	3.6E-05	0.0E+00	0.0E+00
U-238	4.1E-05	5.4E-04	4.1E-05	5.4E-04	1.1E-05
Y-90	5.3E+02	6.9E+03	5.3E+02	6.9E+03	1.4E+02
Zr-93	4.5E-02	5.9E-01	4.5E-02	5.9E-01	1.2E-02

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Table 6.2-7: Assigned Type II Sand Pad Chemical Inventory at Closure

Chemical	Tank 13 (kg)	Tank 14 (kg)	Tank 15 (kg)	Tank 16 (kg)	
	Primary	Primary	Primary	Primary	Secondary
Ag	1.2E-02	1.5E-01	1.2E-02	1.5E-01	3.1E-03
Al	2.7E+01	3.5E+02	2.7E+01	3.5E+02	6.9E+00
As	9.3E-04	1.2E-02	9.3E-04	1.2E-02	2.4E-04
B	1.7E-01	2.2E+00	1.7E-01	2.2E+00	4.5E-02
Ba	7.9E-02	1.0E+00	7.9E-02	1.0E+00	2.1E-02
Cd	1.2E-02	1.6E-01	1.2E-02	1.6E-01	3.2E-03
Cl	2.4E-01	3.1E+00	2.4E-01	3.1E+00	6.3E-02
Co	1.0E-01	1.3E+00	1.0E-01	1.3E+00	2.7E-02
Cr	1.1E-01	1.4E+00	1.1E-01	1.4E+00	2.8E-02
Cu	5.5E-01	7.1E+00	5.5E-01	7.1E+00	1.4E-01
F	9.9E-02	1.3E+00	9.9E-02	1.3E+00	2.6E-02
Fe	1.2E+01	1.6E+02	1.2E+01	1.6E+02	3.2E+00
Hg	8.9E-01	1.2E+01	8.9E-01	1.2E+01	2.3E-01
I	1.4E-03	1.8E-02	1.4E-03	1.8E-02	3.6E-04
Mn	1.2E-01	1.6E+00	1.2E-01	1.6E+00	3.2E-02
Mo	1.3E-01	1.7E+00	1.3E-01	1.7E+00	3.4E-02
Ni	1.8E-01	2.4E+00	1.8E-01	2.4E+00	4.8E-02
NO_2	2.3E+01	3.0E+02	2.3E+01	3.0E+02	6.0E+00
NO_3	2.0E+01	2.6E+02	2.0E+01	2.6E+02	5.2E+00
Pb	4.7E-01	6.0E+00	4.7E-01	6.0E+00	1.2E-01
PO_4	9.9E-02	1.3E+00	9.9E-02	1.3E+00	2.6E-02
Sb	2.6E-01	3.3E+00	2.6E-01	3.3E+00	6.7E-02
Se	4.5E-03	5.9E-02	4.5E-03	5.9E-02	1.2E-03
SO_4	3.5E+00	4.6E+01	3.5E+00	4.6E+01	9.1E-01
Sr	2.3E-02	3.0E-01	2.3E-02	3.0E-01	5.9E-03
U	8.6E-01	1.1E+01	8.6E-01	1.1E+01	2.2E-01
Zn	1.6E-01	2.1E+00	1.6E-01	2.1E+00	4.3E-02

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6.3 The H-Tank Farm Analysis of Performance

This section will discuss the impact of the new characterization information on the HTF analysis of performance information presented in Section 4.0 of the HTF PA.

6.3.1 Overview of Analysis

Section 4.1 of HTF PA contains an overview of analysis. The overview of analysis information presented in the HTF PA is not affected by the new characterization information.

6.3.2 Integrated Site Conceptual Model of Facility Performance

Section 4.2 of HTF PA describes the Integrated Conceptual Model (ICM), which is used to simulate the release of radiological and chemical contaminants from the 29 underground waste tanks and associated ancillary equipment in HTF. The Section 4.2 ICM information presented in the HTF PA is not affected by the new characterization information.

Section 4.2.1 (Source Term Release) of the HTF PA includes a discussion of the waste release model, which is an integral part of the modeling process. The information regarding the residual waste characteristics presented in the Tank 16 waste characterization report (SRR-CWDA-2014-00071) is summarized in Section 5.0 of this SA, is consistent with the source term release assumptions, and does not impact the waste release model. As documented in the *Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program, FY2015 Implementation Plan* (SRR-CWDA-2014-00108), work is underway to provide additional information regarding the residual waste solubility assumptions used in the performance assessment waste release models, as recommended in the NRC HTF TER. The task involves developing a series of analytic methods for use in testing the solubility of plutonium, neptunium, uranium and technetium under various simulated waste tank chemistry conditions using actual waste tank residuals. While these activities are expected to provide additional model support to further reduce analysis uncertainty, it should be noted that the modeling results from this SA are most sensitive to I-129, which is not a radionuclide impacted by waste release model uncertainty (e.g., Pu, Np, U).

Section 4.2.2 (Radionuclide Transport) of HTF PA includes a discussion of the groundwater flow simulation modeling. This SA utilizes the HTF PA flow field modeling, which is based on the most current H-Area far-field model available. Flow field sensitivity analyses were performed previously to supplement the HTF PA, and these sensitivity analyses provide assurance that the Tank 16 SA results would not be significantly impacted by flow field uncertainty. [SRR-CWDA-2013-00106] The nominal flow characterization currently embodied in the HTF models represents a reasonable estimate of hydrogeological behavior within the post-closure environment. The GSA model reasonably fits the underlying data and is adequate for the purposes of fate and transport modeling in the HTF PA, considering the risk significance of hydraulic conductivity and flow field variability. The risk significance of hydraulic conductivity adjustments and other settings in the GSA/PORFLOW far field flow model were assessed by considering the sensitivity of solute transport simulations to potential variations in the aquifer velocity field, which affects plume travel time and distance.

Section 4.2.2.2 (Material Properties) of HTF PA includes a discussion of the materials properties that are of interest to the modeling process. The soil and cementitious material distribution coefficients used in the HTF PA were updated to reflect the most currently available sorption coefficients (K_d). [SRNL-STI-2014-00612]

6.3.3 Modeling Codes

Section 4.3 of the HTF PA contains a discussion of the modeling codes. The HTF PORFLOW flow model was not changed for the modeling runs performed for this SA but the model was rerun with the updated HTF inventories. The HTF PORFLOW transport model was slightly changed from the HTF PA, with the primary change being segmentation of the annulus inventories from the sand pad inventories. The modeling runs performed for this SA, presented in Section 6.2, also included updated HTF inventories and updated K_d values. Notable K_d changes included updates to the iodine K_d for soils. [SRNL-STI-2014-00612]

The inventory segmentation was implemented as follows:

- No changes were made to the primary liner modeling.
- For the TypeI, TypeI_noliner, TypeII and TypeII_noliner models, a new material zone named "ANN_WASTE" was created from the bottom half-inch of the previous "ANNULUS_GROUT" zone, and the latter redefined to omit the former.
- The ANN_WASTE zone was assigned the same physical properties as CONTAM_ZONE (primary waste layer inside a tank), Reducing+ModerateAge (i.e., Region II) cement K_d, and no solubility constraints.
- Eh and pH transitions are tied to those of the overlying ANNULUS_GROUT region.
- The new ANN_WASTE zone provides more flexibility in positioning residual waste outside the primary liner. For example, separate waste inventories are now assigned to the ANN_WASTE and P_SAND_INV zones for TypeII and TypeII_noliner models.

For the PORFLOW deterministic sensitivity runs, some additional inputs were updated, as discussed in detail in Section 6.3.6.

Additional HTF transport modeling for this SA was performed using an HTF GoldSim model (*GoldSim HTF Radionuclide Model*, HTF_Transport_Model_v1.010_Rad.gsm hereinafter referred to as GoldSim SRS HTF v1.010 Rad), which is discussed in more detail in Section 6.4.6 of this SA. [SRR-CWDA-2014-00060] GoldSim SRS HTF v1.010 Rad also includes updates to the dose calculator. Changes to the dose calculator are documented in *Dose Calculation Methodology for Liquid Waste Performance Assessments at the Savannah River Site* (SRR-CWDA-2013-00058). Quality assurance and user documentation for the updated dynamic link library are found in *Software Quality Assurance Plan for ReadPORFLOWFiles.dll for the Savannah River Sites Liquid Waste Program* (B-SQP-C-00003). Quality assurance (e.g., verification of modeling inputs used) for this model revision is documented in the *Tank 16 Special Analysis for the Performance Assessment for the H-Area Tank Farm at the Savannah River Site: Quality Assurance Report* (SRR-CWDA-2014-00134).

6.3.4 Closure System Modeling

Section 4.4 of the HTF PA describes how the HTF design elements and their associated properties were represented in the computer modeling codes. The closure system modeling information presented in the HTF PA is not affected by the new characterization information.

6.3.5 Airborne and Radon Analysis

Section 4.5 of the HTF PA contains a discussion of the airborne and radon analysis methodology. The air and radon pathway conceptual model and analysis approach presented in the HTF PA are not affected by the new characterization information.

6.3.6 Biotic Pathways

Section 4.6 of the HTF PA documents the bioaccumulation factors and human health exposure parameters used in the HTF PA modeling effort. The bioaccumulation factors and human health exposure parameters presented in the HTF PA are not affected by the new characterization information. The biotic pathway inputs are revised as necessary as the HTF dose calculator is updated.

6.3.7 Dose Analysis

Section 4.7 of the HTF PA contains a discussion of the dose analysis approach used and presents the set of dose conversion factors (DCFs) used in the dose calculations modeling effort methodology. This approach and the related DCFs have been revised to reflect the most recent available data. For example, applicable ingestion and inhalation DCFs were updated based on the *DOE Standard Derived Concentration Technical Standard* (DOE-STD-1196-2011). A complete discussion of the revised dose approach and related inputs is provided in the report *Dose Calculation Methodology for Liquid Waste Performance Assessments at the Savannah River Site* (SRR-CWDA-2013-00058).

6.3.8 RCRA/CERCLA Risk Evaluation

Section 4.8 of the HTF PA contains a discussion of the Resource Conservation and Recovery Act/Comprehensive Environmental Response, Compensation, and Liability Act (RCRA/CERCLA) risk evaluation methodology. The RCRA/CERCLA risk evaluation approach presented in the HTF PA is not affected by the new characterization information.

6.4 H-Tank Farm Results of Analysis

This section will discuss the impact of the new characterization information on the HTF results presented in Section 5.0 of the HTF PA.

6.4.1 Source Term (Analyses Results)

Section 5.1 of the HTF PA discusses source term release from the HTF waste tanks and ancillary equipment. The source term analysis and release results process is not affected by the new residual waste information.

6.4.2 Environmental Transport of Radionuclides

Section 5.2 (Environmental Transport of Radionuclides) of the HTF PA presents the groundwater concentrations for the HTF radionuclides and chemicals. Maximum groundwater concentrations are presented for two exposure points: 1) 100 meters from the HTF and 2) at the seeplines for Upper Three Runs (UTR) and Fourmile Branch. Results are presented in the HTF PA for the three distinct aquifers modeled, UTR Aquifer-Upper Zone (UTRA-UZ), UTRA-Lower Zone (UTRA-LZ) and Gordon Aquifer. The groundwater concentrations at 100 meters and at the seeplines were recalculated using the PORFLOW HTF model for the HTF PA Base Case using the revised HTF inventories presented in Section 6.1.3 of this SA and updated K_d values discussed in Section 6.3.2.

6.4.2.1 Groundwater Concentrations

Groundwater concentrations at 100 meters are calculated in the HTF PA using the PORFLOW HTF model, which divides the area around HTF into computational cells.

Calculation of the 100-meter groundwater concentrations using the PORFLOW HTF model is discussed in more detail in Section 5.2.1 of the HTF PA. The PORFLOW 100-meter groundwater concentrations are calculated for six sectors (Sectors A through F) as shown on Figure 6.4-1. The peak concentration values for the 100-meter results are recorded for the three aquifers of concern (i.e., UTRA-UZ, UTRA-LZ and Gordon Aquifer). The six sectors are analyzed for each radionuclide and chemical to find the maximum groundwater concentrations at 100 meters from the HTF.

Figure 6.4-1: PORFLOW HTF 1-Meter and 100-Meter Model Evaluation Sectors

Note: The individual sectors are indicated by unique diamond colors.

Tables A-1 through A-3 (Appendix A) present the updated peak 100-meter radionuclide concentrations within 1,000 years in each sector for the three aquifers. These radionuclide concentrations reflect the peak concentrations for each radionuclide in the sector.

Tables A-1 through A-3 (Appendix A) also list the MCL for each constituent with the derived values for beta-gamma and photon emitters. The drinking water standard for beta particle and photon radioactivity is specified in the South Carolina *State Primary Drinking Water Regulation*, which states that "the average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water must not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year (mrem/year)." [SCDHEC R.61-58] Because two or more radionuclides are used in the HTF modeled inventory, the effective dose equivalent (EDE) comparison to the MCL is calculated using the sum of the fractions for the individual radionuclides present, as specified in Section R.61-58.5H.(4). The peak concentration of each beta-gamma emitter is compared (in Appendix A) to a specific MCL to determine their fraction. To determine if the 4 mrem/yr beta-gamma limit is met, the sum of the fractions must be less than 1.0.

The EPA document *Radionuclides in Drinking Water: A Small Entity Compliance Guide* outlines the requirements for beta particle and photon emitters. [EPA 815-R-02-001] The Compliance Guide contains a table providing the derived concentrations (pCi/L) of beta and photon emitters in drinking water that yield an EDE of 4 mrem/yr as defined in the *Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure, National Bureau of Standards (NBS) Handbook 69*. [NBS Handbook 69] The derived concentrations in the table are based on a two liter per day drinking water ingestion rate and the 168 hour data listed in the NBS Handbook 69, as amended August 1963. [SCDHEC R.61-58, EPA 815-R-02-001]

Total alpha and total radium concentrations are also provided in Tables A-1 through A-3 (Appendix A). The total alpha MCL includes Ra-226, but does not include radon or uranium. The radium MCL includes both Ra-226 and Ra-228. [SCDHEC R.61-58]

Tables A-4 through A-6 (Appendix A) show the peak updated 100-meter chemical concentrations within 1,000 years in each sector for the three aquifers.

The PORFLOW one-meter groundwater radionuclide and chemical concentrations are also calculated for the six sectors (Sector A through F), shown in Figure 6.4-1. Tables A-9 through A-11 present the peak updated one-meter radionuclide concentrations within 1,000 years in each sector for the three aquifers. Tables A-12 through A-14 show the peak updated one-meter chemical concentrations within 1,000 years in each sector for the three aquifers.

Similarly, Appendix B presents peak radionuclide and chemical concentrations at one-meter and 100-meters within 10,000 years.

Appendix C (Tables C-1 and C-2) presents the peak concentrations for the four radionuclides that make up approximately 99% of the beta-gamma inputs for the individual aquifers and sectors (C-14, I-129, Ni-59 and Tc-99) within 10,000 years. These four radionuclides were analyzed individually, by time of peak occurrence, against the concentration at the same time for the remaining radionuclides.

Appendix D (Tables D-1 and D-2) provides a summary of beta-gamma summed peak concentrations in 1,000 years and 10,000 years, respectively, using updated water ingestion pathway dose conversion factors (WIPDCFs) presented in *Dose Calculation Methodology for Liquid Waste Performance Assessments at the Savannah River Site* (SRR-CWDA-2013-00058) as an alternative MCL calculation. Two radionuclides make up approximately 99% of the beta-gamma dose for the individual aquifers and sectors (Tc-99 within 1,000 years, I-129 and Tc-99 within 10,000 years). For Appendix D, the peak concentrations from sectors and seeplines presented in Appendices A and B are multiplied by the updated WIPDCFs and by a conversion to account for an ingestion rate of 2 liters of water consumed per day (ingestion rate = 2 L/day ÷ 0.931 L/day [assumed consumption rate, described in Section B.1 of *Dose Calculation Methodology for Liquid Waste Performance Assessments at the Savannah River Site*, SRR-CWDA-2013-00058]).

6.4.2.2 Sensitivity Run Radionuclide Determination

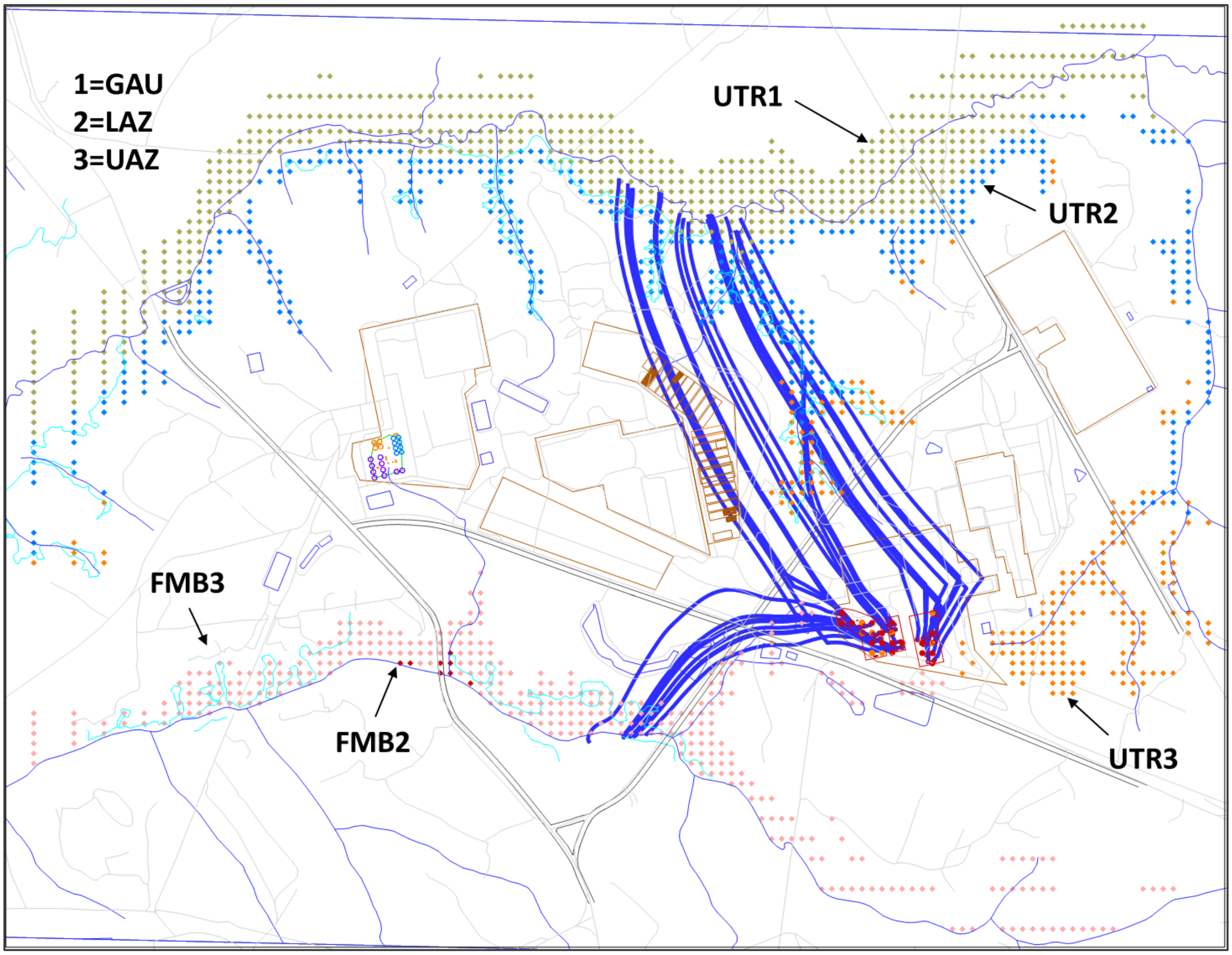
Section 5.2.2 of the HTF PA presents the methodology used to determine which radionuclides were most significant and to document which radionuclides would be considered a "sensitivity run radionuclide." The modeling runs performed for the Tank 16 SA included all of the radionuclides identified in the HTF waste tank inventory and did not utilize the sensitivity run radionuclide list described in the HTF PA.

6.4.2.3 Groundwater Concentrations at the Seeplines

The seepline groundwater concentrations were calculated using the PORFLOW HTF model. Figure 6.4-2 shows that the PORFLOW seepline concentrations are provided for five evaluation sectors (UTR1, UTR2, UTR3, FMB2 and FMB3). These evaluation sectors are based on stream locations (UTR or FMB) and aquifer depths (1 = Gordon, 2 = UTR-LZ and 3 = UTR-UZ) that represent the nearest downstream seeplines to the HTF. The peak concentration values for the seepline results were recorded for each evaluation sector.

Tables A-7 (UTR) and A-8 (Fourmile Branch) in Appendix A present the updated peak seepline radionuclide and chemical concentrations out to 1,000 years. These concentrations reflect the peak concentrations for each constituent in the highest sector. These values are conservatively high for the radionuclides present in multiple decay chains because the totals are simply the sum of the individual peaks within that sector for a given radionuclide without regard to time or location. Similarly, Tables B-7 (UTR) and B-8 (Fourmile Branch) in Appendix B presents peak radionuclide and chemical concentrations within 10,000 years.

Figure 6.4-2: PORFLOW HTF Seepline Evaluation Sectors



UTR1 = Gordon Aquifer Unit (GAU) outcropping to UTR
UTR2 = UTRA-LZ (LAZ) outcropping to UTR
UTR3 = UTRA-UZ (UAZ) outcropping to UTR
FMB2 = UTRA-LZ (LAZ) outcropping to Fourmile Branch
FMB3 = UTRA-UZ (UAZ) outcropping to Fourmile Branch

6.4.3 Air Pathway and Radon Analysis

Section 5.3 of HTF PA presents the air pathway and radon analysis results. Section 4.5 of HTF PA describes the method used to conservatively bound the dose from airborne radionuclides and the results in that section provide a dose to the maximally exposed individual per curie of inventory. Since the HTF Air Pathway dose and Radon results are insignificant (less than 0.0001 mrem/yr and less than 1.5E-14 pCi/m^2/s, respectively) and the radionuclides impacting these results (e.g., C-14, Sn-126, Ra-226, U-234, Pu-238) were not significantly changed by the final Tank 16 inventory, the air pathway and radon analysis results presented in the HTF PA are not appreciably affected by the new characterization information and no revision to those results is required.

6.4.4 Biotic Pathways

Section 5.4 of HTF PA describes how the biotic pathways doses to the MOP are calculated for the receptor with 100-meter well water as a primary water source and for the receptor with groundwater from a stream as a primary water source. The MOP exposure pathway dose methodology is used to convert radionuclide concentrations to total effective dose equivalent (TEDE) values. The MOP dose calculations utilize the most recent DCFs, elemental transfer factors and individual consumption rates as documented in the HTF PA (Section 4.2.3.1, *Member of the Public Exposure Pathways*) and updated in the HTF dose calculator (SRR-CWDA-2013-00058). The TEDE methodology used in calculating TEDE for DOE M 435.1-1 assessment includes multiple dose pathways (e.g., water, vegetable, and beef ingestion), in comparison to the radiological beta-gamma dose calculated for the state drinking water standard (Tables 5.1-1 and 5.1-2), which is an EDE based solely on water ingestion. The information regarding biotic pathways calculations presented in the HTF PA is not affected by the new characterization information.

6.4.5 Dose Analysis of Member of the Public Exposure

Section 5.5 (Dose Analysis) of the HTF PA contains calculations of the peak total doses for a) the MOP at 100 meters and b) the MOP at applicable stream seeplines (either UTR or Fourmile Branch). The peak doses have been recalculated using the peak groundwater concentrations identified in Section 6.4.2 of this SA (i.e., the groundwater concentrations at 100 meters and at the seepline). The doses were recalculated using the PORFLOW HTF model for the HTF PA Base Case using the revised HTF inventories.

6.4.5.1 Member of the Public at 100-Meter Groundwater Pathway Dose Results

Table 6.4-1 shows a comparison of the 100-meter peak groundwater pathway doses (recalculated using the concentrations associated with the revised HTF inventories) for the different 100-meter sectors within 1,000 and 10,000 years. In calculating the peak groundwater pathway dose, the highest radionuclide concentration within each sector's vertical and horizontal computational mesh from each of the three distinct aquifers modeled (UTRA-UZ, UTRA-LZ and the Gordon Aquifer), is used, maximizing the computed dose within each sector at each time step. The calculated groundwater pathway doses are TEDE, as described in Section 6.4.4.

Table 6.4-1: 100-Meter MOP Peak Groundwater Pathways Dose by Sector

Sector[a]	Peak Dose in 1,000 Years	Peak Dose in 10,000 Years
A	**0.2 mrem/yr (year 780)** Principal Radionuclide: Tc-99	**4 mrem/yr (year 2,610)** Principal Radionuclide: I-129
B	**0.2 mrem/yr (year 780)** Principal Radionuclide: Tc-99	**2 mrem/yr (year 3,920)** Principal Radionuclides: I-129
C	**0.2 mrem/yr (year 830)** Principal Radionuclide: Tc-99	**2 mrem/yr (year 10,000)** Principal Radionuclide: Ra-226
D	**0.03 mrem/yr (year 880)** Principal Radionuclide: Tc-99	**0.1 mrem/yr (year 3,840)** Principal Radionuclide: I-129
E	**0.1 mrem/yr (year 870)** Principal Radionuclide: Tc-99	**0.1 mrem/yr (year 870)** Principal Radionuclide: Tc-99
F	**0.1 mrem/yr (year 870)** Principal Radionuclide: Tc-99	**0.2 mrem/yr (year 3,950)** Principal Radionuclide: I-129

[a] Sectors illustrated in Figure 6.4-1

Note: Dose values are shown to two significant figures to illustrate changes/trends. The use of two significant figures is not meant to imply this level of precision for these dose projections.

Figures 6.4-3 and 6.4-4 present the peak doses to the 100-meter MOP receptor over time during the 1,000 and 10,000 time-periods for the 100-meter sectors respectively. The peak 100-meter MOP groundwater pathway dose within 1,000 years is 0.2 mrem/yr (in Sectors A, B and C), and within 10,000 years is 4.1 mrem/yr (in Sector A). The all-pathways dose is the same as the groundwater pathways dose due to the negligible dose contribution from the air pathway, as discussed in Section 6.4.3.

An overview of the modeling results indicate:

- Early dose peaks (prior to year 2,500) are associated with the inventory from ancillary equipment (including transfer lines), from sand pads under Type II tanks and waste tanks assumed to have failed steel liners at the time of closure (Tanks 12, 14, 15 and 16).
- Peak doses to the MOP within 10,000 years at the 100-meter boundary are primarily from Tc-99, I-129 and Ra-226 (Figures 6.4-6 and 6.4-8) from the groundwater pathways in Sectors A, B and C.
- The 4.1 mrem/yr peak dose in Sector A (at year 2,610) is primarily from the Tank 12 I-129 inventory. This dose peak is a change from the HTF PA, resulting from the Tank 12 forecast inventory conservatively increasing the assigned Tank 12 I-129 inventory.
- There is a gradual increase in the Sector A, B and C peak doses after year 5,000 due to Ra-226 release.

- The peak dose associated with Tc-99 within 10,000 years (1.2 mrem/yr in Sector A) is around year 8,800 (Figure 6.4-6) and is associated with releases from the annuli of Tank 9, 10 and 11.

Peak doses beyond 10,000 years are investigated in Section 6.4.5.3 of this SA, which provides the 100-meter MOP receptor doses within 100,000 years for Tanks 12 and 16. These waste tanks are the tanks with significant inventory changes from what was previously modeled in the HTF PA.

Figure 6.4-3: 100-Meter MOP Groundwater Pathway Dose within 1,000 Years for the Six 100-Meter Sectors

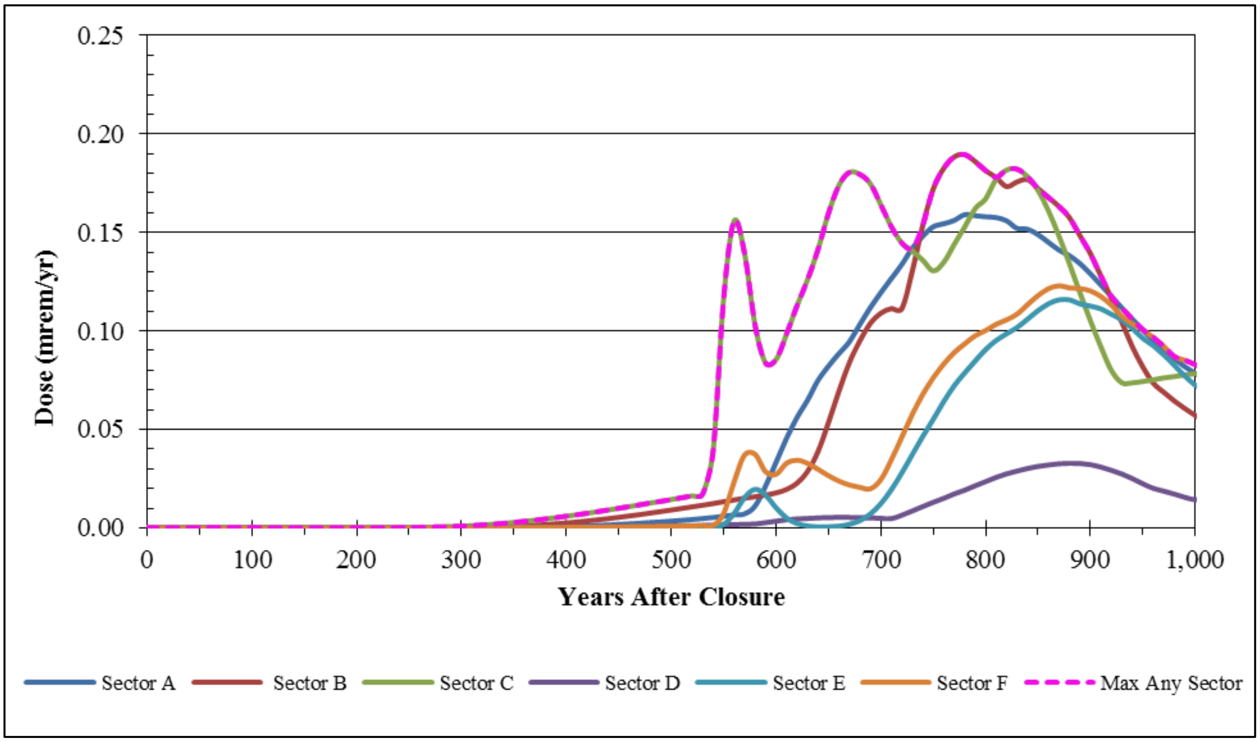
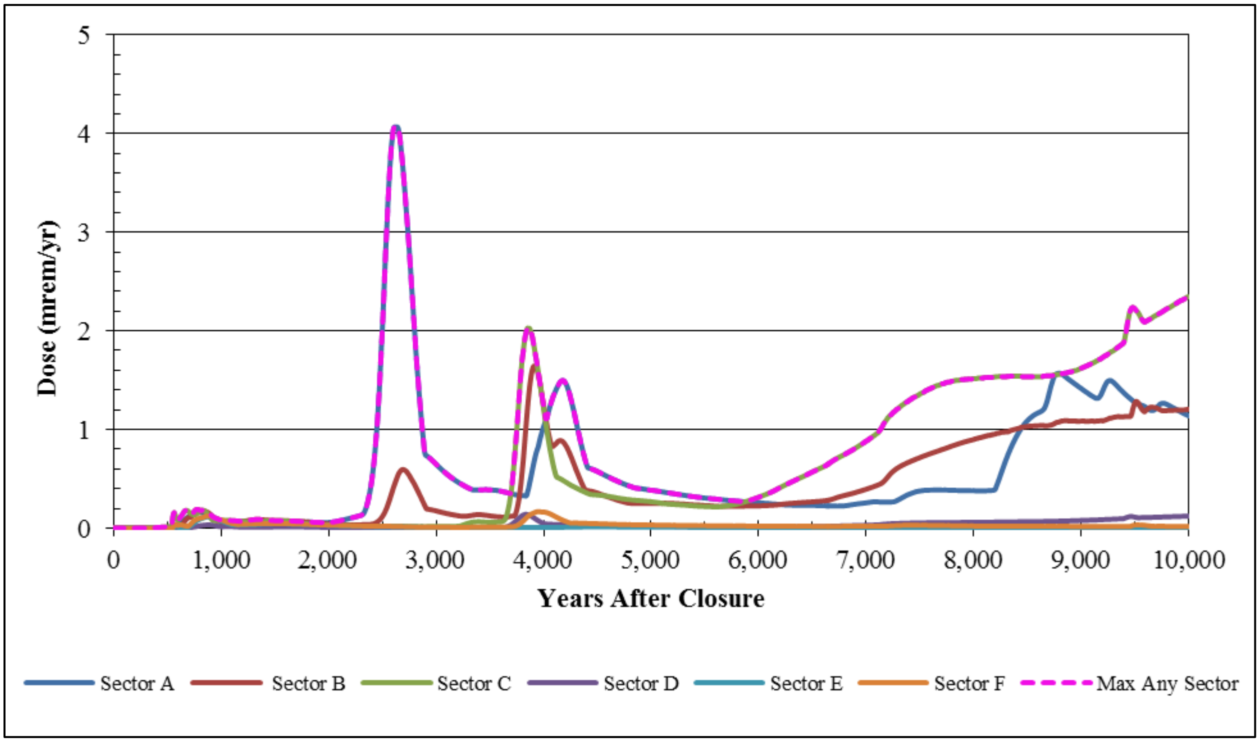


Figure 6.4-4: 100-Meter MOP Groundwater Pathway Dose within 10,000 Years for the Six 100-Meter Sectors



Using the residual inventories for Tank 16, as well as the revised estimates for the other waste tanks, resulted in no significant change to the magnitude of the groundwater pathway dose peak in 1,000 or 10,000 years, relative to the HTF PA.

This dose represents reasonably conservative modeling assumptions that were incorporated into the HTF PA Base Case due to uncertainty inherent in a number of the modeling parameters.

6.4.5.2 Individual Radionuclide Contributions to the MOP 100-Meter Peak Annual Groundwater Pathway Dose

Sectors A and C were the sectors with highest peak doses within 10,000 years. Figures 6.4-5 through 6.4-8 show the relative contributions from individual radionuclides to peak dose in these Sectors within 1,000 and 10,000 years.

For Sector A, the peak groundwater pathway dose to the MOP at 100-meters within 10,000 years is associated with I-129, with all other radionuclides contributing less than 1% at the year of peak dose (year 2,610). The individual contributors to peak groundwater pathway dose in 10,000 years are changed from the HTF PA. The Sector A peak dose is dominated by I-129 because the Tank 12 I-129 inventory was increased from the assigned HTF PA inventory. The Sector A peak dose in 10,000 year was previously (i.e, in the HTF PA) dominated by Tc-99 releases from Tanks 9, 10 and 11. The Tc-99 releases from these waste tanks has decreased (to just slightly over 1.0 mrem/yr) because the Tc-99 inventory in these waste tanks was reassessed based on Tank 16 annulus characterization data for Tc-99, discussed further in Section 6.2 of this SA.

For Sector C, the peak groundwater pathway dose to the MOP at 100-meters within 10,000 years is associated with Ra-226 (74% of the total dose at year 10,000). The other contributors to the Sector C peak dose at year 10,000 are Pa-231 (12%), Np-237 (7%) and Pb-210 (6%). The individual contributors to peak groundwater pathway dose in 10,000 years are essentially unchanged from the HTF PA, with the only change being the percentages varied slightly due to updates to the Tank 12 inventory.

Figure 6.4-5: Individual Radionuclide Contributors to the Sector A 100-Meter Groundwater Pathway Dose, 1,000 years

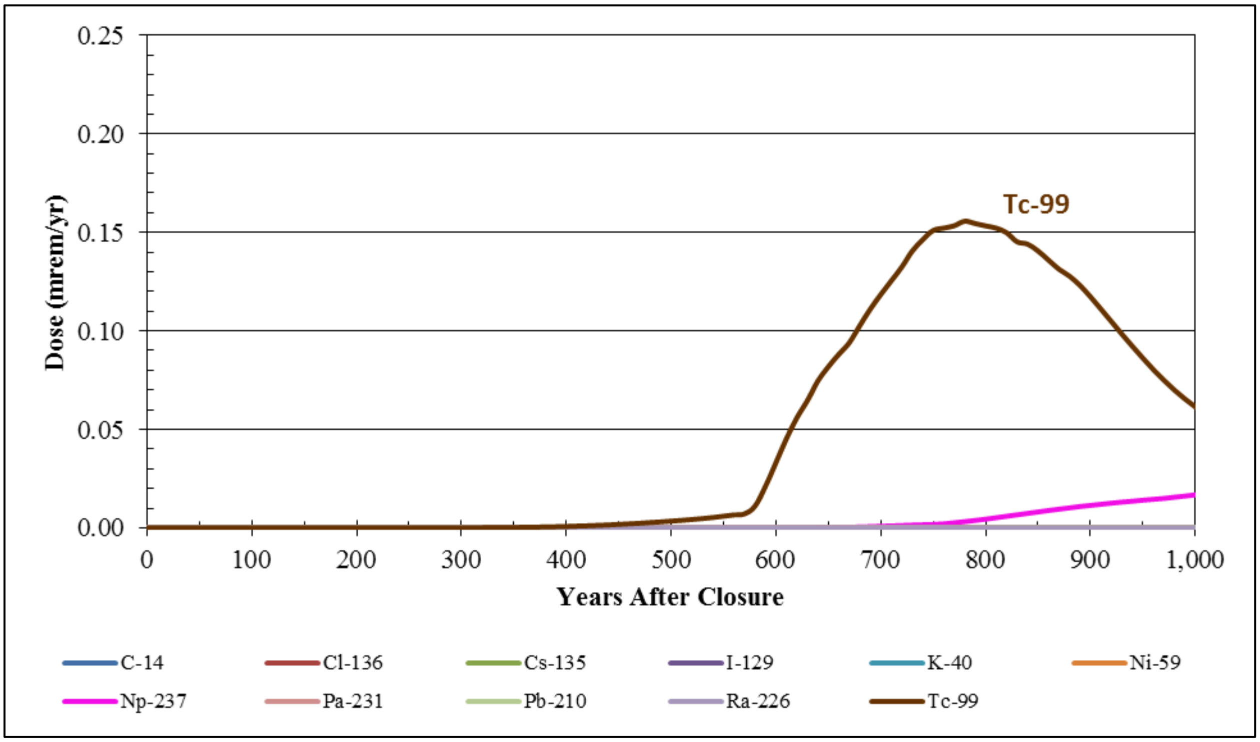


Figure 6.4-6: Individual Radionuclide Contributors to the Sector A 100-Meter Groundwater Pathway Dose, 10,000 years

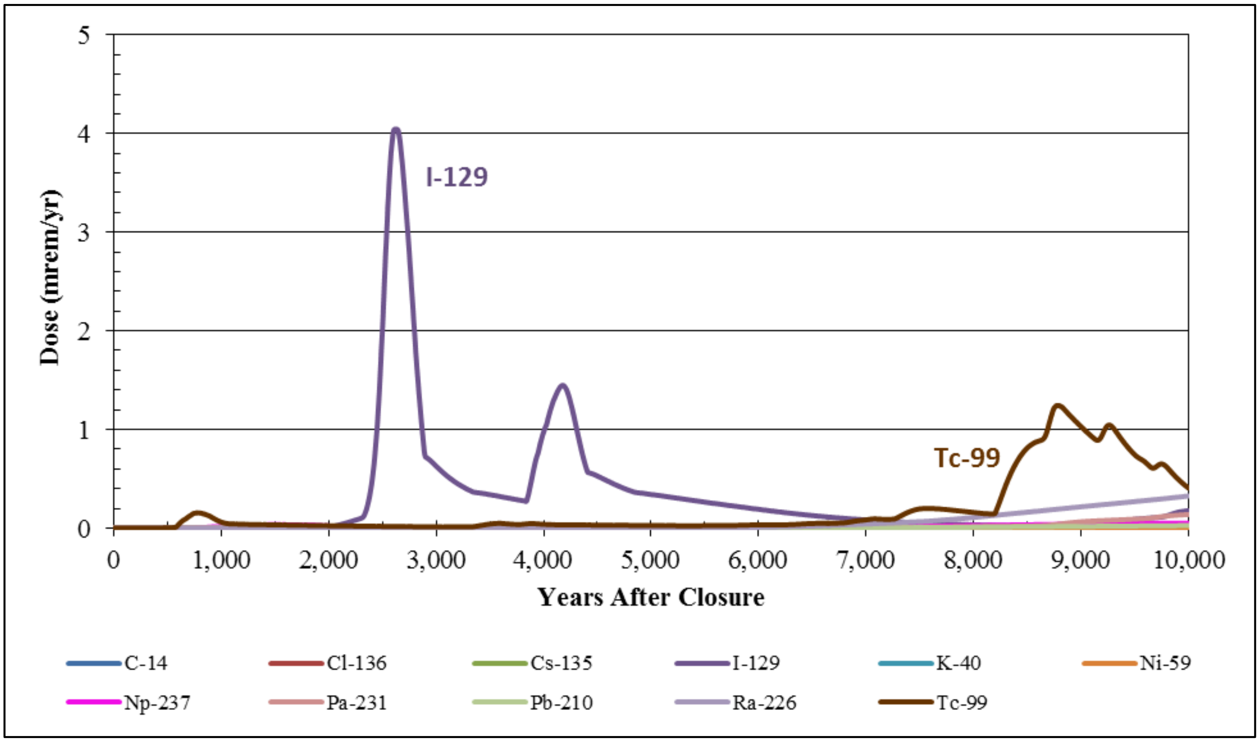


Figure 6.4-7: Individual Radionuclide Contributors to the Sector C 100-Meter Groundwater Pathway Dose, 1,000 Years

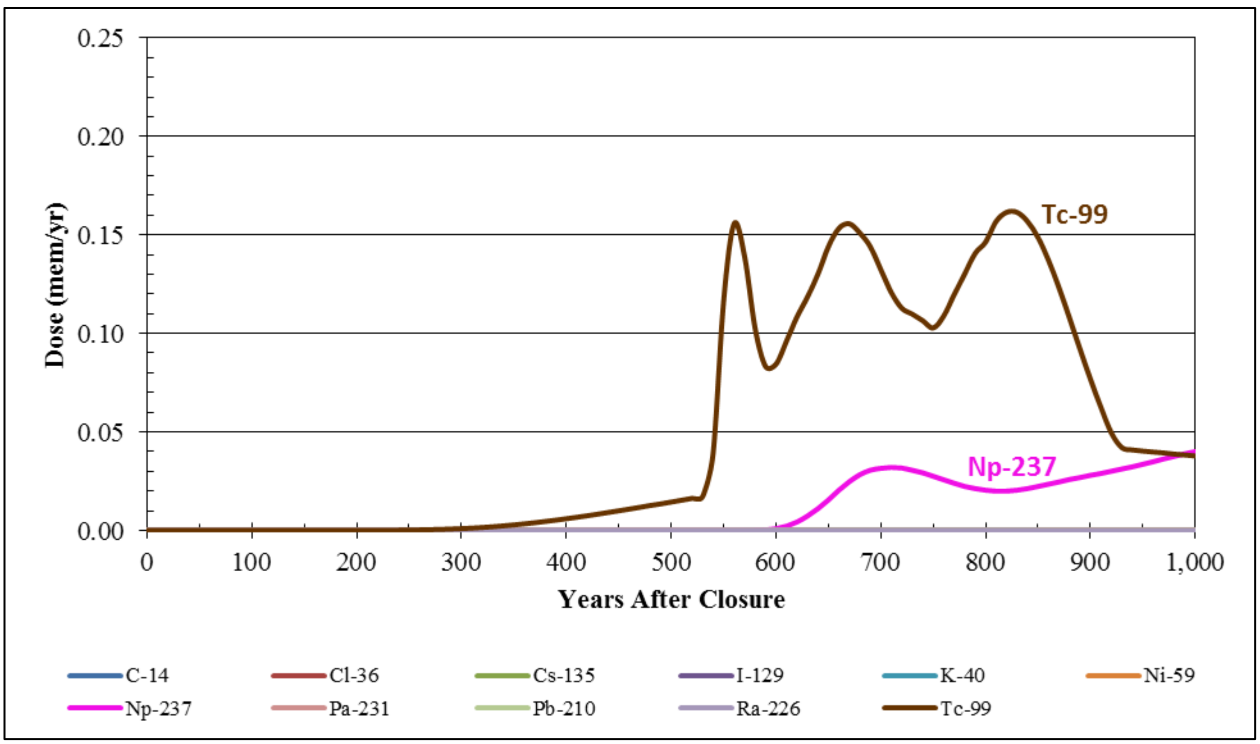
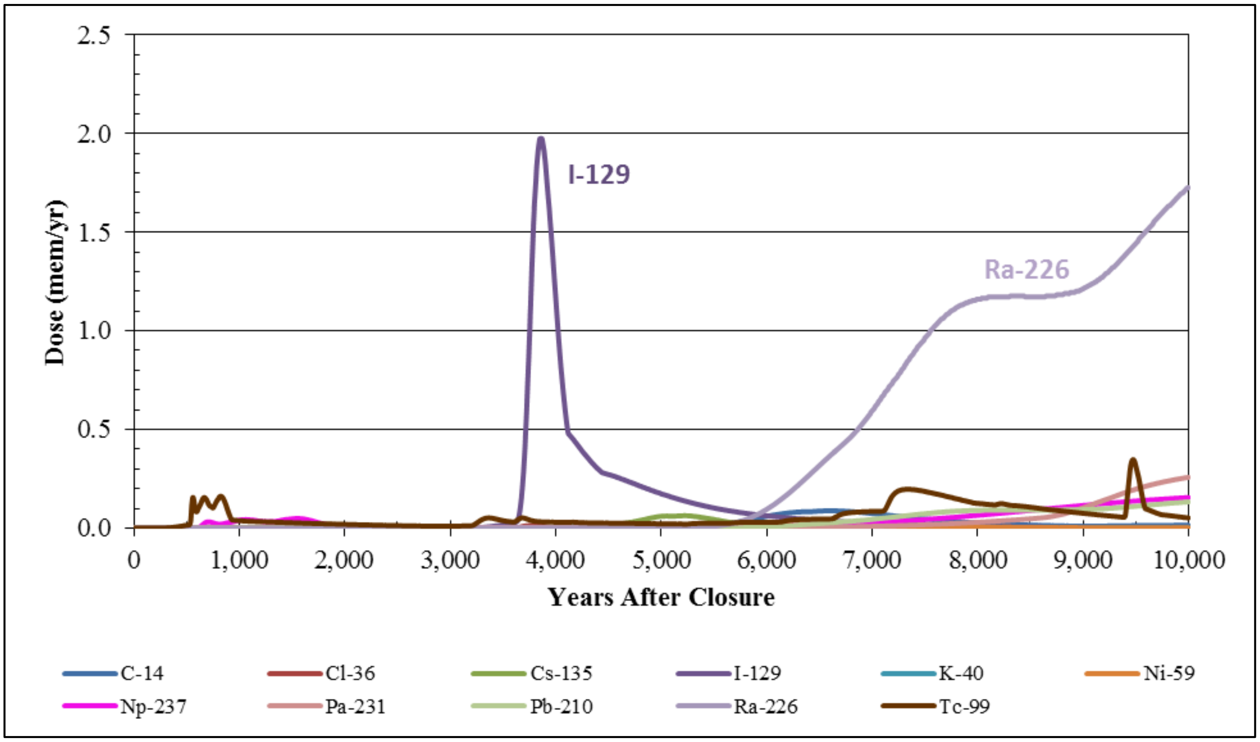


Figure 6.4-8: Individual Radionuclide Contributors to the Sector C 100-Meter Groundwater Pathway Dose, 10,000 Years



6.4.5.3 Individual Tank Contributions to MOP 100-Meter Peak Annual Groundwater Pathway Dose

Peak doses beyond 10,000 years are investigated in Figures 6.4-9 and 6.4-10, which show the 100-meter MOP peak groundwater-pathway dose associated with Tanks 12 and 16 for all sectors. These waste tanks are the tanks with significant inventory changes from what was previously modeled in the HTF PA.

Tank 16 has the highest 100-meter peak groundwater-pathway dose impact on Sector C. The peak dose associated with Tank 16 within 100,000 years is 2.1 mrem/yr, and this peak occurs within 10,000 years (at year 3,850).

Tank 12 has the highest 100-meter peak groundwater-pathway dose impact on Sector A. The peak dose associated with Tank 12 within 20,000 years is 4.0 mrem/yr, and this peak occurs within 10,000 years (at year 2,610).

Figure 6.4-9: 100-Meter MOP Groundwater Pathway Dose within 100,000 Years for Each Sector – with Tank 16 Contribution Only

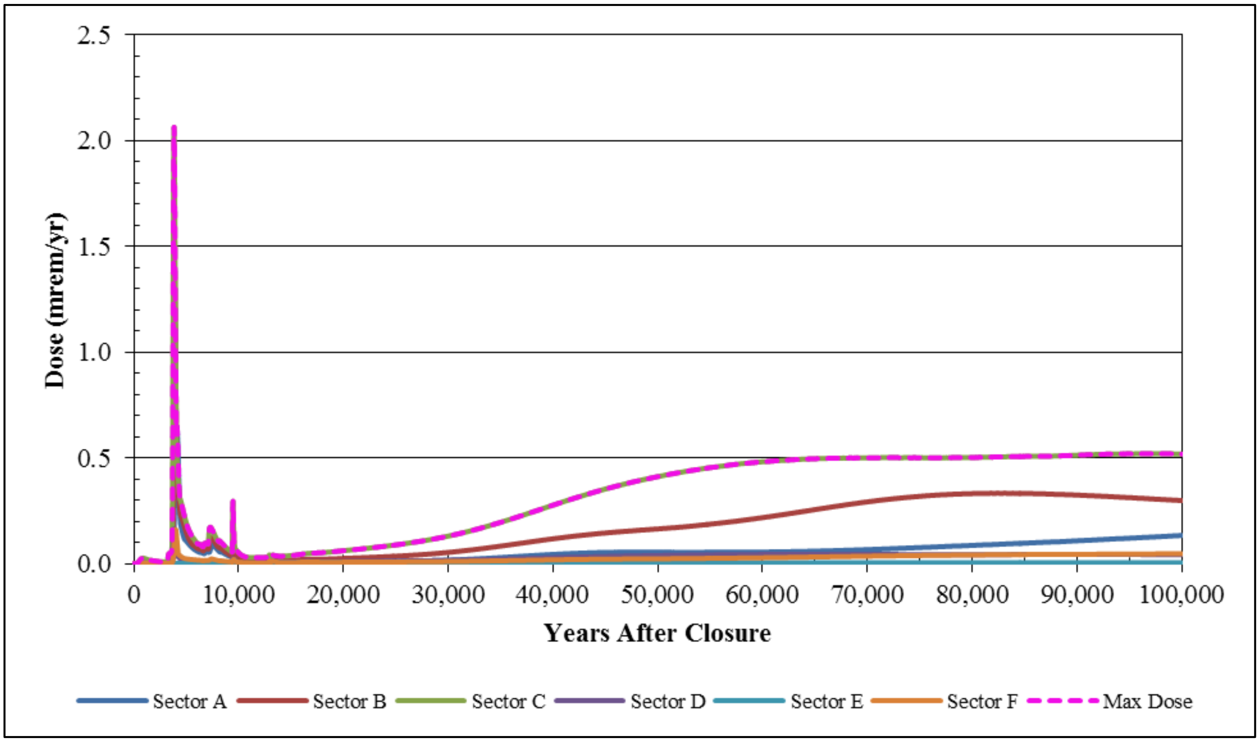


Figure 6.4-10: 100-Meter MOP Groundwater Pathway Dose within 20,000 Years for Each Sector – with Tank 12 Contribution Only

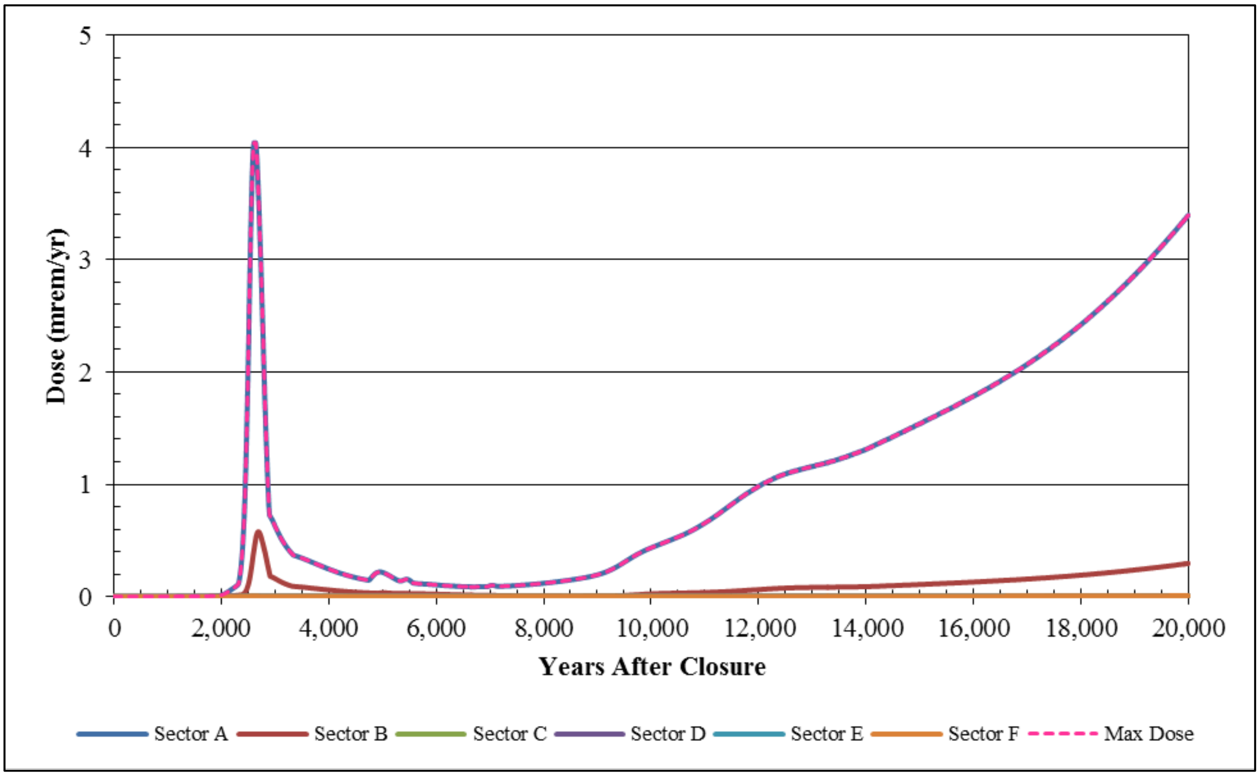
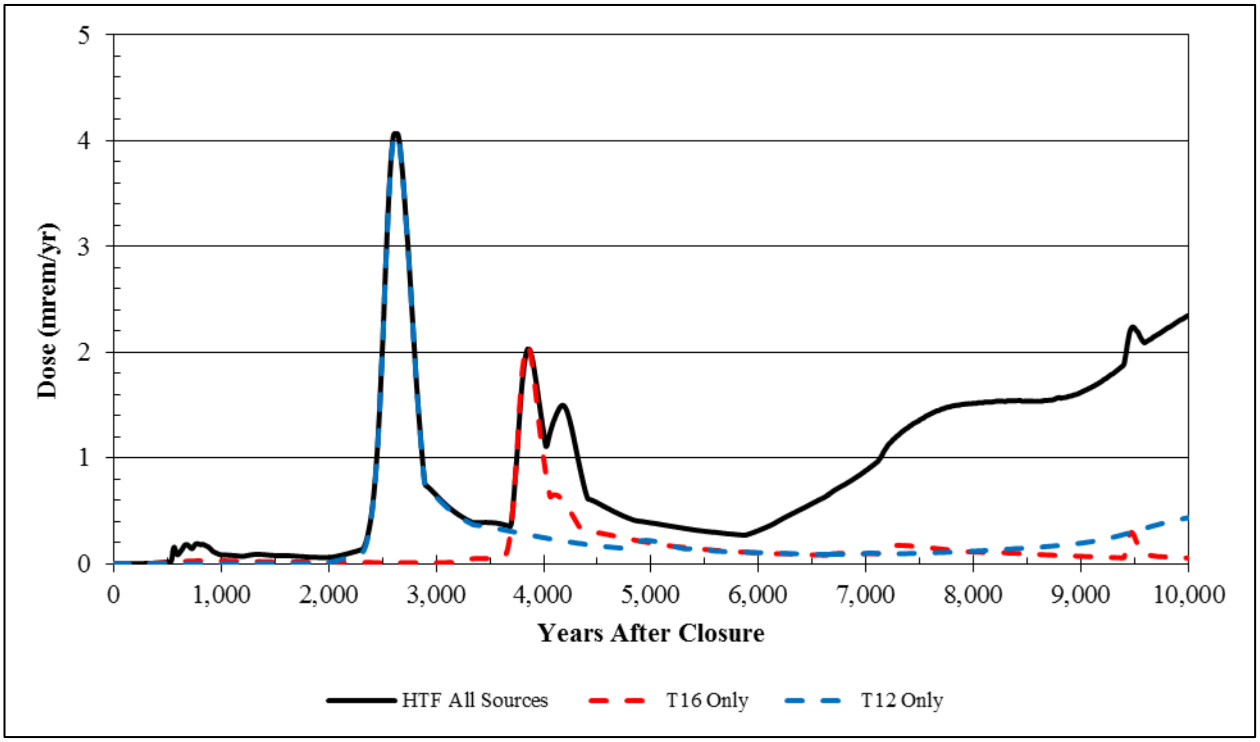


Table 6.4-2 and Figure 6.4-4 present the relative contributions from Tanks 12 and 16 to 100-meter MOP groundwater peak dose (in any sector). Since the liners for Tanks 12 and 16 are assumed to be degraded and since Tank 16 has inventory in its annulus and sand pads, the HTF PA Base Case dose results within 10,000 years includes Tanks 12 and 16 contributions to the peak dose within 10,000 years.

Table 6.4-2: 100-Meter MOP Peak Groundwater Pathway Dose Individual Source Contributions at Peak Years within 10,000 Years

Waste Source	Contribution (mrem/yr) to Peak Dose at Year 2,610	Percentage of Peak Dose at Year 2,610
Tank 12	4.0	99%
Tank 16	< 0.1	0%
All Other Sources	0.1	1%
Total	**4.1**	**100%**

Figure 6.4-11: 100-Meter MOP Groundwater Pathway Dose within 10,000 Years for Any Sector – with Tank 12 and Tank 16 Individual Contributions



Tank 16 is a negligible contributor to the 100-meter peak groundwater-pathway dose (4.1 mrem/yr at year 2,610) within 10,000 years. Although Sector A provides the highest doses when considering all of the sources within the HTF, presented in Section 6.4.5.1 of this SA, Tank 16 provides greater impacts on Sector C. Tank 16 is the dominant contributor to a 2.1 mrem/yr peak at year 3,850, primarily due to I-129 (there is an I-129 peak groundwater concentration of 12.9 pCi/L associated with Tank 16 at year 3,850).

Tank 12 is the dominant contributor to the 100-meter peak groundwater-pathway dose (4.1 mrem/yr at year 2,610) within 10,000 years, primarily due to I-129 (there is an I-129 peak groundwater concentration of 25.7 pCi/L associated with Tank 12 at year 2,610).

6.4.5.4 Individual Pathway Contributions to MOP 100-Meter Peak Annual Groundwater Pathway Dose

As stated previously, the total peak groundwater-pathway dose results are the summation of the doses associated with all the individual 100-meter well pathways. Table 6.4-3 shows the relative contributions from the individual groundwater pathways to the recalculated (i.e., using the updated waste tank inventories) Sector A 100-meter MOP dose at year 2,610 (the year of the peak dose within 10,000 years). The primary contributor is water ingestion (96% of peak dose) with a minor contribution from vegetable ingestion (3% of peak dose), with I-129 being the principal radionuclide contributor for all of the individual groundwater pathways. The individual pathway contributions are somewhat impacted by using the updated Tank 12 and Tank 16 inventories (as compared to the HTF PA), with the water ingestion pathway almost completely dominating due to I-129 being the principal radionuclide contributor.

Table 6.4-3: 100-Meter MOP Peak Dose Individual Groundwater Pathway Contributions for Sector A

Pathway	Associated Contribution at year 2,610 (mrem/yr)	Percentage of Total Peak Dose
Water Ingestion	3.9	96%
Vegetable Ingestion	0.1	3%
Other	<0.1	1%
Total	**4.1**	**100%**

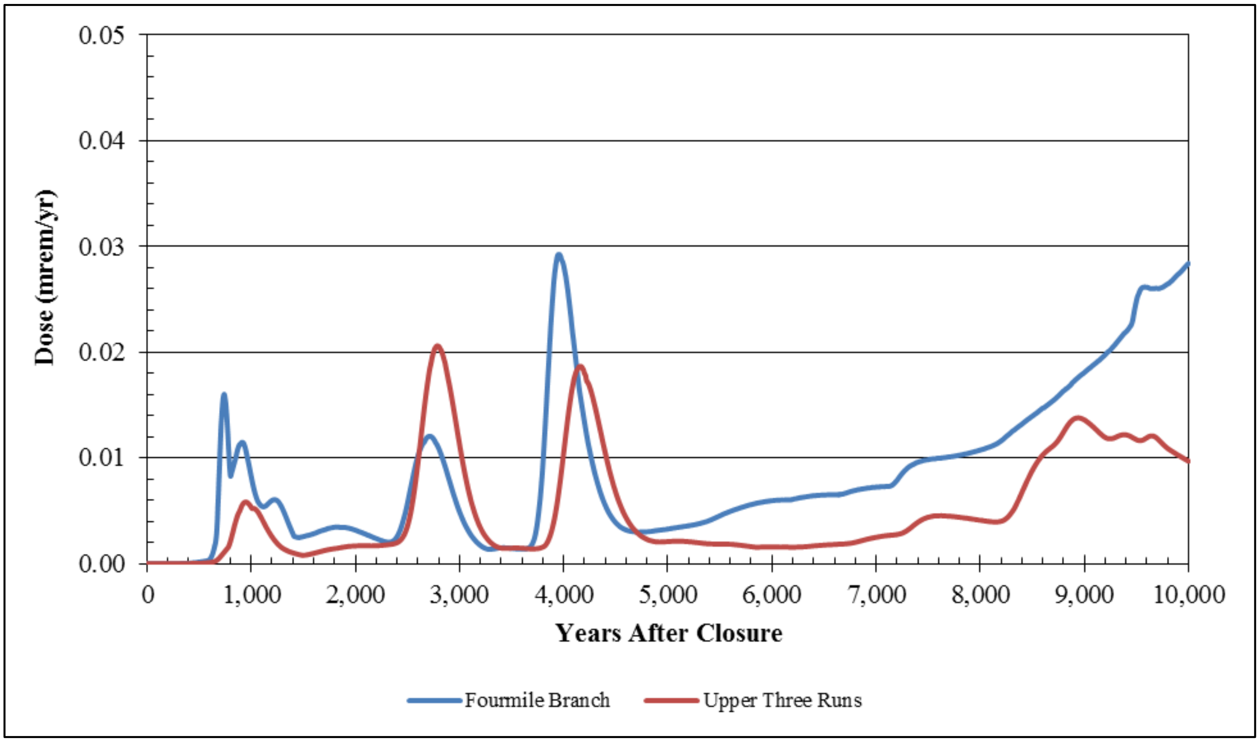
6.4.5.5 Peak Annual MOP Dose at the Stream Seepline

The peak groundwater-pathway doses for the two stream seeplines (Fourmile Branch and UTR) have been recalculated using the highest concentration for each radionuclide in the sector. Table 6.4-4 shows a comparison of the MOP, stream seepline peak groundwater pathway doses for the two stream sectors. The highest peak groundwater-pathway dose within 10,000 years is associated with Fourmile Branch seepline. Figure 6.4-12 shows the peak groundwater pathway doses over 10,000 years for the seeplines at the two streams (UTR and Fourmile Branch). The stream peak groundwater-pathway dose for a MOP in 10,000 years is 0.03 mrem/yr.

Table 6.4-4: Peak Groundwater Pathway MOP Doses at the Stream Seepline by Sector

Sector	Peak Dose in 1,000 Years	Peak Dose in 10,000 Years
Fourmile Branch	**0.02 mrem/yr (year 740)** Principal Radionuclide: Tc-99	**0.03 mrem/yr (year 3,950)** Principal Radionuclide: I-129
UTR	**0.01 mrem/yr (year 950)** Principal Radionuclide: Tc-99	**0.02 mrem/yr (year 2,780)** Principal Radionuclide: I-129

Figure 6.4-12: Groundwater Pathway MOP Dose at the Stream Results within 10,000 Years for the Two Stream Sectors



6.4.5.6 Member of the Public at 100-Meter and at Seepline Peak Annual All-Pathway Dose

The peak all-pathways annual dose for the MOP at 100-meters is calculated using the recalculated peak 100-meter groundwater-pathway dose results in 10,000 years (4.1 mrem/yr) in combination with the negligible air pathway results (less than 0.0001 mrem/yr). The peak all-pathways annual dose for the MOP is 4.1 mrem/yr and is associated with Sector A.

The peak all-pathways annual dose for the two stream seeplines (Fourmile Branch and UTR) is calculated using the highest concentration for each radionuclide in the sector. The seepline peak groundwater dose in 10,000 years is 0.03 mrem/yr in year 3,950. The seepline peak groundwater dose, in combination with the negligible air pathway results (less than 0.0001 mrem/yr), results in an all-pathways annual dose for the MOP at the seepline of 0.03 mrem/yr and is associated with Fourmile Branch.

6.4.6 Uncertainty and Sensitivity Analysis

Section 5.6 of the HTF PA considers the effects of uncertainties in the conceptual models used and sensitivities in the parameters used in the mathematical models. The uncertainty analyses and sensitivity analyses were primarily performed using a probabilistic model (i.e., the GoldSim HTF model), but some additional single parameter sensitivity analyses were performed through deterministic modeling using both the PORFLOW and GoldSim models.

The probabilistic model varies multiple parameters simultaneously, so concurrent effects of changes in the model can be analyzed, and the potential impact of changes can be assessed. This assessment allows for identification of parameters that are only of significance when varied simultaneously with another parameter. The deterministic model single parameter analysis provides a method to evaluate parametric effects in isolation, so the importance of the uncertainty around a parameter of concern can be more effectively evaluated. Using both probabilistic and deterministic models for sensitivity analysis versus a single approach provides additional information concerning which parameters are of most importance to the HTF PA modeling.

In general, the uncertainty analyses and sensitivity analyses information presented in the HTF PA are not significantly impacted by the new characterization information, and the uncertainty analyses and sensitivity analyses insights remain unaffected. The impacts on the GoldSim benchmarking, as discussed in Section 5.6.2 of HTF PA, are not presented herein but are documented in the HTF GoldSim Model report. [SRR-CWDA-2014-00060] Note that the benchmarking efforts are not significantly impacted by the changes to the Tank 16 residual inventory but can be impacted by the improvements to the modeling methodology applied within GoldSim. The updated version (GoldSim SRS HTF v1.010 Rad) of the HTF GoldSim Model is based on the version used for the HTF PA. Several improvements were made to the GoldSim HTF Model, including:

- updating of the inventory data base,
- emplacement of inventory in the bottom of the tank annuli,
- updating of sorption coefficients to reflect recent experimental results,
- addition of the capability to import time-dependent diffusion data from PORFLOW,
- the addition of an alternate fast zone (AFZ) submodel, to evaluate the hazard potential of a fracture system directly connecting the annulus to the saturated soil in which the Type I and Type II tanks reside.

With respect to the use of HTF PA parameters presented in Section 5.6.3 of HTF PA, the parameter impacted by the residual inventories at operational closure is the radiological inventory.

The following sections describe some additional uncertainty analyses and sensitivity analyses activities that were performed utilizing the Tank 16 residual inventory at operational closure.

6.4.6.1 Deterministic Model Barrier Analysis

Section 5.6.6 of the HTF PA provided a comprehensive barrier analyses that identified barriers to waste migration and evaluated the capabilities of each barrier as understood from the results of the HTF PA. The barrier analyses assessed the contribution of individual barriers (e.g., closure cap, grout, contamination zone, waste tank liner and waste tank concrete) by comparing contaminant flux results under various barrier conditions. No new barrier analyses were performed in support of this SA.

6.4.6.2 Deterministic Model Single Parameter Sensitivity Analysis

The impact of input variability on the peak dose was further evaluated in this SA by performing several single parameter sensitivity analyses using the HTF PA Base Case PORFLOW model with changes to select parameters (a detailed discussion of the

PORFLOW HTF model and the individual HTF PA Base Case parameters is provided in the HTF PA).

Additional inventory sensitivity analyses were performed to provide insight into the potential effects of removing additional waste material from the Tank 16 annulus. These analyses compare dose results using the final Tank 16 inventories to results generated by removing one-half and 75% of the final Tank 16 annulus inventory. The other Tank 16 inventory locations (i.e., the tank primary and the sand pads) were not modified for this sensitivity analyses. The Tank 16 100-meter all pathways peak dose is 2.1 mrem/yr at year 3,850 due to I-129. There are no other dose peaks over 0.5 mrem/yr in 100,000 years. If one-half of the annulus volume were eliminated, the Tank 16 100-meter all pathways peak dose would still be 1.1 mrem/yr due to I-129. If 75% of the annulus inventory were eliminated, the Tank 16 100-meter all pathways peak dose would be approximately 0.9 mrem/yr. Results are shown for the 100-meter MOP, peak all pathways dose within 100,000 years (Figures 6.4-13 and 6.4-14).

This sensitivity study shows that the peak doses associated with Tank 16 are not appreciably impacted by reducing the total inventory in the Tank 16 annulus. No independent sensitivity analysis of the Tank 16 primary inventory was performed because the peak dose associated with the primary inventory was relatively insignificant (less than 1 mrem/yr peak).

Figure 6.4-13: 100-Meter MOP All Pathways Dose within 10,000 Years with Tank 16 Contribution Only – Variable Tank 16 Annulus Inventory

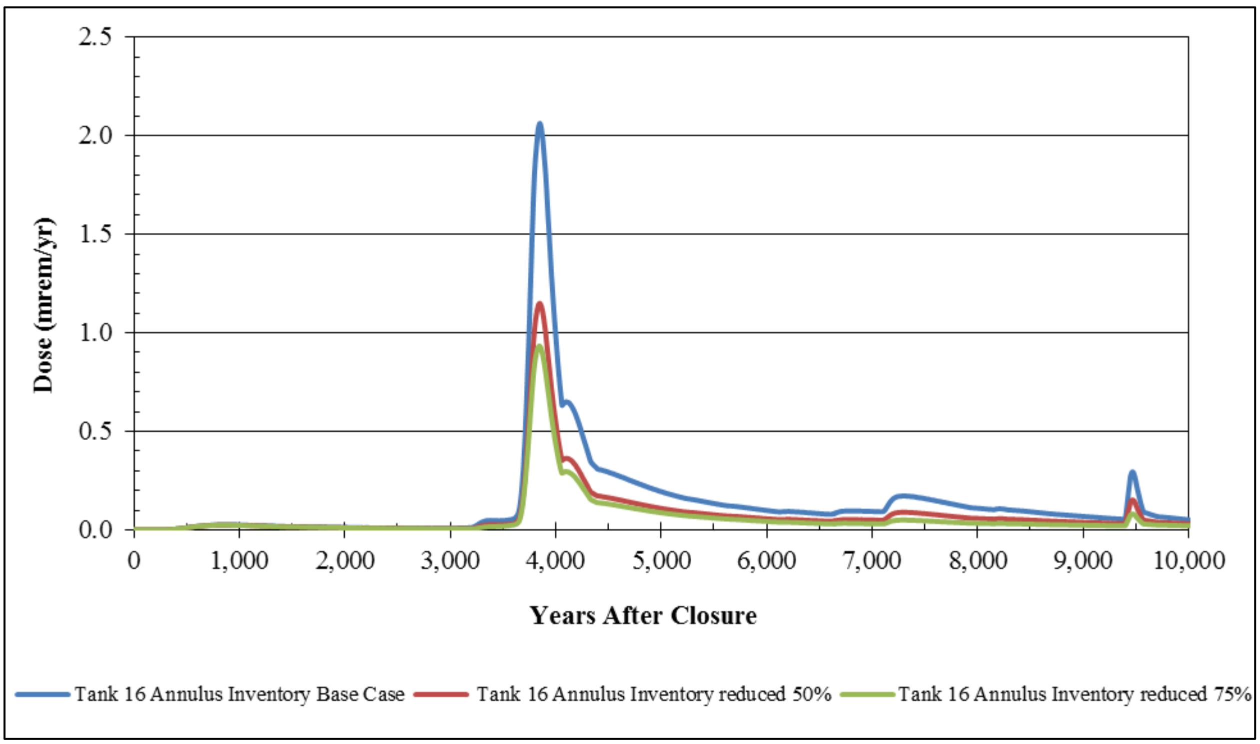
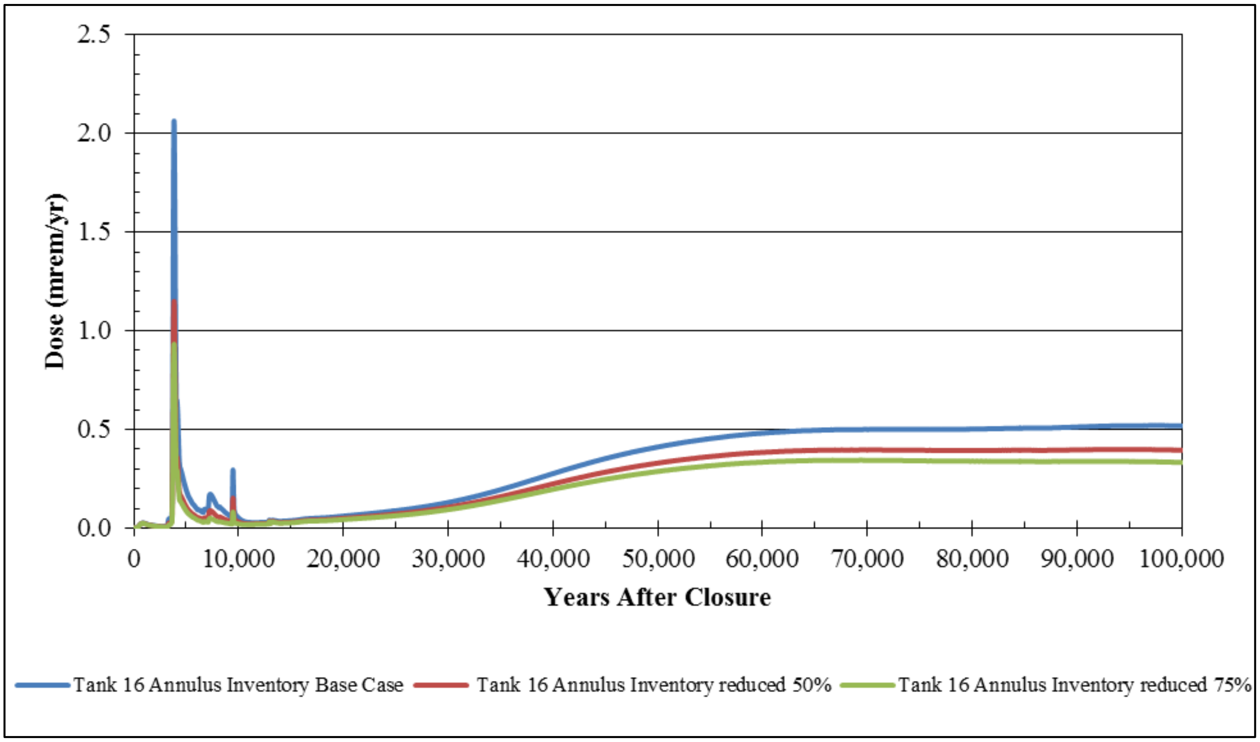


Figure 6.4-14: 100-Meter MOP All Pathways Dose within 100,000 Years with Tank 16 Contribution Only – Variable Tank 16 Annulus Inventory



6.4.6.3 Alternate Fast Zone Sensitivity Analyses

In the HTF TER the NRC stated that DOE should conduct a more comprehensive analysis of contaminant release from the annular regions of Type I and II tanks. [ML14094A496] Based on historical evidence of waste release from Tank 16 into the environment and operational observations of groundwater in-leakage over a relatively short timeframe, the NRC raised a concern that radionuclides could migrate out of the waste tanks through a fast pathway early in the performance period. [DP-1358, SRR-ESH-2013-00078] The NRC recognized that grouting of the waste tanks and annuli would help limit the potential for preferential pathways and the hydraulic head associated with the fully and partially submerged tanks; however, grouting will not necessarily eliminate all flow. Because of the activity of radionuclides in the annulus and sand pads (e.g., Cs-137, Sr-90) and the high solubility of this waste as discussed in Section 3.4.2.2 of the HTF PA, even minimal flow through the grouted annuli and sand pads could result in an increased contaminant release.

To address the concern that risk from the radionuclide inventories outside of the primary liners is not adequately accounted for in the HTF PA Base Case analyses, an AFZ sensitivity analysis has been performed to address the potential release of radionuclides from the annuli and sand pads in the Type I and Type II tanks. The AFZ sensitivity analyses (i.e., changes from HTF PA Base Case) focused on addressing the four primary issues raised on page 4-75 in the NRC TER (ML14094A496). To address the NRC issues, the AFZ sensitivity analyses were modeled to:

- Address the concern that while HTF PA Base Case might maximize peak doses associated with long-lived radionuclides, the HTF PA Base Case might not reflect impact of waste tank annulus preferential release pathways on short-lived radionuclides.
- Reflect the potential for liquid flow through vault side wall preferential release pathways based on Type I and Type II tank history (i.e., small volume release from the Tank 16 annulus pan to the environment, slow ground water leakage into the Tank 11 annulus pan).
- Assume all Type I and Type II tanks potentially have preferential release pathways through waste tank side walls.
- Recognize that the grout placed above annulus waste will serve as a release barrier for short-lived radionuclides.

The new AFZ sensitivity analysis scenario was evaluated using the HTF GoldSim Model, modified to reflect an alternate configuration that includes annulus preferential pathways for the Type I and Type II tanks (using the updated GoldSim SRS HTF v1.010 Rad). [SRR-CWDA-2014-00060] This AFZ sensitivity analysis (i.e., changes from HTF PA Base Case) includes the following changes from the HTF PA Base Case:

- The modeled configuration allows flow to enter the Type I and Type II tanks through an upstream seam in the waste tank wall and exit through a downstream seam in waste tank wall. Water is allowed to enter/exit the waste tank annulus above the annulus pan (5 foot above the waste layer).
- For Type I tanks, water in the fast release pathway is assumed to enter through the upgradient seam (construction joint) area, follow a circular pathway around the annulus and exit through the downgradient seam area. Radionuclide transport in the fast pathway is assumed to occur at the waste level of the annulus except in the vicinity of the downgradient seam area where upward flow into the seam and out through the wall occurs. Based on the symmetry of the annulus, the fast pathway is represented by a string of mixing cells representing the left (or right) half of the annulus bottom when looking downgradient. The entire annulus inventory is applied to these cells as an initial condition, with the inventory equally distributed in the annulus bottom cells. The downgradient cell, is in turn linked to a vertical string of cells representing the flow out through the downgradient seam. The incremental steady-state flow-rate through the fast pathway is calculated as a function of the head difference associated with a 1% hydraulic gradient between the most upgradient and downgradient points on the waste tank circumference. The hydraulic conductivities used to determine velocities in the fast zone are based on the time-dependent hydraulic conductivities used for the annulus grout in the HTF PORFLOW Flow model Base Case. Note that for this model, transport through the annulus is independent of transport through the rest of the system, and releases from the annulus are superimposed on releases initiated in the contaminant zone (CZ).
- For Type II tanks the flow that enters the waste tank is similarly calculated based on a 1% flow gradient with the through-tank flow path, which traverses the annulus grout, and the primary sand layer. The wall seam is assumed to provide no resistance to

flow, with vertical flow restricted only by presence of grout in the annulus. The abstraction of the fast zone assumes a highly simplified geometry with the bottom of the fast zone simulated by a rectangular region, with the annulus divided into upgradient and downgradient strips, separated by the primary sand layer. In this model, the fast zone is not modeled independently from the remainder of the system. The primary sand layer, is linked to the liners above and below, with the rest of the circuitry (grout, CZ, secondary sand layer, and basemat) unchanged from the regular model. The downgradient segment of the annulus, located above the contaminated zone, is subdivided into five GoldSim mixing cells. Vertically upward transport through the annulus is assumed to occur only in the downgradient half of the annulus, with the radionuclides migrating from the bottom of the annulus to the downgradient seam, through the vertical segments of the annulus.

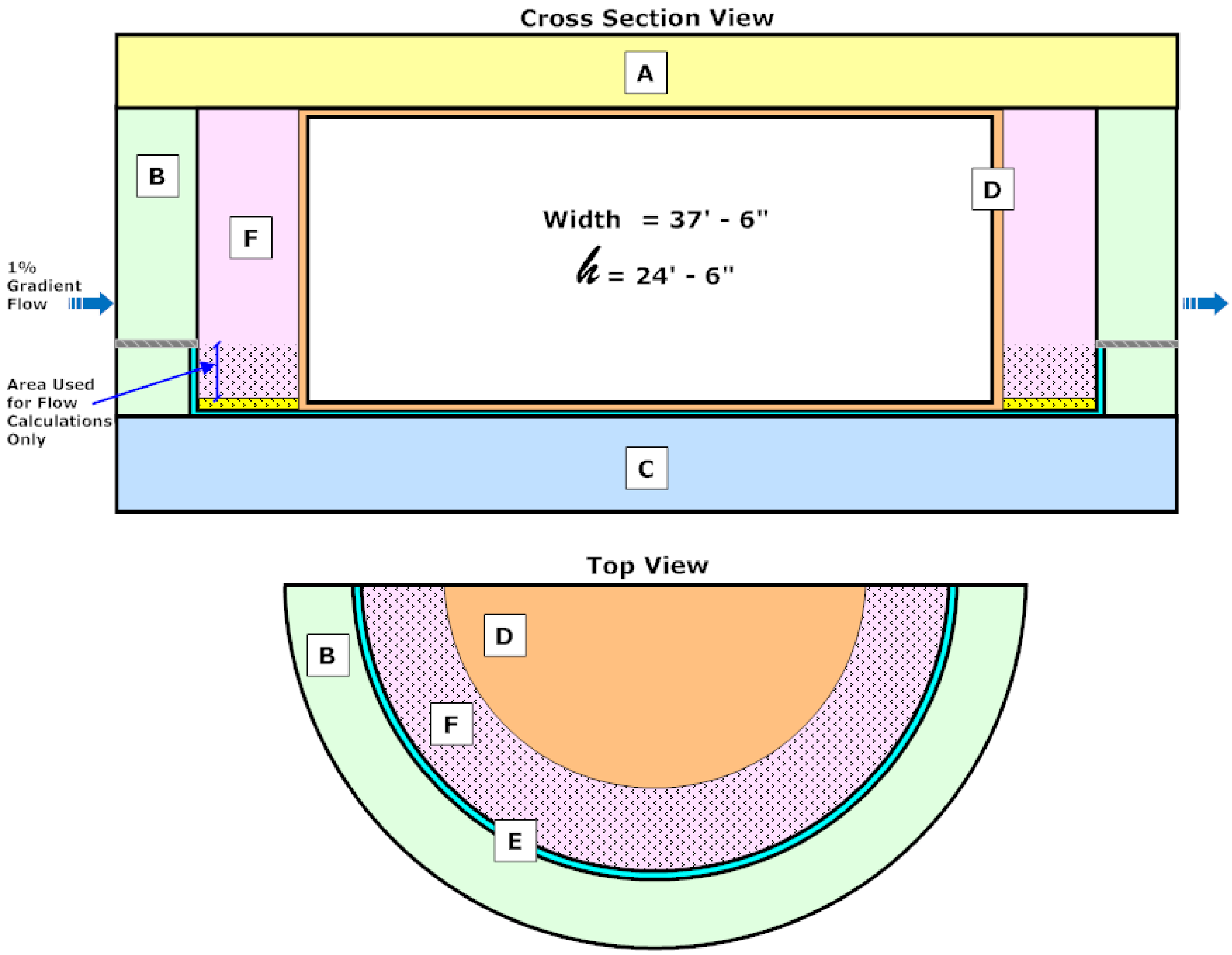
- For the AFZ simulations, all tank cementitious materials subject to sorption are assumed to be oxidized (i.e., use Oxidized Region III Kds) throughout the simulations.
- The sand pad waste layers are assumed not to be subject to sorption.

6.4.6.3.1 AFZ Modeling

A primary purpose of the AFZ analysis is to evaluate whether or not a high conductivity pathway could accelerate the early release of rapidly decaying species such as Sr-90 (half-life = 28.9 years) or Cs-137 (half-life = 30.0 years) to the degree that dose levels at the IHI wells would become problematic. This section discusses the changes in IHI dose levels associated with release of Sr-90 and Cs-137, when the AFZ analysis is used. Only the IHI wells are considered here because the concentrations of rapidly decaying species are quickly reduced by the time the released water and its contents reach the 100-meter boundary.

Two simplified pathways were utilized in the model one for the Type I tanks and one for the Type II tanks. The AFZ models are based on two basic conceptualizations, one for the Type I tanks (Figure 6-4.15), and one for the Type II tanks (Figure 6-4.16). The Type I tank conceptual model assumes that water enters the waste tank at the upgradient edge of the tank wall, entering the waste tank through a seam (construction joint) that traverses from outside the wall to the top of the secondary liner pan. After flowing over the secondary liner pan, the water flows downwards through the annulus, around the contaminated bottom of the annulus picking up radionuclides, and back up and finally through a seam that traverses from the top of the secondary liner pan through the tank wall. The Type II tank conceptual model again assumes there is leakage through construction joints but uses a simplified rectangular structure to represent a pathway from the upgradient portion of the annulus through the primary sand layer and back out the downgradient segment of the annulus. This model also assumes that a high conductivity structure (i.e., fracture) penetrates the primary liner. Again, the flow rate through the fast zone is based upon the assumption that the drop in potential (hydraulic head) from one end of the pathway to the other is consistent with a 0.01 gradient across the saturated zone. The head drop from the most upgradient point of the waste tank to the most downgradient point is the used in conjunction with the total length of the segments of the fast pathway and a composite hydraulic conductivity based on their individual hydraulic conductivities to generate a flow rate. Note that flow and associated radionuclide migration around the annulus is not considered, in this second simplified conceptual model. Also note that mass from the CZ and mass initiated in the primary sand pad is passed through this AFZ and the AFZ is also subject to downward leakage into the secondary sand pad.

Figure 6.4-15: Typical Type I Tank AFZ Modeling Dimensions



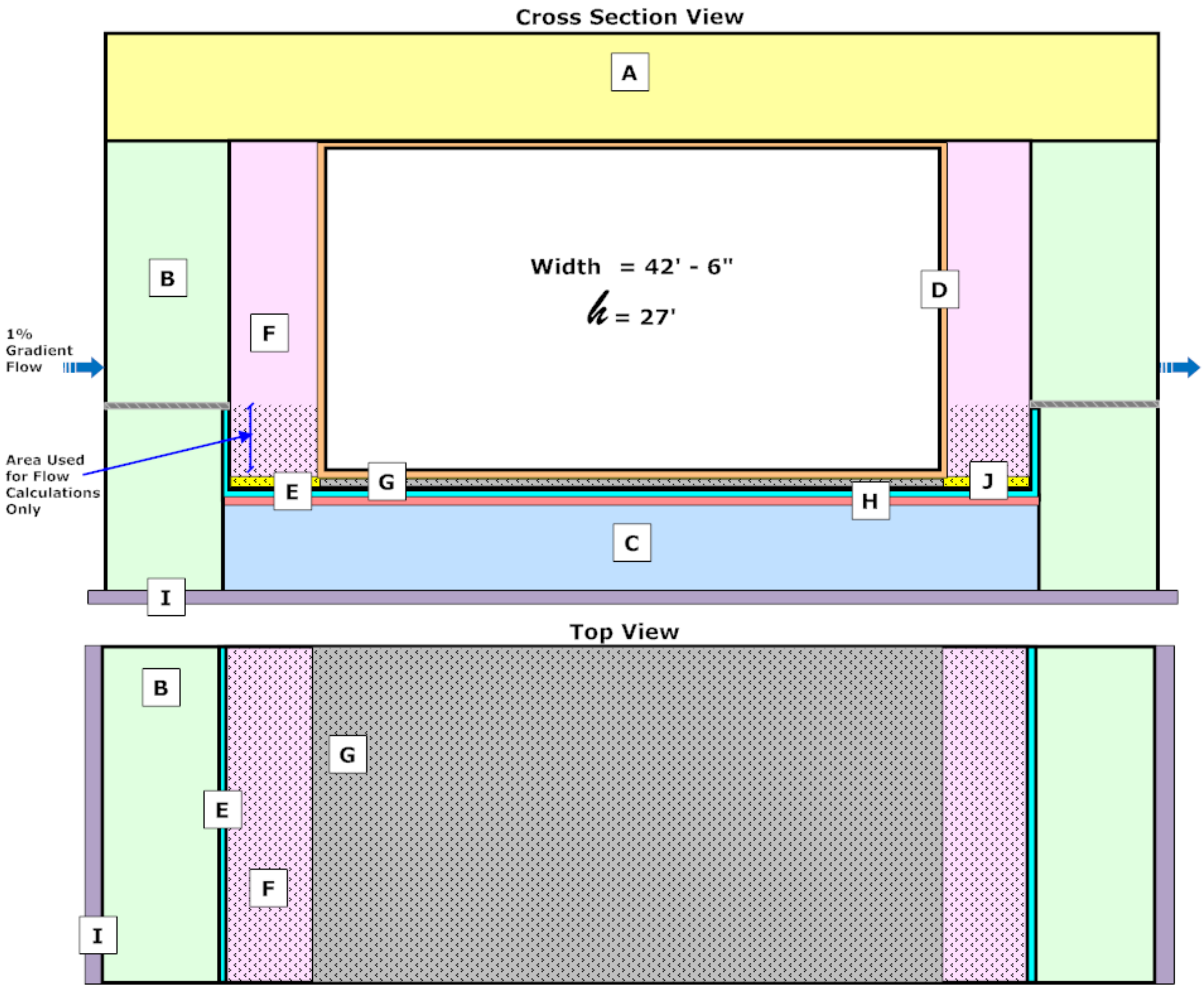
LABEL	THICKNESS
A Roof	22"
B Wall	22"
C Basemat	30"
D Primary Liner	0.5"

LABEL	THICKNESS
E Secondary Liner	5' high and 0.5" thick
F Grouted Annulus	30"
I Working Slab	6"

LABEL	THICKNESS
J Annulus Contamination Zone	0.5"
Alternate Fast Zone	Not Applicable
Construction Joint	Not Applicable

[NOT TO SCALE]

Figure 6.4-16: Typical Type II Tank AFZ Modeling Dimensions



LABEL	THICKNESS	LABEL	THICKNESS	LABEL	THICKNESS
A Roof	45"	E Secondary Liner	5' high and 0.5" thick	I Working Slab	6"
B Wall	33"	F Grouted Annulus	30.625"	J Annulus Contamination Zone	1"
C Basemat	42"	G Primary Sand Pad	1"	Alternate Fast Zone	Not Applicable
D Primary Liner	0.5"	H Secondary Sand Pad	1"	Construction Joint	Not Applicable

[NOT TO SCALE]

The peak Sr-90 release for a Type I tank as determined by the PORFLOW Base Case model is extremely low (6.9E-27 mol/yr). Similarly, the peak release from the HTF GoldSim Model Base Case is zero mol/yr. For Cs-137, the peak release as determined by the PORFLOW Base Case model is also extremely low (6.7E-28 mol/yr). Again, the peak release from the HTF GoldSim Model Base Case is zero mol/yr. Note that the PORFLOW model allows for radial release through the walls creating a negligible mass release process not considered by the HTF GoldSim Model. When the AFZ water flow path following the construction joints and annulus waste layer is present, the model predicts that zero Sr-90 and Cs-137 mass will reach the natural environment from the annulus. This lack of release reflects the occurrence of any low resistant material in the pathway that influences the flow rates enough to allow the radionuclide decay process to control the attenuation process; specifically, the intact annulus fill grout (with a hydraulic conductivity of 2.1E-09 cm/s from year 0 to 5,100 years) prevents any significant flow through the AFZ pathway. The peak dose contributions for the IHI dose results are 8.7 mrem/yr for Sr-90 and 0.95 mrem/yr for Cs-137. These dose contributions can be traced back to the dose contribution from garden soil concentrations associated with drill cuttings, which dominate the dose results.

When the AFZ model for Type I tanks is used to evaluate the accelerated release of Sr-90 and Cs-137 from the annulus, of a Type I tank without the liners intact (Tank 12), it can be seen that that the releases are higher than releases from the PORFLOW Base Case model. Note that the HTF GoldSim Model Base Case releases are generally three orders of magnitude lower than the PORFLOW model results. With the water flow path following the construction joints and annular pathway through the annulus contamination zone, the model now predicts that Sr-90 and Cs-137 mass will leave the annulus. This difference from Tank 9 releases is associated with radionuclides from the annulus bottom being released to and through the basemat at a higher rate due to the assumption of Oxidized Region III conditions in cementitious material K_ds (rather than Region II in the Base Case) in conjunction with the lack of a primary or secondary liner. This condition still generates peak dose contributions of 8.7 mrem/yr for Sr-90 and 0.95 mrem/yr for Cs-137 on the IHI dose results. These dose contributions can be traced back to the dose contribution from garden soil concentrations, which dominate the dose results.

For a Type II tank with the liner intact (Tank 13), it can be seen that that the releases from the AFZ simulation are orders of magnitude higher than from the PORFLOW model or the HTF GoldSim Model Base Case. This greater release rate, is nonetheless very small relative to the dose contributions drill cuttings in the garden soil, therefore generating peak dose contributions of 8.7 mrem/yr for Sr-90 and 0.95 mrem/yr for Cs-137 on the IHI dose results. The resistance to flow associated with the intact annulus grout generates flow velocities low enough to allow decay to have a large influence on the release. When the water flow path follows the construction joints, annulus grout, annulus waste layer, and primary sand, the model predicts a negligible amount of Sr-90 (5.0E-24 mol/yr) and Cs-137 (4.0E-26 mol/yr) will leave the annulus. This condition has negligible contribution to the peak dose contributions of 8.7 mrem/yr for Sr-90 and 0.95 mrem/yr for Cs-137 on the IHI dose results. These dose contributions can again be traced back to the dose contribution from garden soil concentrations, which dominate the dose results.

For a Type II tank without the liners intact (Tanks 15 and 16), it can be seen that that the releases from the AFZ simulation are orders of magnitude higher than from the HTF GoldSim Model Base Case. Note that they are still less than the PORFLOW Base Case model. Although the AFZ model release rates are greater than the HTF GoldSim Model Base Case release rates, they are still small relative to the releases from the garden soil. With the garden soil mass controlling the dose contributions the peak IHI dose contributions for Tanks 15 and 16, are 8.7 mrem/yr for Sr-90, and 0.95 mrem/yr for Cs-137. These results are approximately the same as the PORFLOW Base Case model dose contributions. The resistance to flow associated with the flow through the intact annulus grout, generates flow velocities low enough to allow the process of radionuclide decay to control the release.

In conclusion, the AFZ analysis showed that for both Type I and for Type II tanks, the preferential pathway scenario has a negligible impact on doses when compared to the HTF PA Base Case. As can be seen by examining the results of AFZ analysis, even with the presence of features like construction joints, total continuity of low-resistance pathways is evidently a necessary criteria for the possibility of releasing rapidly decaying species such as Sr-90 or Cs-137 to IHI wells at concentrations of concern. The capability of an AFZ to release unacceptable quantities of rapidly decaying radionuclides is dependent on the influence of the low-resistance (high conductivity) structures on flow velocities. Additional studies indicate that even if a totally continuous zone of high conductivity could occur, its exposure area to the source would have to be unrealistically large to produce releases large enough to allow the tank releases to dominate over the garden soil releases. [SRR-CWDA-2014-00060]

6.4.6.4 Probabilistic Model Sensitivity Analysis

The updated HTF inventory described in Section 6.2 has been incorporated into the HTF GoldSim Model and the HTF inventory distributions used in the probabilistic model have been revised to reflect the inventory uncertainty associated with the new HTF inventory information. A probabilistic uncertainty analysis has been performed (using the updated GoldSim SRS HTF v1.010 Rad) to assess the impact of the updated HTF inventory information. In addition to the revised inventories and inventory distributions, this probabilistic model incorporates other improvements to the GoldSim HTF model from the HTF PA as discussed in the GoldSim HTF model report (SRR-CWDA-2014-00060) and in Section 6.4.6 of this SA. This probabilistic model was run twice, each for 3,000 realizations (for an All Cases probabilistic model and for the HTF PA Base Case probabilistic model) to demonstrate the effects of the revised inventory data and modeling corrections. The results of these modeling runs are discussed below.

6.4.6.4.1 All Cases Probabilistic Model

The All Cases probabilistic model is defined by the 72 parametric flow cases presented in Section 3.4.1 of the GoldSim HTF model report. [SRR-CWDA-2014-00060] Statistical results associated with the GoldSim SRS HTF v1.010 Rad model probabilistic peak dose results for the 3,000-realization All Cases Latin Hypercube Sampling (LHS) simulation are presented in Figures 6.4-17 and 6.4-18 (10,000 years log scale).

Figure 6.4-17: All Cases Probabilistic Results (1,000 Year) Log Scale

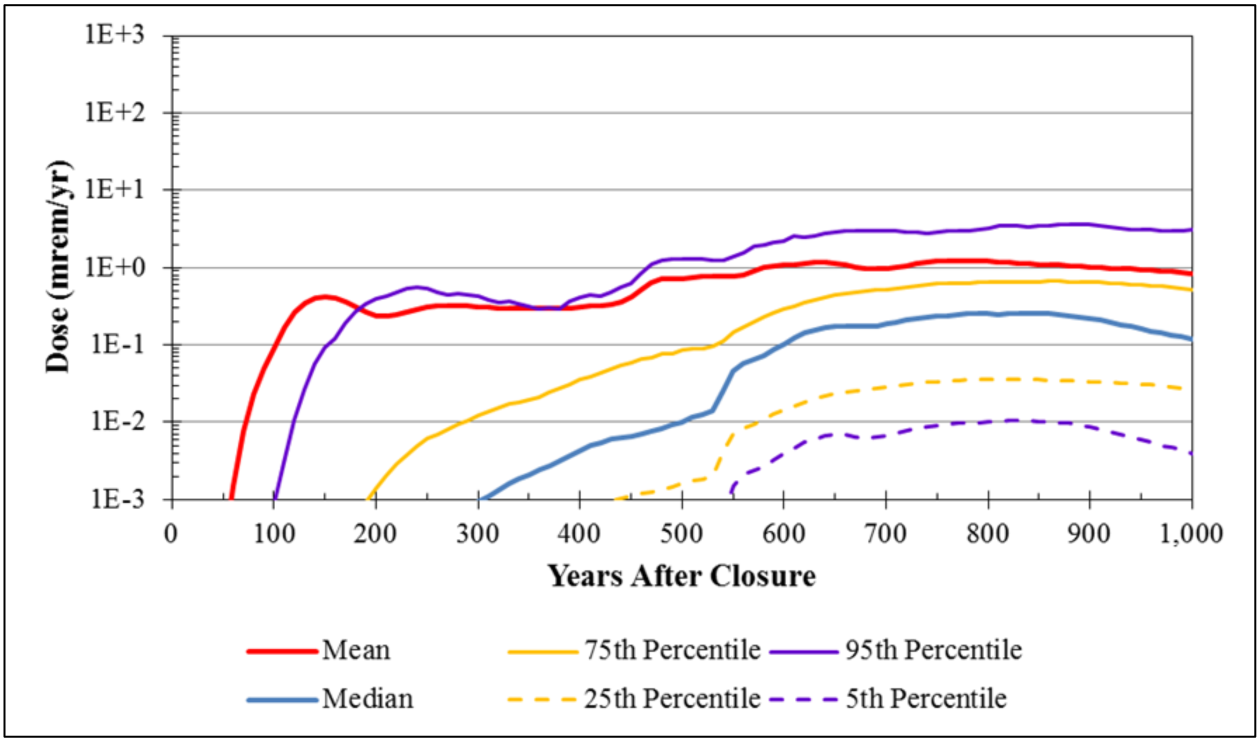
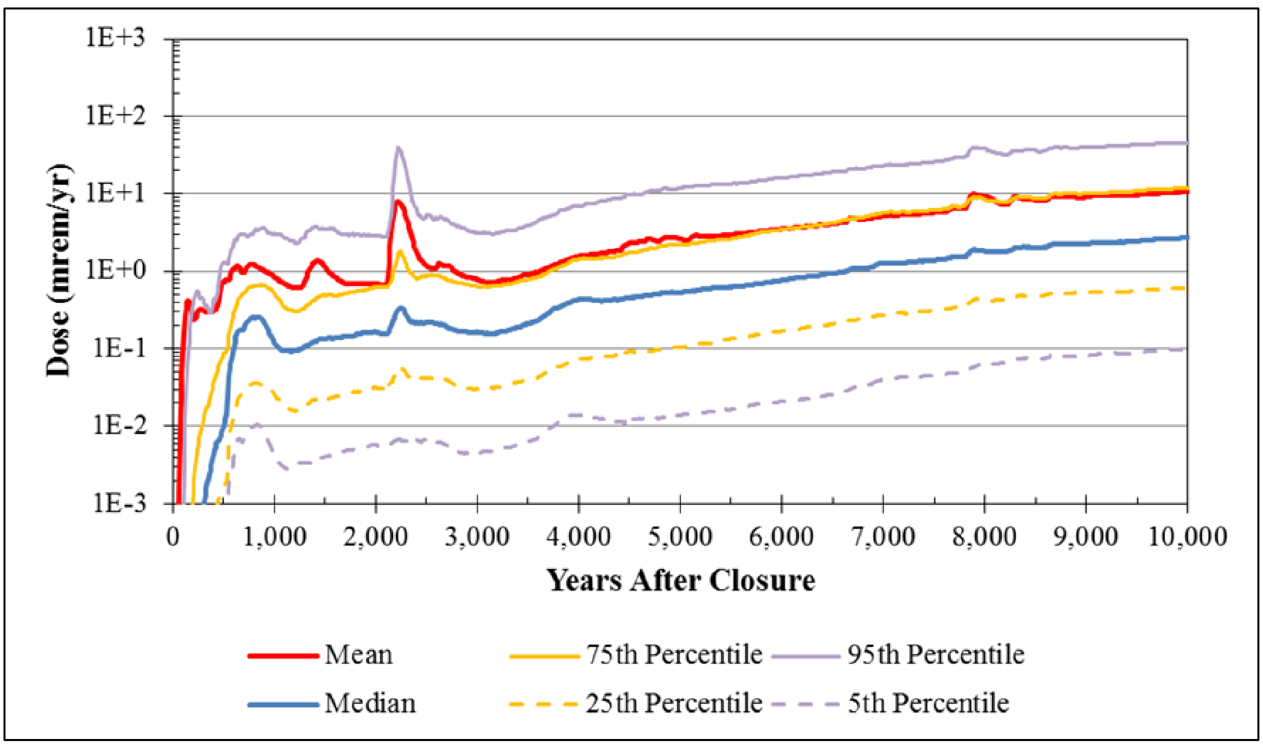


Figure 6.4-18: All Cases Probabilistic Results (10,000 Year) Log Scale



The probabilistic dose results for 3,000-realization All Cases simulation in 1,000 years showed the peak of the mean to be 1 mrem/yr, the peak of the median to be 0.3 mrem/yr, and the peak of the 95th percentile of the doses to be 4 mrem/yr. Over the first 10,000 years the peak of the mean was 11 mrem/yr (versus 15 mrem/yr in the HTF PA), the peak of the median was 3 mrem/yr (versus 6 mrem/yr in the HTF PA) and the peak of the 95th percentile of the doses to be 45 mrem/yr (versus 58 mrem/yr in the HTF PA).

6.4.6.4.2 HTF PA Base Case Probabilistic Model

The HTF PA Base Case probabilistic model is defined by the 24 parametric flow cases presented in Section 3.4.1 of the GoldSim HTF model report. [SRR-CWDA-2014-00060] These flow fields represent the parametric flow cases without a fast-flow zone present. Statistical results associated with the GoldSim SRS HTF v1.010 Rad model probabilistic peak dose results for the 3,000-realization HTF PA Base Case LHS simulation are presented in Figures 6.4-19 and 6.4-20 (10,000 years log scale).

Figure 6.4-19: HTF PA Base Case Probabilistic Results (1,000 Year) Log Scale

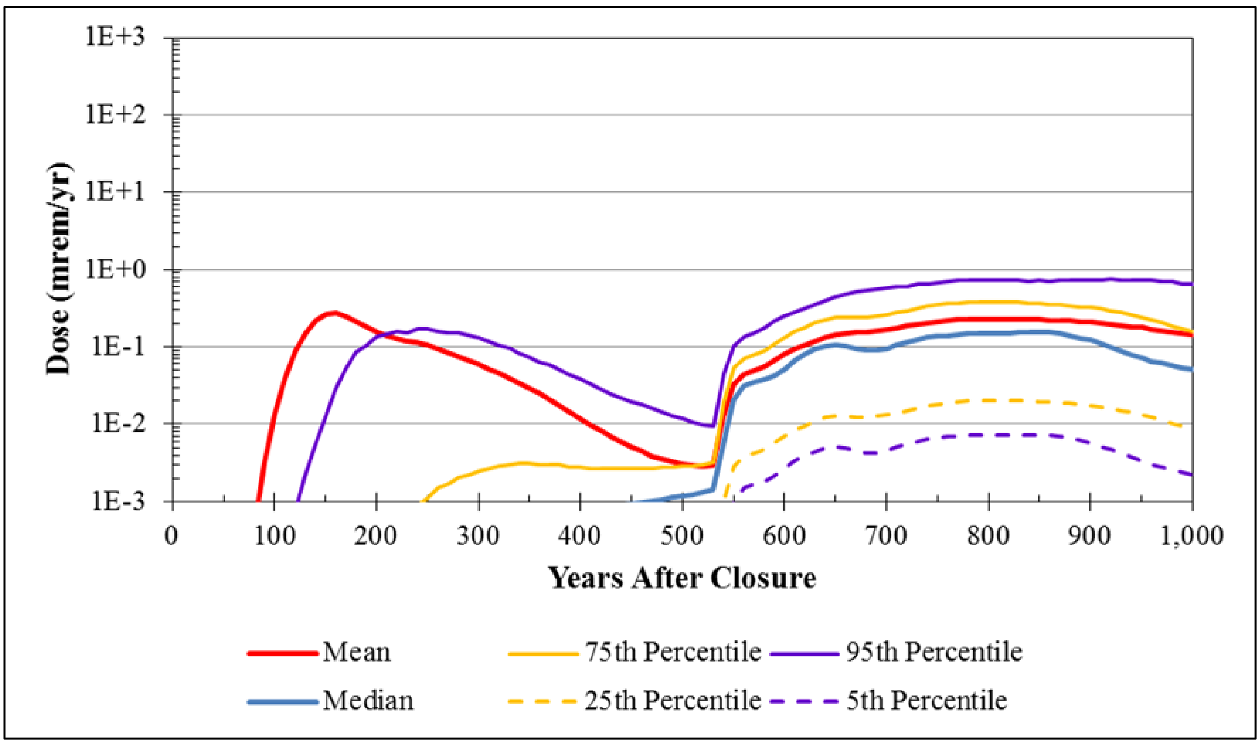
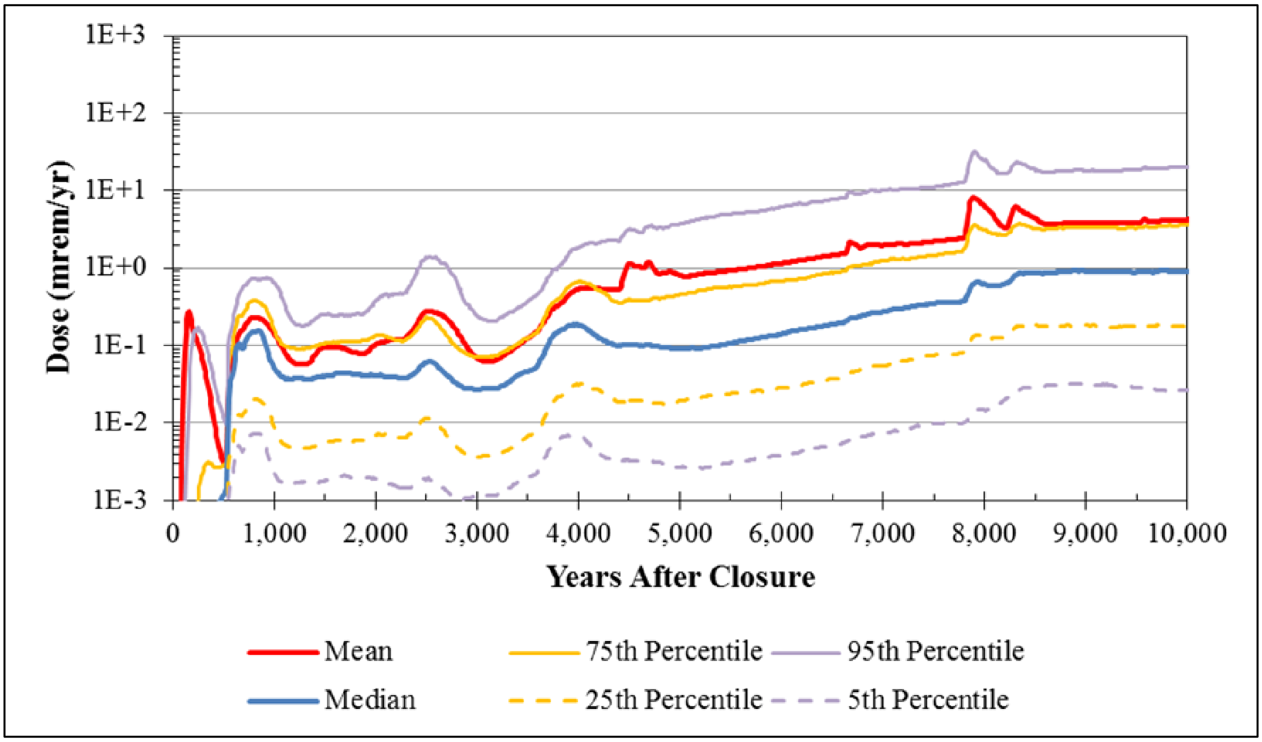


Figure 6.4-20: HTF PA Base Case Probabilistic Results (10,000 Year) Log Scale



The probabilistic dose results for 3,000-realization HTF PA Base Case simulation in 1,000 years showed the peak of the mean to be 0.3 mrem/yr, the peak of the median to be 0.2 mrem/yr and the peak of the 95th percentile of the doses to be 0.7 mrem/yr. Over the first 10,000 years the peak of the mean was 8 mrem/yr (versus 13 mrem/yr in the HTF PA), the peak of the median was 0.9 mrem/yr (versus 2 mrem/yr in the HTF PA) and the peak of the 95th percentile to be 32 mrem/yr (versus 24 mrem/yr in the HTF PA).

6.4.6.4.3 Sensitivity Analysis of Probabilistic Results

Section 5.6.5 of the HTF PA provided a probabilistic sensitivity analysis that identified those input parameters that exerted the greatest influence over various results (or endpoints). [SRR-CWDA-2010-00128] Due to the large dimensionality of the model (i.e., more than 2,500 variables and 3,000 realizations per probabilistic result set) and the high computational cost associated with this type of analysis, the analysis was not repeated for this SA. However, GoldSim provides a Sensitivity Analysis tool (as a feature of the Multi Variate result element) that provides a simplified statistical analysis of modeled endpoints. Although this tool provides insight relative to variables that have strong relationships to the total MOP dose, there are limitations that should be considered. First, GoldSim determines the variable correlations without accounting for covariance between variables. As such, the results are less reliable with each successive variable considered. Second, GoldSim only analyzes values relative to the last timestep in the simulation (i.e., 20,000 years), rather than the timestep that corresponds to a specific peak value. Regardless of these limitations, using the GoldSim Sensitivity Analysis tool can provide insight into how the changes to the model are influencing the probabilistic dose results.

To understand the differences between the HTF PA probabilistic results and the SA probabilistic results, both models are considered. Table 6.4-5 shows the top five GoldSim-determined Sensitivity Indices from both the HTF PA and the SA, using the Case A flow conditions. Similarly, Table 6.4-6 shows the top five GoldSim-determined Sensitivity Indices from both the HTF PA and the SA, when all flow conditions are sampled (All Cases).

As with the HTF PA, the results from the probabilistic SA models show that the depth of the water well is important. This parameter strongly influences the concentrations of contaminants within water used by the MOP, as described in Section 5.6.3.11 of the HTF PA. [SRR-CWDA-2010-00128] The inventory of Tc-99 also shows a strong prevalence in both the HTF PA and the SA.

Table 6.4-5: GoldSim-Determined Sensitivity Indices from HTF PA and SA Probabilistic Modeling, Base Case

Variable[a]	Correlation Coefficient	Regression Coefficient	Partial Coefficient	Importance Measure
HTF PA (Case A)				
Tank 12 inventory multiplier for Tc-99	0.38	0.245	0.221	0
Water well completion stratum selector	-0.272	0	0.014	0.16
Tank 10 inventory multiplier for U-235	0.127	-0.383	-0.327	0
Technetium solubility in Oxidizing Region III cementitious materials	-0.12	-0.484	-0.164	0.014
Tank 11 inventory multiplier for Am-243 (parent to Pu-239)	0.112	0.105	0.116	0.052
Special Analysis (Case A)				
Water well completion stratum selector	-0.407	-0.079	-0.081	0.232
Water ingestion multiplier	0.262	0.298	0.391	0.08
Tank 12 inventory multiplier for Tc-99	0.252	0.215	0.294	0.075
Tank 10 inventory multiplier for Tc-99	0.167	0.192	0.285	0.049
Tank 9 inventory multiplier for Tc-99	0.167	0.128	0.189	0.041

[a] The HTF PA uses a result element that recorded the total peak dose within 10,000 years to identify the variables of importance. This element was not included in the SA. Therefore, to reduce the statistical noise in determining the parameters of importance, the SA uses the Sector A total doses.

Table 6.4-6: GoldSim-Determined Sensitivity Indices from HTF PA and SA Probabilistic Modeling, All Cases

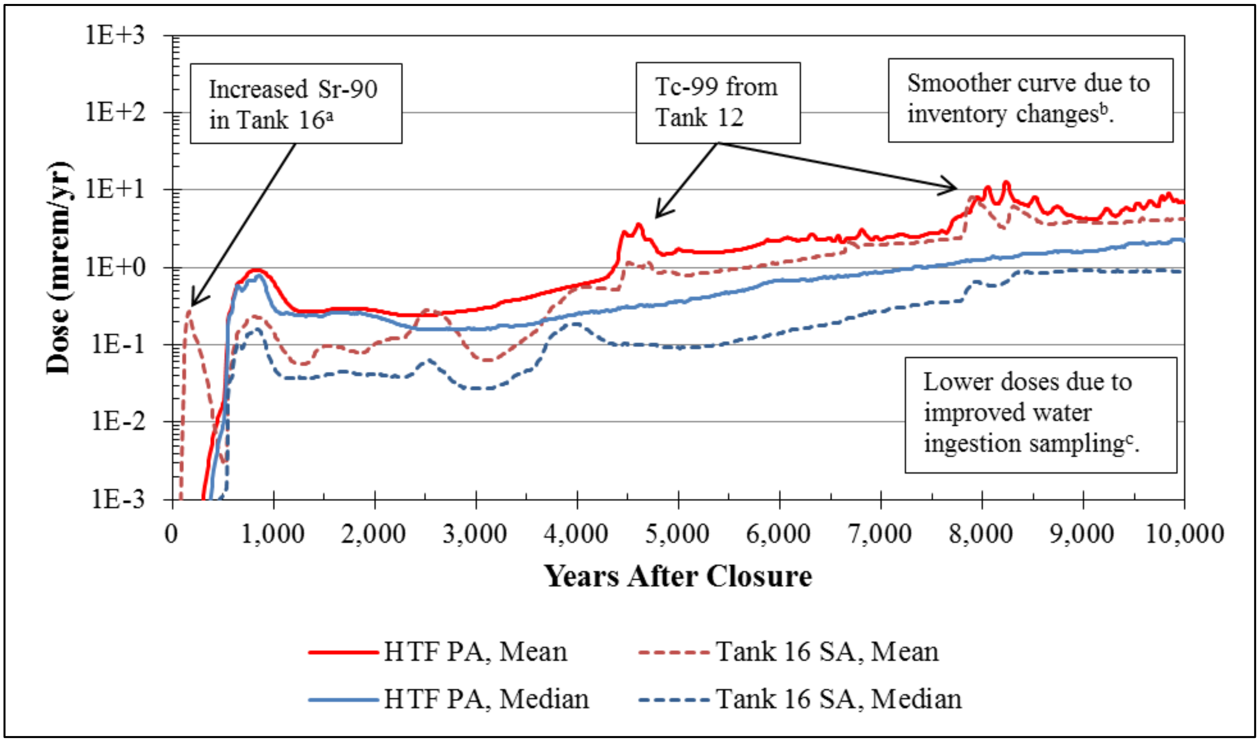
Variable[a]	Correlation Coefficient	Regression Coefficient	Partial Coefficient	Importance Measure
HTF PA (All Cases)				
Water well completion stratum selector	-0.441	0	0.007	0.289
Tank 12 inventory multiplier for Tc-99	0.156	-0.244	-0.866	0.041
Tank 35 inventory multiplier for Pa-231	-0.134	0	-0.001	0.015
Tank 39 inventory multiplier for U-232	0.125	0	0.006	0.033
Till Depth	0.12	0	0.003	0.029
Special Analysis (All Cases)				
Water well completion stratum selector	-0.396	-0.043	-0.042	0.254
Water ingestion multiplier	0.261	0.345	0.433	0.078
Tank 12 inventory multiplier for Tc-99	0.219	0.217	0.295	0.056
Tank 9 inventory multiplier for Tc-99	0.169	0.119	0.17	0.042
Tank 10 inventory multiplier for Tc-99	0.15	0.133	0.185	0.046

[a] The HTF PA uses a result element that recorded the total peak dose within 10,000 years to identify the variables of importance. This element was not included in the SA. Therefore, to reduce the statistical noise in determining the parameters of importance, the SA uses the Sector A total doses.

The most notable difference is the emergence of the water ingestion multiplier in the SA results. In the HTF PA, the water ingestion uncertainty sampled values along an overly simplistic triangular distribution with a minimum of 184 L/yr, a maximum of 730 L/yr, and a mode of 337 L/yr. This is described in Section 5.6.3.12.1 of the HTF PA. [SRR-CWDA-2010-00128] For the SA, as part of incorporating the revised dose methodology (SRR-CWDA-2013-00058), this was modified such that water ingestion is now sampled along a distribution that is based on data from the *Exposure Factors Handbook, 2011 Edition*. [EPA-600-R-090-052F] This new approach samples a truncated gamma distribution with a mean of 408 L/yr, a minimum of 88.4 L/yr, and a maximum of 782 L/yr to reflect real data, as described in Section B.1 of *Dose Calculation Methodology for Liquid Waste Performance Assessments at the Savannah River Site*. [SRR-CWDA-2013-00058] With the higher mean and larger distribution range, it is not surprising that water ingestion now has greater influence over the dose results.

In general, this more realistic sampling distribution resulted in slightly lower dose results, as shown in Figures 6.4-21 and 6.4-22. These figures include additional notes to summarize the key differences between probabilistic results from the HTF PA and this SA.

Figure 6.4-21: Comparison of Mean and Median Doses from the HTF PA and the SA Probabilistic Modeling, Case A

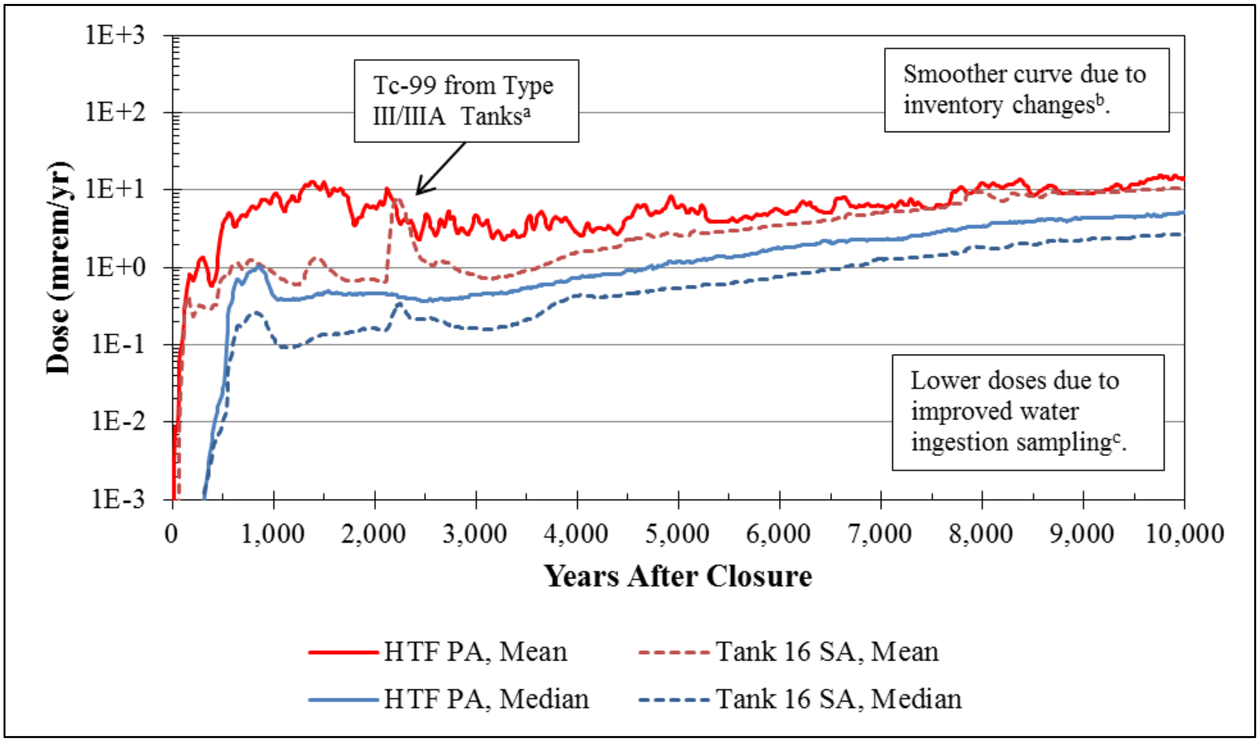


[a] In the HTF PA the annulus and sand pad inventories were modeled simplistically. The Tank 16 SA improves the modeling approach by modeling a waste layer at the bottom of the annuli of the Type II waste tanks. This modeling improvement, combined with the revised inventory assignments resulted in higher early doses at Sector C due to the release of Sr-90 from Tank 16.

[b] With the increased inventory assigned to Tank 12, there is less variability with respect to which sector exhibits the highest dose at any given time. As such, Sector A is the dominant sector for most time periods, thus the total dose curve is less variable.

[c] Water ingestion rates have been updated to reflect data from the EPA's *Exposure Factors Handbook, 2011 Edition*. [EPA-600-R-090-052F]

Figure 6.4-22: Comparison of Mean and Median Doses from the HTF PA and the SA Probabilistic Modeling, All Cases



[a] Three of the five highest dose realizations come from cases with early release and fast flow through Type III/IIIA tanks, resulting in a significant Tc-99 dose at around 2,200 years after closure.

[b] With the increased inventory assigned to Tank 12, there is less variability with respect to which sector exhibits the highest dose at any given time. As such, Sector A is the dominant sector for most time periods, thus the total dose curve is less variable.

[c] Water ingestion rates have been updated to reflect data from the EPA's *Exposure Factors Handbook, 2011 Edition*. [EPA-600-R-090-052F]

The other modeling parameters described in the HTF PA Section 5.6.3 are unaffected by the residual inventories at operational closure. The uncertainty and sensitivity analyses results described in the remainder of HTF PA Sections 5.6.4 through 5.6.7 (aside from those discussed above) remain valid irrespective of the revised Tank 16 residual inventories and do not require further analysis.

6.4.7 RCRA/CERCLA Risk Analysis

The RCRA/CERCLA risk assessment for the HTF final facility closure follows the current Area Completion Project protocols for human health and ecological risk assessments. The HTF contaminant migration constituents of concern (CMCOCs) were identified through a system that is consistent with both the Area Completion Project protocols and HTF PA. The CMCOC were identified by modeling the release of contaminants and their travel through the vadose zone, using the deterministic HTF PA Base Case model with the updated inventories. The concentrations of contaminants that are modeled to reach the water table are compared to MCL, RSLs, PRGs or other appropriate standards in cases where the constituent does not have an MCL. Any constituents that are predicted to exceed these standards (i.e., fraction greater than 1.0) in the groundwater directly beneath HTF (one meter from boundary) are identified as CMCOC as shown in Tables 6.4-7 and 6.4-8, which reflects concentrations calculated using the revised HTF inventories. Based on the 1,000-year concentration curves, no constituents were identified as CMCOCs.

Table 6.4-7: Groundwater Radionuclide Concentrations at 1 Meter from HTF

Radionuclide	MCL** (pCi/L)	Residential Tap Water PRG*** (pCi/L)	Peak Concentration (pCi/L) 1 to 1,000 Years	Fraction of MCL or PRG at 1 meter
Ac-227	N/A	2.4E-01	1.9E-07	7.9E-07
Al-26	N/A	2.8E+00	4.0E-05	1.4E-05
Am-241	N/A	4.6E-01	1.3E-01	2.8E-01
Am-242m	N/A	6.7E-01	5.7E-06	8.5E-06
Am-243	N/A	4.6E-01	8.8E-03	1.9E-02
Ba-137m*	N/A	Cs-137 daughter	N/A	N/A
C-14	2.0E+03	MCL used	4.3E-03	2.2E-06
Cf-249	N/A	3.8E-01	5.8E-14	1.5E-13
Cf-251	N/A	3.6E-01	6.8E-15	1.9E-14
Cl-36	7.0E+02	MCL used	4.5E-02	6.4E-05
Cm-243	N/A	5.0E-01	4.1E-11	8.2E-11
Cm-244	N/A	5.7E-01	1.9E-10	3.2E-10
Cm-245	N/A	4.6E-01	3.0E-05	6.5E-05
Cm-247	N/A	4.8E-01	7.6E-14	1.6E-13
Cm-248	N/A	5.0E-03	7.9E-14	1.6E-11
Co-60	1.0E+02	MCL used	3.2E-10	3.2E-12
Cs-135	9.0E+02	MCL used	4.4E-02	4.9E-05
Cs-137	2.0E+02	MCL used	4.6E-02	2.3E-04
Eu-152	2.0E+02	MCL used	6.8E-11	3.4E-13
Eu-154	6.0E+01	MCL used	6.1E-11	1.0E-12
H-3	2.0E+04	MCL used	1.3E+02	6.6E-03
I-129	1.0E+00	MCL used	3.2E-03	3.2E-03
K-40	N/A	1.9E+00	6.6E-03	3.5E-03
Nb-93m	1.0E+03	MCL used	5.8E-02	5.8E-05
Nb-94	N/A	6.1E+00	5.1E-05	8.4E-06
Ni-59	3.0E+02	MCL used	6.4E+00	2.1E-02
Ni-63	5.0E+01	MCL used	9.6E+00	1.9E-01
Np-237	N/A	7.7E-01	7.4E-01	9.6E-01
Pa-231	N/A	2.8E-01	9.1E-05	3.2E-04
Pb-210	N/A	5.4E+02	6.8E-06	1.3E-08
Pd-107	N/A	1.9E+02	9.6E-01	5.1E-03

Table 6.4-7: Groundwater Radionuclide Concentrations at 1 Meter from HTF (Continued)

Radionuclide	MCL** (pCi/L)	Residential Tap Water PRG*** (pCi/L)	Peak Concentration (pCi/L) 1 to 1,000 Years	Fraction of MCL or PRG at 1m
Pt-193	3.0E+03	MCL used	4.5E-04	1.5E-07
Pu-238	N/A	3.6E-01	2.4E-02	6.8E-02
Pu-239	N/A	3.5E-01	2.1E-01	6.0E-01
Pu-240	N/A	3.5E-01	1.2E-01	3.3E-01
Pu-241	3.0E+02	MCL used	5.2E-05	1.7E-07
Pu-242	N/A	3.7E-01	3.7E-04	1.0E-03
Pu-244	N/A	3.5E-01	1.7E-06	4.8E-06
Ra-226 + Ra-228	5.0E+00	MCL used	3.5E-03	7.1E-04
Ra-228	N/A	4.6E-02	3.0E-03	6.4E-02
Se-79	N/A	6.5E+00	5.5E-03	8.5E-04
Sm-151	1.0E+03	MCL used	6.9E-02	6.9E-05
Sn-126	N/A	1.9E+00	1.7E-03	8.8E-04
Sr-90	8.0E+00	MCL used	3.4E-01	4.3E-02
Tc-99	9.0E+02	MCL used	3.4E+02	3.8E-01
Th-229	N/A	2.1E-01	2.9E-04	1.4E-03
Th-230	N/A	5.2E-01	3.6E-05	7.0E-05
Th-232	N/A	4.7E-01	5.6E-05	1.2E-04
U-232	N/A	1.6E-01	1.8E-08	1.1E-07
U-233	N/A	6.6E-01	1.7E-02	2.6E-02
U-234	N/A	6.7E-01	2.3E-02	3.5E-02
U-235	N/A	6.8E-01	4.6E-05	6.8E-05
U-236	N/A	7.1E-01	3.6E-04	5.1E-04
U-238	N/A	7.4E-01	4.1E-04	5.5E-04
Y-90*	N/A	2.6E+00	N/A	N/A
Zr-93	2.0E+03	MCL used	8.7E-03	4.3E-06

* Daughters are assumed to be in equilibrium with the parent nuclide

** MCL values for beta and photon emitters are calculated in *Radionuclides in Drinking Water: A Small Entity Compliance Guide* (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

*** Residential tap water PRGs are calculated based on a target cancer risk of 1.0E-06 (EPA_PRGs_11-13-2007)

Table 6.4-8: Groundwater Chemical Concentrations at 1 Meter from HTF

Chemical	MCL* (μg/L)	Tap Water RSLs** (μg/L)	Peak Concentration (μg/L) 1 to1,000 Yrs	Fraction of MCL or RSL at 1 meter
Ag	1.0E+02***	MCL used	8.3E-03	8.3E-05
Al	2.0E+02	MCL used	1.3E-03	6.4E-06
As	1.0E+01	MCL used	2.1E-05	2.1E-06
B	N/A	3.1E+03	9.1E+01	2.9E-02
Ba	2.0E+03	MCL used	1.3E-02	6.7E-06
Cd	5.0E+00	MCL used	1.5E-02	3.0E-03
Cl	2.5E+05	MCL used	9.5E-01	3.8E-06
Co	N/A	4.7E+00	1.0E-04	2.1E-05
Total Chromium	1.0E+02	MCL used	3.3E-05	3.3E-07
Cu	1.3E+03	MCL used	1.1E-03	8.8E-07
F	4.0E+03	MCL used	2.3E-01	5.7E-05
Fe	3.0E+02***	MCL used	1.1E-01	3.7E-04
Hg	2.0E+00	MCL used	1.0E-03	5.1E-04
I	N/A	1.6E+02	7.9E-03	4.9E-05
Mn	5.0E+01***	MCL used	2.5E-01	5.1E-03
Mo	N/A	7.8E+01	2.3E-04	3.0E-06
Ni	N/A	7.3E+02	1.6E+01	1.6E-03
$NO_2 + NO_3$	1.0E+04	MCL used	1.9E-01	2.6E-04
Pb	1.5E+01	MCL used	2.7E-05	1.8E-06
PO_4	N/A	7.6E+05	2.2E+01	2.9E-05
Sb	6.0E+00	MCL used	3.0E-06	5.0E-07
Se	5.0E+01	MCL used	3.3E-07	6.7E-09
SO_4	2.5E+05	MCL used	1.7E+02	7.0E-04
Sr	N/A	9.3E+03	1.0E-02	1.1E-06
U	3.0E+01	MCL used	1.2E-03	3.9E-05
Zn	5.0E+03***	MCL used	5.0E-03	1.0E-06

* EPA 816-F-09-0004
** EPA_RSLs_April2012
*** EPA 816-F-10-079

6.4.8 As Low As Reasonably Achievable Analysis

Section 5.8 of the HTF PA describes how the “as low as reasonably achievable” (ALARA) requirement of DOE Order 435.1, Chg. 1 and 10 CFR 61.41 are implemented for HTF. The ALARA information presented in the HTF PA is not affected by the new characterization information.

Since the HTF PA was approved, DOE has issued a new DOE ALARA Handbook (*DOE Handbook, Optimizing Radiation Protection of the Public and the Environment for Use with DOE O 458.1, ALARA Requirements,* DOE-HDBK-1215-2014). The ALARA Handbook provides information to assist DOE program and field offices in understanding what is necessary and acceptable for implementing the ALARA provisions of *Radiation Protection of the Public and the Environment* (DOE O 458.1, Chg. 3). The ALARA Handbook identifies the goals, requirements and issues that need to be addressed when developing ALARA analyses for optimization of various programs to support DOE's diverse missions.

6.5 H-Tank Farm Inadvertent Intruder Analysis

This section will discuss the impact of the new characterization information on the HTF inadvertent intruder analysis information presented in Section 6.0 of the HTF PA.

6.5.1 Groundwater Concentrations at One Meter

Section 6.1 of the HTF PA presents the one-meter groundwater concentrations for the HTF radionuclides and chemicals. Maximum groundwater concentrations are given for the modeling cell adjoining the analyzed source terms. Results are presented for the three distinct aquifers modeled (UTRA-UZ, UTRA-LZ and Gordon Aquifer).

These groundwater concentrations were recalculated using the PORFLOW HTF model for the HTF PA Base Case using the revised HTF residual inventories presented in Section 6.3.1. Tables A-9 through A-11 (Appendix A) show peak one-meter radionuclides concentrations for the three aquifers in 1,000 years. These radionuclide concentrations reflect the peak concentrations for each radionuclide in the highest sector. The peak 1-meter chemical concentrations for the three aquifers in 1,000 years are shown Tables A-12 through A-14 (Appendix A). These chemical concentrations also reflect the peak concentrations for the sector. Similarly, Appendix B presents peak radionuclide concentrations within 10,000 years.

6.5.2 Acute Exposure Scenarios

Section 6.2 of the HTF PA describes how the biotic pathways doses are calculated for the Acute Exposure Scenarios. The acute exposure scenarios information presented in the HTF PA is not significantly affected by the new characterization information.

6.5.3 Chronic Exposure Scenarios

Section 6.3 of the HTF PA describes how the biotic pathways doses are calculated for the chronic exposure scenarios. The chronic exposure scenarios information presented in the HTF PA is not affected by the new characterization information.

6.5.4 Groundwater Doses at One Meter

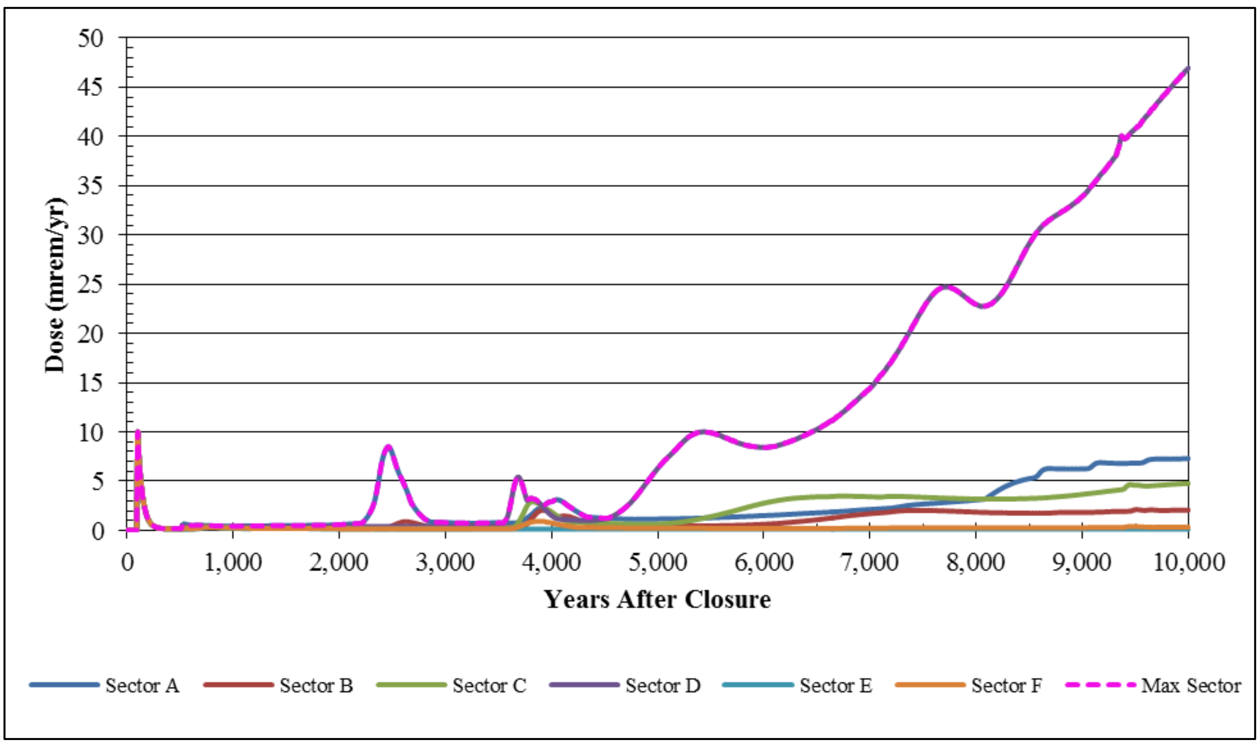
Section 6.4 of the HTF PA contains calculations of the peak total intruder doses for the acute intruder scenario and for the chronic intruder agricultural (post-drilling) scenario. For the acute intruder, doses were calculated assuming the acute intruder drills into a three-inch diameter transfer line at any time after the 100-year period of institutional control following HTF facility closure. For the chronic intruder, annual doses were calculated assuming contamination from the drill cuttings, as well as from the use of water obtained from a well.

As described in Section 6.5.1.2 of the HTF PA, "the waste tank engineered barriers (e.g., closure cap erosion barrier, tank top concrete and tank liner, where applicable), will prevent drilling into the waste inventory." Therefore, the acute intruder scenario is dependent on the transfer line inventory (i.e., it does not include a groundwater contribution) and is not affected by a revision to the HTF inventories. The peak dose for the acute intruder in 10,000 years therefore remains 1 millirem at year 100, primarily due to exposure to drill cuttings.

The peak chronic doses have been recalculated using the peak groundwater concentrations identified in Section 6.3.2 of this SA (i.e., groundwater concentrations at 1-meter and at the seepline recalculated using the PORFLOW HTF model for the HTF PA Base Case using the updated HTF inventory). For the chronic intruder, the contributions to the peak doses from the six 1-meter sectors were recalculated using the highest concentration for each radionuclide in the sector, with the recalculation based on the updated HTF inventory. These peak doses were the total dose associated with drill cuttings and all the individual 1-meter well pathways.

In the HTF PA, the peak dose for the chronic intruder scenario in a 10,000-year period is 50 mrem/yr, at year 10,000 in Sector D. Using the updated HTF inventory, the peak dose for the chronic intruder scenario in a 10,000-year period is 47 mrem/yr. Figure 6.5-1 graphically presents the annual dose to the chronic intruder for each of the six one-meter sectors for 10,000 years after HTF facility closure. Table 6.5-1 presents the chronic intruder peak dose associated with the updated HTF inventory within 10,000 years and identifies the contribution from the significant pathways radionuclides. The principal radionuclide contributors to the chronic intruder peak dose remain Ra-226, U-234 and U-233, as was true in the HTF PA. This peak annual dose was is almost entirely due to water and vegetable ingestion, as it was in the HTF PA.

Figure 6.5-1: Annual Dose to the Chronic Intruder within 10,000 Years



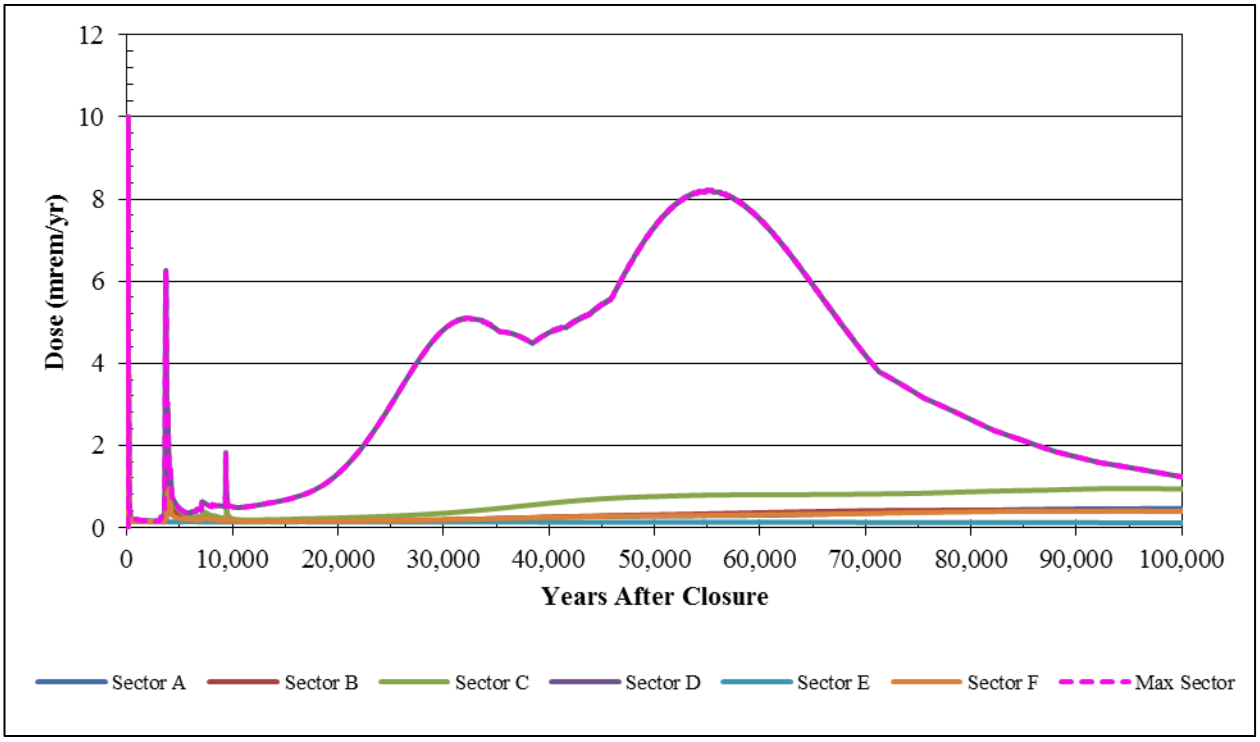
Note: Peak at year 100 occurs for all sectors.

Table 6.5-1: Chronic Intruder Peak Dose Contributors within 10,000 Years

Chronic Intruder Pathway Contributors	Contribution to Peak (mrem/yr)	Chronic Intruder Radionuclide Contributors	Contribution to Peak (mrem/yr)
Water Ingestion	46.2	Ra-226	18.4 (39%)
Vegetable Ingestion	0.6	U-234	13.2 (28%)
Others	0.2	U-233	4.9 (10%)
		Th-229	4.8 (10%)
		Others	5.7 (12%)

Figure 6.5-2 presents the Tank 16 inventory contribution to the chronic intruder peak dose in 100,000 years. The Tank 16 only peak dose is less than 10 mrem/yr (at year 100) and does not coincide with the year of peak dose attributed to all of HTF (10,000 years). Thus, the overall HTF chronic intruder peak dose is not impacted by updating the HTF inventory to include the residual inventories at operational closure for Tank 16.

Figure 6.5-2: Tank 16 Contribution to the Annual Dose to the Chronic Intruder within 100,000 Years



6.5.5 Inadvertent Intruder Uncertainty/Sensitivity Analysis

Section 6.5 of the HTF PA considers the effects on the inadvertent intruder analysis of uncertainties in the conceptual models used and sensitivities to the parameters used in the mathematical models. In general, given the insignificant change in the Tank 16 inventory from what was modeled in the HTF PA, the inadvertent intruder uncertainty and sensitivity analyses information presented in the HTF PA is not affected by the new characterization information and the uncertainty and sensitivity analyses insights remain unaffected.

6.6 H-Tank Farm Interpretation of Results

Section 7.0 of the HTF PA summarizes the conservatisms used in modeling and provides a summary and interpretation of the results presented in Section 5.0 and Section 6.0 of the HTF PA. The HTF PA conservatisms information presented in the HTF PA is not affected by the new characterization information. The integrated system behavior discussion provided in Section 7.1.1 of the HTF PA remains valid irrespective of the updated HTF residual inventory presented in this SA. The individual dose results provided in the Section 7.1.2 of the HTF PA have been updated based on the revised HTF PA Base Case modeling using the updated HTF residual inventories at closure, and are summarized in the following sections. Additional sensitivity studies were also performed to evaluate the impact of Tank 16 annulus inventory variability and annulus preferential pathways.

6.6.1 100-Meter (Water from Well) Groundwater Pathways Doses

The peak 100-meter groundwater pathway doses in 1,000 years are in Sectors A and C (0.2 mrem/yr). Similarly, in 10,000 years the peak 100-meter groundwater pathway doses are also in Sector A (4.1 mrem/yr) and Sector C (2.4 mrem/yr), as expected, because these sectors are closest to the Type I and Type II tanks, which are the only waste tanks projected in the HTF PA Base Case to have their liners degraded at the time of closure (i.e., year 0). The primary pathway contributors to the peak 100-meter groundwater dose is water ingestion. The 100-meter groundwater-pathway peak doses in 1,000 years are primarily associated with Tc-99. The 100-meter groundwater-pathway peak doses in 10,000 years are primarily associated with I-129. The individual pathway contributors to peak groundwater pathway dose in 10,000 years are changed from the HTF PA. The Sector A peak dose is dominated by I-129 because the Tank 12 I-129 inventory was increased from the HTF PA inventory. The Sector A peak dose in 10,000 year was previously (i.e, in the HTF PA) dominated by Tc-99 releases from Tanks 9, 10 and 11. The Tc-99 releases from these waste tanks have decreased (because the Tc-99 inventory in these tanks was reassessed based on Tank 16 annulus characterization data for Tc-99 (discussed further in Section 6.2).

As discussed in Section 6.4.5.3, Tank 16 is a negligible contributor (less than 0.1 mrem/yr) to the 100-meter peak groundwater-pathway dose within 10,000 years (4.1 mrem/yr at year 2,610). Although Sector A provides the highest doses when considering all of the sources within the HTF (Section 6.4.5.1), Tank 16 provides greater impacts on Sector C. Tank 16 is the dominant contributor to a 2.1 mrem/yr peak at year 3,850, primarily due to I-129. This 2.1 mrem/yr peak at year 3,850 is the highest peak associated with Tank 16 within 100,000 years.

6.6.2 Water at the Stream Groundwater Pathways Doses

The MOP peak-groundwater pathway dose at the stream seepline in 10,000 years is associated with Fourmile Branch. The peak MOP groundwater pathway dose at the stream seepline in 1,000 years is 0.02 mrem/yr at year 740, primarily due to Tc-99. The peak MOP groundwater pathway dose in 10,000 years is 0.03 mrem/yr at year 3,950, primarily due to I-129. The primary contributor to the Fourmile Branch peak dose is water ingestion.

6.6.3 All-Pathways Dose

The peak all-pathways annual dose for the MOP at 100-meters is calculated using the recalculated peak 100-meter groundwater-pathway dose results in 10,000 years (4 mrem/yr) in combination with the negligible air pathway results (less than 0.0001 mrem/yr). The peak all-pathways annual dose for the MOP is 4 mrem/yr and is associated with Sector A. Tank 16 is a negligible contributor to the 100-meter peak all-pathways annual dose within 10,000 years.

6.6.4 Inadvertent Intruder Dose

The peak dose for the HTF acute intruder in 10,000 years is 1 mrem (primarily due to exposure to drill cuttings). The acute intruder scenario does not include a groundwater contribution and therefore does not vary by HTF sector. The peak dose for the HTF chronic intruder scenario in 10,000 years is approximately 47 mrem/yr, which is essentially unchanged from the 50 mrem/yr peak reported in the HTF PA. The 47 mrem/yr peak dose is almost entirely due to ingestion of vegetables contaminated with drill cuttings. The chronic intruder scenario peak dose is also driven by the drill cutting contributions. The peak inadvertent intruder doses in 10,000 years presented in the HTF PA were not significantly impacted when the residual inventory at facility closure is used for Tank 16.

6.6.5 Airborne Dose/Radon Flux

The HTF Air Pathway and Radon dose results are insignificant (less than 0.0001 mrem/yr and less than 1.5E-14 $pCi/m^2/s$, respectively in the HTF PA) and the radionuclides affecting these results (e.g., C-14, Sn-126, Ra-226, U-234, Pu-238) were not significantly changed by the final Tank 16 inventory (Section 5.0). The air pathway and radon analysis results presented in the HTF PA are therefore not appreciably affected by the new characterization information.

6.6.6 Sensitivity Analysis/Uncertainty Analysis Results

Additional sensitivity studies were performed to evaluate 1) Tank 16 annulus inventory variability and 2) Annulus preferential pathways. The Tank 16 annulus inventory sensitivity analyses were performed to provide insight into the potential effects of removing additional waste material from the Tank 16 annulus. These analyses compare dose results, generated by removing one-half and 75% of the final Tank 16 annulus inventory. As documented in Section 6.4.6.2, this sensitivity study shows that the peak doses associated with Tank 16 are not appreciably impacted by reducing the total inventory in the Tank 16 annulus. The AFZ sensitivity analysis showed that for both Type I and for Type II tanks the preferential pathway scenario has a negligible difference from the HTF PA Base Case. These results reflect the dominance of soil concentrations in the dose calculations. [SRR-CWDA-2014-00060]

The probabilistic uncertainty analysis was run twice, each for 3,000 realizations (for an All Cases probabilistic model and for the HTF PA Base Case probabilistic model) to demonstrate the effects of the revised inventory data and modeling corrections. The probabilistic dose results for 3,000-realization All Cases simulation in 10,000 years showed the peak of the mean to be 11 mrem/yr (versus 15 mrem/yr in the HTF PA), the peak of the median was 3 mrem/yr (versus 6 mrem/yr in the HTF PA) and the peak of the 95^{th} percentile to be 45 mrem/yr (versus 58 mrem/yr in the HTF PA). [SRR-CWDA-2014-00060]

The probabilistic dose results for 3,000-realization HTF PA Base Case simulation in 10,000 years showed the peak of the mean to be 8 mrem/yr (versus 13 mrem/yr in the HTF PA), the peak of the median was 0.9 mrem/yr (versus 2 mrem/yr in the HTF PA) and the peak of the 95^{th} percentile to be 32 mrem/yr (versus 24 mrem/yr in the HTF PA). [SRR-CWDA-2014-00060] These results show that the probabilistic uncertainty analysis was not appreciably affected by the new characterization information.

6.6.7 State Drinking Water Regulations

The calculated peak groundwater radionuclide concentrations provide reasonable assurance that compliance is maintained with the state drinking water requirements, as applicable per DOE M 435.1-1 and the *Industrial Wastewater General Closure Plan for H-Area Waste Tank Systems* (SRR-CWDA-2011-00022). The peak groundwater radionuclide concentrations within 1,000 years were calculated and no contaminants were above the respective MCL or PRG values at one meter. The peak concentrations within 1,000 years for the chemicals of concern were also calculated, and all were less than the MCL or RSL at a distance of one meter from HTF. Drinking water results for time periods beyond 1,000 years and at points of assessment beyond 1 meter are presented in Appendix D.

6.7 H-Tank Farm Performance Evaluation

Section 8.0 of the HTF PA describes intended use and future work to be done to support its maintenance. The HTF PA use and future work information presented in the HTF PA are not adversely impacted by the new characterization information, and the new information documented in this SA will be used for further information during future HTF PA maintenance activities. As discussed in Section 6.3.2, work is underway to provide additional information regarding the residual waste solubility assumptions used in the performance assessment waste release models. [SRR-CWDA-2014-00108]

7.0 CONCLUSION

The HTF PA provides groundwater radionuclide concentrations at one meter, 100 meters and exposure points at the two seeplines; the UTR seepline located approximately 2 miles northwest of the HTF or the Fourmile Branch seepline, approximately 1 mile south of the HTF. The groundwater concentrations are provided for each of the three aquifers as applicable as a part of the HTF groundwater modeling. The HTF PA also provides groundwater concentrations for chemical contaminants at one meter and 100 meters. In addition, HTF PA provides intruder doses as well as analyses for the air pathways and radon ground surface flux. The HTF PA results can be used in subsequent documents to demonstrate compliance with the pertinent requirements identified below for final facility closure of HTF as indicated in Table 7.0-1.

Table 7.0-1: Key Limits from Regulatory Requirements

Requirement	All-Pathways Dose	Intruder Dose	Air Pathway Dose	Radon Flux	Groundwater Protection
NDAA Section 3116: 10 CFR 61.41 and 61.42	25 mrem/yr	500 mrem/yr	N/A	N/A	N/A
DOE M 435.1-1	25 mrem/yr	500 mrem – acute 100 mrem/yr – chronic	10 mrem/yr	20 pCi/m^2/s at ground surface	< MCLs and < 4 mrem/yr beta-gamma dose
SCDHEC Primary Drinking Water Regulations (SCDHEC R.61-58)	N/A	N/A	N/A	N/A	< MCLs and < 4 mrem/yr beta-gamma dose

The key radiological results of this SA are presented in Table 7.0-2.

Table 7.0-2: Summary Radiological Results for H-Tank Farm

Location	Tank 16 Special Analysis Peak Within 10,000 Years		
	All-Pathways Dose (mrem/yr)	Groundwater Pathway Dose (mrem/yr)	Air Pathway Dose (mrem/yr)
100 meters from HTF	4 at ~ year 2,610	4 at ~ year 2,610	<0.0001
At Seepline	0.03 at ~ year 3,950	0.03 at ~ year 3,950	<0.0001

Note: Dose values are shown to two significant figures to illustrate changes/trends. The use of two significant figures is not meant to imply this level of precision for these dose projections.

Note: The HTF PA, Rev.1 peak intruder dose is 50 mrem/yr at year 10,000 from a chronic scenario, drilling through a transfer line and using groundwater concentrations at the maximum 1-meter HTF location. This value is decreased (47 mrem/yr) in this Special Analysis.

Note: The HTF PA, Rev.1 peak radon flux at the ground surface is 1.5E-14 pCi/m^2/s. The SA peak radon flux remains insignificant (less than 1.5E-14 pCi/m^2/s) as discussed in Section 6.4.3.

The peak groundwater radionuclide concentrations within 1,000 years were calculated and no contaminants were above the respective MCL or PRG values at one meter. The peak concentrations within 1,000 years for the chemicals of concern were also calculated, and all were less than the MCL or RSL at a distance of 1 meter from HTF.

The SA results provide reasonable assurance that compliance is maintained with the specific requirements of DOE M 435.1-1 (including the applicable state drinking water regulations) and NDAA Section 3116. The additional sensitivity and uncertainty analyses performed using the lessons learned regarding waste release modeling and distribution coefficients provide further confidence. The results presented in the HTF PA are not significantly impacted by new information regarding the residual inventory that is to be grouted in-place in Tank 16.

8.0 REFERENCES

10 CFR 61, *Licensing Requirements for Land Disposal of Radioactive Waste*, U.S. Nuclear Regulatory Commission, Washington DC, January 1, 2010.

B-SQP-C-00003, *Software Quality Assurance Plan for ReadPORFLOWData.dll for the Savannah River Site's Liquid Waste Program*, Savannah River Site, Aiken, SC, Rev. 1, June 4, 2013.

C-ESR-G-00003, *SRS High Level Waste Tank Crack and Leak Information,* Savannah River Site, Aiken, SC, Rev. 11, August 6, 2014.

DHEC_01-25-1993, *Bureau of Water Pollution Control Permit to Construct, F and H-Area High-Level Radioactive Waste Tank Farms, Construction Permit #17,424-IW*, South Carolina Department of Health and Environmental Control, Columbia, SC, January 25, 1993.

DOE M 435.1-1, Chg. 1, *Radioactive Waste Management Manual*, U.S. Department of Energy, Washington DC, June 19, 2001.

DOE O 435.1, Chg. 1, *Radioactive Waste Management*, U.S. Department of Energy, Washington DC, August 28, 2001.

DOE O 458.1, Chg. 3, *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, Washington DC, January 15, 2015.

DOE/SRS-WD-2014-001, *Basis for Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 0, December 2014.

DOE_11-10-1999, *Maintenance Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses*, U.S. Department of Energy, Washington DC, November 10, 1999.

DOE-HDBK-1215-2014, *DOE Handbook*, *Optimizing Radiation Protection of the Public and the Environment for Use with DOE O 458.1*, *ALARA Requirements*, U.S. Department of Energy, Washington DC, October 2014.

DOE-STD-1196-2011, *DOE Standard Derived Concentration Technical Standard*, U.S. Department of Energy, Washington DC, April 2011.

DOE-WD-2014-001, Moniz, E.J., *Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site*, U.S. Department of Energy, Washington DC, December 19,2014.

DP-1358, Poe, W.L., *Leakage from Waste Tank 16, Amount, Fate, and Impact*, Savannah River Site, Aiken, SC, November 1974.

EPA 815-R-02-001, *Radionuclides in Drinking Water: A Small Entity Compliance Guide,* U.S. Environmental Protection Agency, February 2002.

EPA 816-F-09-0004, *National Primary Drinking Water Regulations*, U.S. Environmental Protection Agency, Washington DC, May 2009.

EPA 816-F-10-079, *Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals*, U.S. Environmental Protection Agency, Washington DC, January 7, 2011.

EPA_PRGs_11-13-2007, *Radionuclide Toxicity and Preliminary Remediation Goals for Superfund*, U.S. Environmental Protection Agency, Washington DC, November 13, 2007.

EPA_RSLs_April2012, *Regional Screening Level (RSL) Summary Table April 2012*, U.S Environmental Protection Agency, April 2012.

EPA-600-R-090-052F, *Exposure Factors Handbook: 2011 Edition*, U.S. Environmental Protection Agency, September 2011.

ML14094A496, *Technical Evaluation Report for Draft Waste Determination for Savannah River Site H Area Tank Farm*, U.S. Nuclear Regulatory Commission, Washington DC, June 17, 2014.

NBS Handbook 69, *Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposur*e, *National Bureau of Standards Handbook 69*, U.S. Department of Commerce, Washington DC, August 1963.

NDAA_3116, *Ronald W. Reagan National Defense Authorization Act (NDAA) for Fiscal Year 2005, Section 3116, Defense Site Acceleration Completion, Public Law 108-375*, October 28, 2004.

SCDHEC R.61-58, *State Primary Drinking Water Regulation*, South Carolina, Department Of Health and Environmental Control, Columbia, SC, August 28, 2009.

SRNL-STI-2014-00612, Flach, G.P. and Taylor, G.A., *H-Area Tank Farm Tank 16 Special Analysis Model Support*, Savannah River Site, Aiken, SC, Rev. 0, December 23, 2014.

SRR-CWDA-2010-00023, Superseded, *H-Area Tank Farm Closure Inventory for use in Performance Assessment Modeling*, Savannah River Site, Aiken, SC, Rev. 3, May 10, 2012.

SRR-CWDA-2010-00023, *H-Area Tank Farm Closure Inventory for use in Performance Assessment Modeling*, Savannah River Site, Aiken, SC, Rev. 4, November 11, 2014.

SRR-CWDA-2010-00128, *Performance Assessment for the H-Area Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 1, November 2012.

SRR-CWDA-2011-00022, *Industrial Wastewater General Closure Plan for H-Area Waste Tank Systems, Industrial Wastewater Construction Permit #17,424-IW*, Savannah River Site, Aiken, SC, Rev. 0, May 2012.

SRR-CWDA-2011-00050, *Liquid Waste Tank Residuals Sampling and Analysis Program Plan*, Savannah River Site, Aiken, SC, Rev. 2, July 2013.

SRR-CWDA-2011-00117, *Liquid Waste Tank Residuals Sampling-Quality Assurance Program Plan*, Savannah River Site, Aiken, SC, Rev. 1, July 2013.

SRR-CWDA-2012-00156, *Tank 16 Radionuclide and Chemical Screening for Residual Inventory Determination*, Savannah River Site, Aiken, SC, Rev. 0, February 2013.

SRR-CWDA-2013-00058, *Dose Calculation Methodology for Liquid Waste Performance Assessments at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 1, July 2014.

SRR-CWDA-2013-00106, *Comment Response Matrix for NRC Staff Request for Additional Information on the Draft Basis for Section 3116 Determination and Associated Performance Assessment for the H-Area Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 1, October 2013.

SRR-CWDA-2014-00040, *Tier 1 Closure Plan for the H-Area Waste Tank Systems at the Savannah River Site* Savannah River Site, Aiken, SC, Rev. 0, December 2014.

SRR-CWDA-2014-00060, *Updates to the H-Area Tank Farm Stochastic Fate and Transport Model*, Savannah River Site, Aiken, SC, Rev. 0, January 2015.

SRR-CWDA-2014-00071, *Tank 16 Inventory Determination*, Savannah River Site, Aiken, SC, Rev. 0, October 23, 2014.

SRR-CWDA-2014-00108, *Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program, FY2015 Implementation Plan*, Savannah River Site, Aiken, SC, Rev. 0, January 2015.

SRR-CWDA-2014-00134, *Tank 16 Special Analysis for the Performance Assessment for the H-Area Tank Farm at the Savannah River Site: Quality Assurance Report*, Savannah River Site, Aiken, SC, Rev. 0, February 2015.

SRR-ESH-2013-00078, Allen, P., *SRR Annual Radioactive Waste Tank Inspection Program–CY2012 (SRR-STI-2013-00321)*, Savannah River Site, Aiken, SC, Rev. 0, June 26, 2013.

SRR-LWE-2012-00039, Clark, D.J., Clark, J.L., *Estimation of Waste Material in the Tank 16 Annulus Following Sampling in November 2011*, Savannah River Site, Aiken, SC, Rev. 0, February 28, 2012.

Title 48_Chapter 1_SC Laws, *South Carolina Pollution Control Act, Environmental Protection and Conservation*, South Carolina Legislative Council, Columbia, SC, Current through the 2008 Session.

WSRC-OS-94-42, *Federal Facility Agreement for the Savannah River Site*, Savannah River Site, Aiken, SC, August 16, 1993.

APPENDIX A

RADIOLOGICAL AND CHEMICAL CONCENTRATION TABLES TO 1,000 YEARS

Table A-1: Radiological 100-Meter Concentrations for UTRA-UZ to 1,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	8.2E-09	960	1.6E-09	1,000	1.2E-08	1,000	6.7E-11	1,000	7.5E-10	836	1.2E-08	790
Al-26	N/A	5.6E-29	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-241	Total α	1.1E-24	1,000	<1.0E-30	1,000	1.2E-30	1,000	4.7E-28	1,000	<1.0E-30	1,000	2.6E-28	1,000
Am-242m	Total α	2.8E-29	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-243	Total α	7.8E-26	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.4E-29	1,000	<1.0E-30	1,000	1.8E-29	1,000
C-14	2,000	8.9E-06	1,000	1.2E-16	1,000	4.1E-08	1,000	4.4E-09	1,000	2.8E-08	1,000	1.1E-05	1,000
Cf-249	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cf-251	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cl-36	700	1.2E-03	658	1.2E-02	952	4.4E-03	1,000	1.5E-03	1,000	1.4E-03	1,000	1.7E-03	998
Cm-243	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	538	<1.0E-30	454	<1.0E-30	1,000	<1.0E-30	1,000
Cm-244	Total α	<1.0E-30	338	<1.0E-30	1,000	<1.0E-30	338	<1.0E-30	284	<1.0E-30	798	<1.0E-30	388
Cm-245	Total α	2.7E-28	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-247	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-248	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Co-60	100	2.8E-29	96	<1.0E-30	270	<1.0E-30	110	<1.0E-30	80	<1.0E-30	192	<1.0E-30	116
Cs-135	900	9.7E-05	1,000	1.1E-14	1,000	3.3E-06	1,000	5.2E-08	1,000	2.3E-06	1,000	2.2E-04	1,000
Cs-137	200	9.9E-09	846	3.1E-19	1,000	1.0E-10	924	2.5E-12	936	5.0E-11	1,000	1.0E-08	852
Eu-152	200	<1.0E-30	252	<1.0E-30	770	<1.0E-30	252	<1.0E-30	214	<1.0E-30	562	<1.0E-30	292
Eu-154	60	<1.0E-30	162	<1.0E-30	450	<1.0E-30	162	<1.0E-30	136	<1.0E-30	322	<1.0E-30	186
H-3	20,000	3.6E-05	74	5.4E-09	106	1.9E-02	64	1.1E-03	58	2.6E-09	80	4.4E-04	70
I-129	1	1.1E-04	898	1.5E-03	892	5.3E-04	940	2.6E-04	1,000	2.5E-04	1,000	3.0E-04	906
K-40	N/A	1.2E-04	1,000	1.2E-08	1,000	4.9E-05	1,000	1.8E-07	1,000	1.7E-05	986	2.8E-04	916
Nb-93m	1,000	1.8E-21	1,000	<1.0E-30	1,000	3.1E-27	1,000	3.0E-25	1,000	<1.0E-30	1,000	5.5E-24	1,000
Nb-94	N/A	6.7E-19	1,000	<1.0E-30	1,000	9.4E-24	1,000	2.2E-23	1,000	<1.0E-30	1,000	1.2E-20	1,000

Table A-1: Radiological 100-Meter Concentrations for UTRA-UZ to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	7.0E-02	1,000	3.7E-09	1,000	7.6E-03	1,000	7.4E-05	1,000	7.5E-03	1,000	2.6E-01	1,000
Ni-63	50	5.1E-03	990	2.3E-10	1,000	5.1E-04	1,000	5.3E-06	1,000	4.6E-04	1,000	1.6E-02	988
Np-237	Total α	2.0E-02	896	8.7E-03	1,000	3.1E-02	1,000	3.9E-04	1,000	2.1E-03	800	3.6E-02	758
Pa-231	Total α	2.8E-06	922	1.1E-06	1,000	4.7E-06	1,000	4.9E-08	1,000	2.9E-07	806	4.7E-06	764
Pb-210	N/A	3.0E-12	1,000	8.6E-29	1,000	3.2E-15	1,000	3.4E-17	1,000	1.2E-17	1,000	2.3E-12	1,000
Pd-107	N/A	1.1E-02	1,000	5.6E-10	1,000	1.2E-03	1,000	1.1E-05	1,000	1.1E-03	1,000	3.9E-02	1,000
Pt-193	3,000	1.6E-08	902	4.0E-16	1,000	1.0E-09	1,000	1.2E-11	950	8.4E-10	988	3.9E-08	936
Pu-238	Total α	1.4E-23	1,000	<1.0E-30	1,000	1.2E-29	1,000	1.9E-27	1,000	<1.0E-30	1,000	8.4E-27	1,000
Pu-239	Total α	6.1E-22	1,000	<1.0E-30	1,000	6.6E-28	1,000	1.0E-25	1,000	<1.0E-30	1,000	3.8E-25	1,000
Pu-240	Total α	3.3E-22	1,000	<1.0E-30	1,000	3.6E-28	1,000	5.5E-26	1,000	<1.0E-30	1,000	2.1E-25	1,000
Pu-241	300	6.8E-28	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-242	Total α	1.1E-24	1,000	<1.0E-30	1,000	1.2E-30	1,000	1.8E-28	1,000	<1.0E-30	1,000	6.7E-28	1,000
Pu-244	Total α	4.9E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.1E-30	1,000
Ra-226	Total α/Ra	3.9E-10	1,000	1.9E-26	1,000	4.5E-13	1,000	5.3E-15	1,000	2.3E-15	1,000	3.1E-10	1,000
Ra-228	Total Ra	3.7E-19	1,000	<1.0E-30	1,000	1.0E-23	1,000	2.1E-23	1,000	6.3E-28	1,000	1.4E-20	1,000
Se-79	N/A	1.4E-25	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.9E-28	1,000	<1.0E-30	1,000	3.8E-29	1,000
Sm-151	1,000	1.3E-25	1,000	<1.0E-30	1,000	<1.0E-30	1,000	5.0E-29	1,000	<1.0E-30	1,000	3.0E-29	1,000
Sn-126	N/A	2.1E-29	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sr-90	8	3.7E-06	764	1.1E-11	1,000	1.6E-07	862	2.4E-09	808	1.2E-07	840	6.8E-06	808
Tc-99	900	1.2E+01	772	1.6E+02	768	5.8E+01	800	2.7E+01	882	2.7E+01	890	2.9E+01	840
Th-229	Total α	8.2E-10	1,000	8.6E-12	1,000	5.2E-10	1,000	1.5E-12	1,000	8.2E-11	1,000	1.5E-09	1,000
Th-230	Total α	5.6E-23	1,000	<1.0E-30	1,000	3.6E-28	1,000	1.4E-26	1,000	<1.0E-30	1,000	1.5E-25	1,000
Th-232	Total α	4.5E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000	2.9E-30	1,000	<1.0E-30	1,000	1.5E-30	1,000

Table A-1: Radiological 100-Meter Concentrations for UTRA-UZ to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	1.9E-26	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.9E-30	1,000	<1.0E-30	1,000	5.9E-29	1,000
U-233	Total U*	2.0E-07	1,000	1.1E-08	1,000	1.9E-07	1,000	4.8E-10	1,000	1.4E-08	1,000	2.1E-07	1,000
U-234	Total U*	3.1E-19	1,000	<1.0E-30	1,000	1.7E-24	1,000	6.9E-23	1,000	<1.0E-30	1,000	1.0E-21	1,000
U-235	Total U*	6.3E-22	1,000	<1.0E-30	1,000	4.4E-27	1,000	1.6E-25	1,000	<1.0E-30	1,000	2.0E-24	1,000
U-236	Total U*	4.9E-21	1,000	<1.0E-30	1,000	3.4E-26	1,000	1.3E-24	1,000	<1.0E-30	1,000	1.6E-23	1,000
U-238	Total U*	5.6E-21	1,000	<1.0E-30	1,000	3.9E-26	1,000	1.4E-24	1,000	<1.0E-30	1,000	1.8E-23	1,000
Zr-93	2,000	7.0E-25	1,000	<1.0E-30	1,000	1.1E-30	1,000	4.4E-28	1,000	<1.0E-30	1,000	2.3E-28	1,000
Sum of beta-gamma MCL fractions		1.4E-02	NA	1.8E-01	NA	6.5E-02	NA	3.1E-02	NA	3.0E-02	NA	3.4E-02	NA
Total alpha	**15**	2.0E-02	NA	8.7E-03	NA	3.1E-02	NA	3.9E-04	NA	2.1E-03	NA	3.6E-02	NA
Total Ra	**5**	3.9E-10	NA	1.9E-26	NA	4.5E-13	NA	5.3E-15	NA	2.3E-15	NA	3.1E-10	NA

* Total uranium is evaluated in Tables A-4 through A-6
** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr
† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table A-2: Radiological 100-Meter Concentrations for UTRA-LZ to 1,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	3.7E-08	1,000	9.1E-09	1,000	1.1E-07	1,000	2.0E-09	1,000	1.0E-08	808	2.0E-08	790
Al-26	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-241	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.6E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-242m	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-243	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
C-14	2,000	3.0E-07	1,000	2.9E-12	1,000	8.1E-05	1,000	5.1E-07	1,000	9.6E-07	1,000	4.9E-06	1,000
Cf-249	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cf-251	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cl-36	700	1.0E-02	928	1.2E-02	978	1.1E-02	998	4.5E-04	1,000	4.8E-03	1,000	5.1E-03	1,000
Cm-243	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	926	<1.0E-30	796	<1.0E-30	1,000	<1.0E-30	1,000
Cm-244	Total α	<1.0E-30	570	<1.0E-30	1,000	<1.0E-30	584	<1.0E-30	506	<1.0E-30	1,000	<1.0E-30	622
Cm-245	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-247	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-248	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Co-60	100	<1.0E-30	158	<1.0E-30	340	1.0E-29	146	2.4E-30	124	<1.0E-30	274	<1.0E-30	172
Cs-135	900	8.0E-06	1,000	3.0E-11	1,000	6.2E-03	1,000	5.6E-06	1,000	8.0E-05	1,000	4.0E-04	1,000
Cs-137	200	2.9E-10	984	2.1E-15	780	5.5E-07	854	3.7E-10	890	1.7E-09	1,000	9.3E-09	984
Eu-152	200	<1.0E-30	426	<1.0E-30	966	<1.0E-30	438	<1.0E-30	380	<1.0E-30	732	<1.0E-30	466
Eu-154	60	<1.0E-30	272	<1.0E-30	574	<1.0E-30	282	<1.0E-30	244	<1.0E-30	432	<1.0E-30	296
H-3	20,000	6.1E-01	100	2.9E+00	86	1.0E+01	68	6.7E-01	66	5.2E-07	78	9.0E-02	90
I-129	1	1.1E-03	910	1.5E-03	906	1.3E-03	972	8.3E-05	1,000	8.7E-04	1,000	8.9E-04	1,000
K-40	N/A	2.0E-04	1,000	1.1E-06	1,000	1.6E-03	870	2.5E-05	1,000	2.3E-04	946	4.6E-04	918
Nb-93m	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.6E-25	1,000	1.6E-25	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Nb-94	N/A	1.1E-28	1,000	<1.0E-30	1,000	8.0E-20	1,000	2.4E-21	1,000	<1.0E-30	1,000	1.5E-30	1,000

Table A-2: Radiological 100-Meter Concentrations for UTRA-LZ to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	3.2E-02	1,000	3.6E-06	1,000	1.7E+00	986	6.7E-03	1,000	1.7E-01	1,000	4.4E-01	1,000
Ni-63	50	2.3E-03	1,000	2.0E-07	1,000	1.7E-01	890	4.8E-04	1,000	1.1E-02	1,000	2.8E-02	982
Np-237	Total α	1.0E-01	1,000	3.8E-02	1,000	2.5E-01	1,000	4.7E-03	964	3.1E-02	776	6.0E-02	758
Pa-231	Total α	1.4E-05	1,000	4.8E-06	1,000	4.3E-05	1,000	7.1E-07	1,000	4.0E-06	780	7.9E-06	764
Pb-210	N/A	8.3E-16	1,000	2.3E-26	1,000	5.9E-11	1,000	3.9E-14	1,000	8.0E-17	1,000	2.8E-15	1,000
Pd-107	N/A	4.9E-03	1,000	5.4E-07	1,000	2.5E-01	986	1.0E-03	1,000	2.6E-02	1,000	6.7E-02	1,000
Pt-193	3,000	4.6E-09	1,000	3.3E-13	1,000	8.0E-07	840	1.1E-09	962	2.1E-08	966	7.0E-08	932
Pu-238	Total α	<1.0E-30	1,000	<1.0E-30	1,000	9.6E-29	1,000	3.1E-28	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-239	Total α	<1.0E-30	1,000	<1.0E-30	1,000	5.4E-27	1,000	1.7E-26	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-240	Total α	<1.0E-30	1,000	<1.0E-30	1,000	3.0E-27	1,000	9.2E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-241	300	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-242	Total α	<1.0E-30	1,000	<1.0E-30	1,000	9.5E-30	1,000	3.0E-29	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-244	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Ra-226	Total α/Ra	1.3E-13	1,000	3.9E-24	1,000	8.3E-09	1,000	5.2E-12	1,000	1.7E-14	1,000	5.5E-13	1,000
Ra-228	Total Ra	2.6E-27	1,000	<1.0E-30	1,000	5.8E-20	1,000	2.7E-21	1,000	2.3E-30	1,000	6.1E-28	1,000
Se-79	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sm-151	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sn-126	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sr-90	8	8.9E-07	862	7.3E-10	1,000	2.4E-04	724	2.1E-07	778	3.3E-06	830	1.2E-05	804
Tc-99	900	1.3E+02	780	1.6E+02	780	1.4E+02	824	1.1E+01	1,000	9.9E+01	876	9.9E+01	870
Th-229	Total α	1.9E-09	1,000	1.1E-10	1,000	1.5E-08	1,000	1.4E-10	1,000	1.2E-09	1,000	2.5E-09	1,000
Th-230	Total α	<1.0E-30	1,000	<1.0E-30	1,000	1.4E-25	1,000	4.3E-26	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Th-232	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000

Table A-2: Radiological 100-Meter Concentrations for UTRA-LZ to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	4.7E-29	1,000	1.3E-29	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-233	Total U*	6.5E-07	1,000	8.8E-08	1,000	2.8E-06	1,000	4.1E-08	1,000	1.8E-07	1,000	4.5E-07	1,000
U-234	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	6.2E-22	1,000	1.8E-22	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-235	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	2.1E-24	1,000	5.5E-25	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-236	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	1.6E-23	1,000	4.2E-24	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-238	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	1.9E-23	1,000	4.9E-24	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Zr-93	2,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.4E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sum of beta-gamma MCL fractions		1.5E-01	NA	1.8E-01	NA	1.7E-01	NA	1.3E-02	NA	1.1E-01	NA	1.1E-01	NA
Total alpha	**15**	1.0E-01	NA	3.8E-02	NA	2.5E-01	NA	4.7E-03	NA	3.1E-02	NA	6.0E-02	NA
Total Ra	**5**	1.3E-13	NA	3.9E-24	NA	8.3E-09	NA	5.2E-12	NA	1.7E-14	NA	5.5E-13	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in *Radionuclides in Drinking Water: A Small Entity Compliance Guide* (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table A-3: Radiological 100-Meter Concentrations for Gordon Aquifer to 1,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	1.2E-13	1,000	1.5E-12	1,000	2.0E-12	1,000	1.4E-14	1,000	3.6E-15	1,000	8.0E-15	1,000
Al-26	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-241	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-242m	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-243	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
C-14	2,000	1.2E-19	1,000	4.4E-17	1,000	3.2E-15	1,000	1.7E-18	1,000	3.5E-20	1,000	5.2E-20	1,000
Cf-249	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cf-251	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cl-36	700	2.7E-06	1,000	4.0E-06	1,000	2.4E-06	1,000	1.6E-08	1,000	1.2E-08	1,000	2.0E-08	1,000
Cm-243	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-244	Total α	<1.0E-30	874	<1.0E-30	1,000	<1.0E-30	892	<1.0E-30	798	<1.0E-30	1,000	<1.0E-30	924
Cm-245	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-247	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-248	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Co-60	100	<1.0E-30	238	<1.0E-30	388	<1.0E-30	234	<1.0E-30	214	<1.0E-30	358	<1.0E-30	252
Cs-135	900	3.0E-16	1,000	1.1E-13	1,000	1.6E-11	1,000	2.1E-15	1,000	2.0E-16	1,000	3.1E-16	1,000
Cs-137	200	1.9E-20	678	5.1E-18	682	3.4E-16	1,000	5.2E-20	1,000	3.2E-21	1,000	5.1E-21	1,000
Eu-152	200	<1.0E-30	654	<1.0E-30	1,000	<1.0E-30	672	<1.0E-30	598	<1.0E-30	964	<1.0E-30	694
Eu-154	60	<1.0E-30	418	<1.0E-30	758	<1.0E-30	428	<1.0E-30	382	<1.0E-30	580	<1.0E-30	442
H-3	20,000	2.6E-03	118	6.6E-03	102	6.2E-03	96	6.9E-05	92	1.9E-11	120	8.8E-06	122
I-129	1	1.3E-06	1,000	1.7E-06	1,000	1.0E-06	1,000	6.5E-09	1,000	1.7E-08	1,000	2.8E-08	1,000
K-40	N/A	4.6E-12	1,000	4.3E-10	1,000	1.3E-09	1,000	3.6E-12	1,000	2.0E-12	1,000	3.7E-12	1,000
Nb-93m	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Nb-94	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000

Table A-3: Radiological 100-Meter Concentrations for Gordon Aquifer to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	5.2E-11	1,000	1.3E-08	1,000	1.7E-07	1,000	7.8E-11	1,000	4.9E-11	1,000	7.3E-11	1,000
Ni-63	50	3.0E-12	1,000	7.3E-10	1,000	1.0E-08	1,000	5.1E-12	1,000	2.8E-12	1,000	4.1E-12	1,000
Np-237	Total α	5.3E-07	1,000	5.6E-06	1,000	7.2E-06	1,000	5.2E-08	1,000	1.1E-08	1,000	2.4E-08	1,000
Pa-231	Total α	6.7E-11	1,000	7.2E-10	1,000	9.5E-10	1,000	6.7E-12	1,000	1.5E-12	1,000	3.4E-12	1,000
Pb-210	N/A	1.3E-30	1,000	1.3E-27	1,000	9.6E-24	1,000	2.3E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pd-107	N/A	7.9E-12	1,000	1.9E-09	1,000	2.6E-08	1,000	1.2E-11	1,000	7.4E-12	1,000	1.1E-11	1,000
Pt-193	3,000	5.1E-18	1,000	1.2E-15	1,000	1.8E-14	1,000	1.0E-17	1,000	4.6E-18	1,000	6.9E-18	1,000
Pu-238	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-239	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-240	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-241	300	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-242	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-244	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Ra-226	Total α/Ra	2.2E-28	1,000	2.1E-25	1,000	1.5E-21	1,000	3.7E-25	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Ra-228	Total Ra	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Se-79	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sm-151	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sn-126	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sr-90	8	7.1E-15	1,000	6.9E-13	962	4.6E-12	876	6.4E-15	988	3.2E-15	976	5.7E-15	984
Tc-99	900	6.7E-01	1,000	7.2E-01	1,000	2.8E-01	1,000	3.5E-03	1,000	3.7E-02	1,000	6.3E-02	1,000
Th-229	Total α	1.3E-15	1,000	3.0E-14	1,000	5.3E-14	1,000	2.8E-16	1,000	1.1E-16	1,000	2.2E-16	1,000
Th-230	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Th-232	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000

Table A-3: Radiological 100-Meter Concentrations for Gordon Aquifer to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-233	Total U*	1.1E-12	1,000	1.7E-11	1,000	2.6E-11	1,000	1.7E-13	1,000	5.5E-14	1,000	1.1E-13	1,000
U-234	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-235	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-236	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-238	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Zr-93	2,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sum of beta-gamma MCL fractions		7.5E-04	NA	8.0E-04	NA	3.1E-04	NA	3.9E-06	NA	4.1E-05	NA	7.0E-05	NA
Total alpha	**15**	5.3E-07	NA	5.6E-06	NA	7.2E-06	NA	5.2E-08	NA	1.1E-08	NA	2.4E-08	NA
Total Ra	**5**	2.2E-28	NA	2.1E-25	NA	1.5E-21	NA	3.7E-25	NA	<1.0E-30	NA	<1.0E-30	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table A-4: Chemical 100-Meter Concentrations for UTRA-UZ to 1,000 Years

Chemical	MCL (µg/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	1.8E-05	1,000	3.2E-15	1,000	9.5E-07	1,000	1.1E-08	1,000	6.7E-07	1,000	6.2E-05	1,000
Al	2.0E+02	1.8E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.4E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
As	1.0E+01	4.3E-17	1,000	<1.0E-30	1,000	3.1E-21	1,000	2.1E-21	1,000	1.5E-27	1,000	2.6E-18	1,000
B	N/A	1.2E-01	580	1.6E+00	580	5.7E-01	588	3.3E-01	600	3.2E-01	604	4.0E-01	582
Ba	2.0E+03	2.1E-06	1,000	5.8E-19	1,000	1.8E-08	1,000	3.5E-10	1,000	2.2E-09	1,000	2.1E-06	1,000
Cd	5.0E+00	2.3E-06	1,000	2.1E-18	1,000	5.9E-08	1,000	4.0E-10	1,000	7.4E-09	1,000	2.4E-06	1,000
Cl	2.5E+05	2.6E-02	658	2.6E-01	954	9.3E-02	1,000	3.2E-02	1,000	3.1E-02	1,000	3.7E-02	998
Co	N/A	2.5E-12	1,000	<1.0E-30	1,000	2.3E-15	1,000	3.7E-17	1,000	4.0E-19	1,000	1.2E-12	1,000
Cr	1.0E+02	8.3E-28	1,000	<1.0E-30	1,000	<1.0E-30	1,000	2.5E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cu	1.0E+03	3.2E-12	1,000	<1.0E-30	1,000	2.4E-15	1,000	9.5E-17	1,000	1.2E-19	1,000	9.8E-13	1,000
F	2.0E+03	1.0E-02	580	1.3E-01	580	4.7E-02	588	2.7E-02	600	2.6E-02	604	3.3E-02	582
Fe	3.0E+02	1.3E-16	1,000	<1.0E-30	1,000	1.8E-21	1,000	1.4E-20	1,000	4.0E-30	1,000	1.3E-18	1,000
Hg	2.0E+00	3.0E-25	1,000	<1.0E-30	1,000	<1.0E-30	1,000	2.6E-28	1,000	<1.0E-30	1,000	1.3E-28	1,000
I	N/A	2.8E-04	898	3.7E-03	894	1.3E-03	940	6.4E-04	1,000	6.1E-04	1,000	7.4E-04	908
Mn	5.0E+01	3.9E-05	1,000	5.6E-18	1,000	1.7E-07	1,000	6.6E-09	1,000	2.1E-08	1,000	4.0E-05	1,000
Mo	N/A	5.8E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000	7.9E-30	1,000	<1.0E-30	1,000	1.6E-30	1,000
N	1.0E+04	7.2E-01	580	9.4E+00	580	3.4E+00	588	2.4E-03	538	5.4E-02	530	8.9E-01	528
Ni	N/A	2.1E-03	1,000	1.2E-10	1,000	2.3E-04	1,000	2.2E-06	1,000	2.3E-04	1,000	7.9E-03	1,000
Pb	1.5E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
PO_4	N/A	1.8E-02	580	2.4E-01	580	8.4E-02	588	4.9E-02	600	4.7E-02	604	5.8E-02	582
Sb	6.0E+00	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Se	5.0E+01	8.5E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
SO_4	2.5E+05	5.6E-02	580	7.4E-01	580	2.6E-01	588	1.5E-01	600	1.5E-01	604	1.8E-01	582
Sr	N/A	2.0E-04	1,000	1.2E-07	1,000	1.1E-04	1,000	3.7E-07	1,000	2.9E-05	966	4.9E-04	900
U	3.0E+01	1.6E-20	1,000	<1.0E-30	1,000	1.1E-25	1,000	4.1E-24	1,000	<1.0E-30	1,000	5.2E-23	1,000
Zn	5.0E+03	7.7E-07	1,000	7.0E-19	1,000	2.0E-08	1,000	1.3E-10	1,000	2.5E-09	1,000	8.0E-07	1,000

Table A-5: Chemical 100-Meter Concentrations for UTRA-LZ to 1,000 Years

Chemical	MCL (µg/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	2.2E-06	1,000	5.6E-12	1,000	1.6E-03	1,000	1.0E-06	1,000	2.3E-05	1,000	1.2E-04	1,000
Al	2.0E+02	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
As	1.0E+01	9.0E-25	1,000	<1.0E-30	1,000	3.7E-17	1,000	8.4E-19	1,000	<1.0E-30	1,000	2.3E-26	1,000
B	N/A	5.3E+01	134	1.9E+01	204	2.3E+01	190	1.2E+00	178	1.1E+00	598	1.2E+00	596
Ba	2.0E+03	1.8E-08	1,000	1.8E-14	1,000	1.4E-04	1,000	6.7E-08	1,000	6.2E-08	1,000	6.9E-07	1,000
Cd	5.0E+00	5.0E-08	1,000	1.8E-14	1,000	4.4E-04	1,000	1.0E-07	1,000	2.2E-07	1,000	2.5E-06	1,000
Cl	2.5E+05	2.2E-01	930	2.6E-01	980	2.3E-01	1,000	9.6E-03	1,000	1.0E-01	1,000	1.1E-01	1,000
Co	N/A	7.4E-17	1,000	2.3E-29	1,000	7.3E-11	1,000	1.1E-13	1,000	2.2E-19	1,000	1.8E-17	1,000
Cr	1.0E+02	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cu	1.0E+03	2.7E-17	1,000	<1.0E-30	1,000	7.2E-11	1,000	2.6E-13	1,000	8.5E-21	1,000	2.3E-18	1,000
F	2.0E+03	1.1E-01	584	1.4E-01	582	1.7E-01	542	1.1E-02	648	9.4E-02	598	9.5E-02	596
Fe	3.0E+02	7.4E-27	1,000	<1.0E-30	1,000	5.1E-18	1,000	3.7E-19	1,000	<1.0E-30	1,000	5.1E-29	1,000
Hg	2.0E+00	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	2.8E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
I	N/A	2.6E-03	876	3.7E-03	906	3.1E-03	974	2.0E-04	1,000	2.1E-03	1,000	2.2E-03	1,000
Mn	5.0E+01	2.3E-07	1,000	3.4E-13	1,000	1.3E-03	1,000	1.3E-06	1,000	6.0E-07	1,000	6.6E-06	1,000
Mo	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
N	1.0E+04	7.9E+00	584	9.7E+00	582	1.2E+01	542	1.7E-01	552	7.4E-01	528	1.7E+00	548
Ni	N/A	9.8E-04	1,000	1.1E-07	1,000	5.0E-02	986	2.0E-04	1,000	5.1E-03	1,000	1.3E-02	1,000
Pb	1.5E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
PO_4	N/A	1.3E+01	136	5.8E+00	202	6.8E+00	188	3.7E-01	178	1.7E-01	598	3.7E-01	212
Sb	6.0E+00	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Se	5.0E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
SO_4	2.5E+05	1.2E+02	232	8.7E+01	194	1.0E+02	182	6.0E+00	172	5.3E-01	598	8.5E+00	206
Sr	N/A	4.3E-04	1,000	2.1E-06	1,000	2.8E-03	844	4.0E-05	1,000	4.2E-04	928	8.2E-04	900
U	3.0E+01	<1.0E-30	1,000	<1.0E-30	1,000	5.5E-23	1,000	1.4E-23	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Zn	5.0E+03	1.7E-08	1,000	6.0E-15	1,000	1.5E-04	1,000	3.4E-08	1,000	7.3E-08	1,000	8.2E-07	1,000

Table A-6: Chemical 100-Meter Concentrations for Gordon Aquifer to 1,000 Years

Chemical	MCL (µg/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	2.3E-16	1,000	8.2E-14	1,000	1.3E-11	1,000	1.3E-15	1,000	1.7E-16	1,000	2.8E-16	1,000
Al	2.0E+02	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
As	1.0E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
B	N/A	6.5E-01	350	6.2E-01	348	2.1E-01	308	1.9E-03	302	1.7E-03	674	4.4E-03	704
Ba	2.0E+03	1.3E-19	1,000	3.5E-17	1,000	4.4E-15	1,000	5.5E-19	1,000	6.4E-22	1,000	1.1E-21	1,000
Cd	5.0E+00	1.4E-18	1,000	3.9E-16	1,000	1.5E-13	1,000	1.9E-17	1,000	2.4E-20	1,000	4.8E-20	1,000
Cl	2.5E+05	5.7E-05	1,000	8.5E-05	1,000	5.0E-05	1,000	3.3E-07	1,000	2.6E-07	1,000	4.2E-07	1,000
Co	N/A	<1.0E-30	1,000	5.0E-29	1,000	2.5E-23	1,000	5.7E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cr	1.0E+02	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cu	1.0E+03	<1.0E-30	1,000	<1.0E-30	1,000	7.8E-24	1,000	2.8E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000
F	2.0E+03	6.2E-04	650	6.4E-04	646	2.3E-04	608	1.6E-05	708	1.4E-04	674	3.1E-04	690
Fe	3.0E+02	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Hg	2.0E+00	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
I	N/A	3.0E-06	1,000	4.0E-06	1,000	2.3E-06	1,000	1.4E-08	1,000	4.3E-08	1,000	6.9E-08	1,000
Mn	5.0E+01	6.6E-19	1,000	1.7E-16	1,000	1.2E-14	1,000	1.5E-18	1,000	1.8E-21	1,000	2.9E-21	1,000
Mo	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
N	1.0E+04	4.4E-02	648	4.6E-02	646	1.7E-02	608	9.6E-05	608	2.7E-06	568	2.2E-04	664
Ni	N/A	1.6E-12	1,000	3.8E-10	1,000	5.3E-09	1,000	2.4E-12	1,000	1.5E-12	1,000	2.2E-12	1,000
Pb	1.5E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
PO_4	N/A	1.9E-01	342	1.8E-01	344	6.0E-02	306	5.9E-04	298	2.5E-04	674	1.3E-03	376
Sb	6.0E+00	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Se	5.0E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
SO_4	2.5E+05	2.7E+00	336	2.6E+00	330	8.2E-01	292	9.9E-03	286	7.8E-04	676	3.0E-02	360
Sr	N/A	1.7E-11	1,000	1.8E-09	1,000	5.4E-09	1,000	1.2E-11	1,000	9.3E-12	1,000	1.7E-11	1,000
U	3.0E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Zn	5.0E+03	4.8E-19	1,000	1.3E-16	1,000	5.1E-14	1,000	6.5E-18	1,000	8.1E-21	1,000	1.6E-20	1,000

Table A-7: Upper Three Runs Seepline Concentrations to 1,000 Years

Radionuclide	Unit	Peak Seepline Concentration in 1,000 Yrs	Year Largest Contribution in 1,000 Years Occurs
Ac-227	pCi/L	2.5E-11	1,000
Al-26	pCi/L	<1.0E-30	1,000
Am-241	pCi/L	9.7E-29	1,000
Am-242m	pCi/L	<1.0E-30	1,000
Am-243	pCi/L	6.6E-30	1,000
C-14	pCi/L	5.6E-11	1,000
Cf-249	pCi/L	<1.0E-30	1,000
Cf-251	pCi/L	<1.0E-30	1,000
Cl-36	pCi/L	1.8E-04	1,000
Cm-243	pCi/L	<1.0E-30	936
Cm-244	pCi/L	<1.0E-30	286
Cm-245	pCi/L	<1.0E-30	1,000
Cm-247	pCi/L	<1.0E-30	1,000
Cm-248	pCi/L	<1.0E-30	1,000
Co-60	pCi/L	<1.0E-30	82
Cs-135	pCi/L	6.1E-10	1,000
Cs-137	pCi/L	2.3E-14	968
Eu-152	pCi/L	<1.0E-30	214
Eu-154	pCi/L	<1.0E-30	136
H-3	pCi/L	2.8E-03	118
I-129	pCi/L	2.4E-05	1,000
K-40	pCi/L	1.2E-08	1,000
Nb-93m	pCi/L	1.8E-26	1,000
Nb-94	pCi/L	1.5E-24	1,000
Ni-59	pCi/L	1.4E-06	1,000
Ni-63	pCi/L	9.8E-08	1,000
Np-237	pCi/L	1.3E-04	1,000

Table A-7: Upper Three Runs Seepline Concentrations to 1,000 Years (Continued)

Radionuclide	Unit	Peak Seepline Concentration in 1,000 Yrs	Year Largest Contribution in 1,000 Years Occurs
Pa-231	pCi/L	1.6E-08	1,000
Pb-210	pCi/L	4.9E-19	1,000
Pd-107	pCi/L	2.1E-07	1,000
Pt-193	pCi/L	2.0E-13	990
Pu-238	pCi/L	4.2E-28	1,000
Pu-239	pCi/L	1.8E-26	1,000
Pu-240	pCi/L	1.0E-26	1,000
Pu-241	pCi/L	<1.0E-30	1,000
Pu-242	pCi/L	3.2E-29	1,000
Pu-244	pCi/L	<1.0E-30	1,000
Ra-226	pCi/L	6.0E-17	1,000
Ra-228	pCi/L	6.5E-25	1,000
Se-79	pCi/L	9.8E-30	1,000
Sm-151	pCi/L	1.2E-29	1,000
Sn-126	pCi/L	<1.0E-30	1,000
Sr-90	pCi/L	3.5E-11	830
Tc-99	pCi/L	4.9E+00	946
Th-229	pCi/L	3.5E-13	1,000
Th-230	pCi/L	4.5E-28	1,000
Th-232	pCi/L	<1.0E-30	1,000
U-232	pCi/L	<1.0E-30	1,000
U-233	pCi/L	1.9E-10	1,000
U-234	pCi/L	2.2E-24	1,000
U-235	pCi/L	4.4E-27	1,000
U-236	pCi/L	3.4E-26	1,000
U-238	pCi/L	3.9E-26	1,000
Zr-93	pCi/L	4.0E-29	1,000

Table A-7: Upper Three Runs Seepline Concentrations to 1,000 Years (Continued)

Chemical	Unit	Peak Seepline Concentration in 1,000 Yrs	Year Largest Contribution in 1,000 Years Occurs
Ag	(μg/L)	1.1E-10	1,000
Al	(μg/L)	<1.0E-30	1,000
As	(μg/L)	4.2E-23	1,000
B	(μg/L)	4.4E-01	206
Ba	(μg/L)	2.1E-12	1,000
Cd	(μg/L)	2.4E-12	1,000
Cl	(μg/L)	3.8E-03	1,000
Co	(μg/L)	7.1E-19	1,000
Cr	(μg/L)	<1.0E-30	1,000
Cu	(μg/L)	1.2E-18	1,000
F	(μg/L)	3.9E-03	630
Fe	(μg/L)	4.1E-22	1,000
Hg	(μg/L)	1.4E-29	1,000
I	(μg/L)	5.9E-05	1,000
Mn	(μg/L)	4.1E-11	1,000
Mo	(μg/L)	<1.0E-30	1,000
N	(μg/L)	2.4E-01	626
Ni	(μg/L)	4.2E-08	1,000
Pb	(μg/L)	<1.0E-30	1,000
PO4	(μg/L)	1.2E-01	212
Sb	(μg/L)	<1.0E-30	1,000
Se	(μg/L)	<1.0E-30	1,000
SO4	(μg/L)	1.5E+00	236
Sr	(μg/L)	2.6E-08	1,000
U	(μg/L)	1.1E-25	1,000
Zn	(μg/L)	7.9E-13	1,000

Table A-8: Fourmile Branch Seepline Concentrations to 1,000 Years

Radionuclide	Unit	Peak Seepline Concentration in 1,000 Yrs	Year Largest Contribution in 1,000 Years Occurs
Ac-227	pCi/L	8.4E-10	1,000
Al-26	pCi/L	3.8E-28	1,000
Am-241	pCi/L	4.7E-24	1,000
Am-242m	pCi/L	1.2E-28	1,000
Am-243	pCi/L	3.2E-25	1,000
C-14	pCi/L	2.2E-10	1,000
Cf-249	pCi/L	<1.0E-30	1,000
Cf-251	pCi/L	<1.0E-30	1,000
Cl-36	pCi/L	9.7E-04	904
Cm-243	pCi/L	<1.0E-30	894
Cm-244	pCi/L	<1.0E-30	260
Cm-245	pCi/L	1.1E-27	1,000
Cm-247	pCi/L	<1.0E-30	1,000
Cm-248	pCi/L	<1.0E-30	1,000
Co-60	pCi/L	1.6E-30	74
Cs-135	pCi/L	2.9E-09	1,000
Cs-137	pCi/L	7.3E-13	780
Eu-152	pCi/L	<1.0E-30	194
Eu-154	pCi/L	<1.0E-30	124
H-3	pCi/L	9.3E-02	86
I-129	pCi/L	1.3E-04	854
K-40	pCi/L	2.9E-07	1,000
Nb-93m	pCi/L	3.3E-22	1,000
Nb-94	pCi/L	1.0E-20	1,000
Ni-59	pCi/L	1.9E-05	1,000
Ni-63	pCi/L	1.1E-06	1,000
Np-237	pCi/L	4.0E-03	1,000

Table A-8: Fourmile Branch Seepline Concentrations to 1,000 Years (Continued)

Radionuclide	Unit	Peak Seepline Concentration in 1,000 Yrs	Year Largest Contribution in 1,000 Years Occurs
Pa-231	pCi/L	5.2E-07	1,000
Pb-210	pCi/L	6.8E-16	1,000
Pd-107	pCi/L	2.8E-06	1,000
Pt-193	pCi/L	2.0E-12	1,000
Pu-238	pCi/L	1.2E-23	1,000
Pu-239	pCi/L	5.2E-22	1,000
Pu-240	pCi/L	2.9E-22	1,000
Pu-241	pCi/L	2.5E-27	1,000
Pu-242	pCi/L	9.2E-25	1,000
Pu-244	pCi/L	4.2E-27	1,000
Ra-226	pCi/L	8.0E-14	1,000
Ra-228	pCi/L	4.6E-21	1,000
Se-79	pCi/L	4.3E-25	1,000
Sm-151	pCi/L	5.6E-25	1,000
Sn-126	pCi/L	5.1E-28	1,000
Sr-90	pCi/L	3.5E-10	906
Tc-99	pCi/L	1.3E+01	738
Th-229	pCi/L	6.3E-12	1,000
Th-230	pCi/L	6.6E-24	1,000
Th-232	pCi/L	1.0E-26	1,000
U-232	pCi/L	1.8E-27	1,000
U-233	pCi/L	6.6E-09	1,000
U-234	pCi/L	2.9E-20	1,000
U-235	pCi/L	5.8E-23	1,000
U-236	pCi/L	4.5E-22	1,000
U-238	pCi/L	5.1E-22	1,000
Zr-93	pCi/L	1.6E-24	1,000

Table A-8: Fourmile Branch Seepline Concentrations to 1,000 Years (Continued)

Chemical	Unit	Peak Seepline Concentration in 1,000 Yrs	Year Largest Contribution in 1,000 Years Occurs
Ag	(μg/L)	6.1E-10	1,000
Al	(μg/L)	1.2E-26	1,000
As	(μg/L)	1.9E-19	1,000
B	(μg/L)	7.1E-01	200
Ba	(μg/L)	1.2E-10	1,000
Cd	(μg/L)	1.4E-10	1,000
Cl	(μg/L)	2.1E-02	904
Co	(μg/L)	1.4E-15	1,000
Cr	(μg/L)	2.5E-27	1,000
Cu	(μg/L)	2.8E-15	1,000
F	(μg/L)	1.1E-02	570
Fe	(μg/L)	3.7E-18	1,000
Hg	(μg/L)	4.8E-25	1,000
I	(μg/L)	3.1E-04	854
Mn	(μg/L)	2.3E-09	1,000
Mo	(μg/L)	1.8E-26	1,000
N	(μg/L)	8.1E-01	572
Ni	(μg/L)	5.7E-07	1,000
Pb	(μg/L)	8.0E-30	1,000
PO4	(μg/L)	1.9E-01	198
Sb	(μg/L)	<1.0E-30	1,000
Se	(μg/L)	2.6E-29	1,000
SO4	(μg/L)	2.1E+00	206
Sr	(μg/L)	1.2E-06	1,000
U	(μg/L)	1.5E-21	1,000
Zn	(μg/L)	4.7E-11	1,000

Table A-9: Radiological 1-Meter Concentrations for UTRA-UZ to 1,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	1.9E-07	576	4.4E-08	1,000	1.3E-07	1,000	1.7E-07	1,000	9.1E-09	1,000	6.3E-08	716
Al-26	N/A	4.0E-05	1,000	<1.0E-30	1,000	1.5E-24	1,000	2.5E-05	1,000	<1.0E-30	980	5.6E-13	1,000
Am-241	Total α	1.3E-01	1,000	<1.0E-30	1,000	4.0E-21	1,000	8.3E-02	1,000	<1.0E-30	998	3.6E-09	1,000
Am-242m	Total α	5.7E-06	714	<1.0E-30	1,000	9.7E-26	1,000	3.6E-06	716	<1.0E-30	1,000	9.0E-14	1,000
Am-243	Total α	8.8E-03	1,000	<1.0E-30	1,000	2.7E-22	1,000	5.6E-03	1,000	<1.0E-30	998	2.4E-10	1,000
C-14	2,000	4.3E-03	588	4.9E-13	1,000	3.3E-05	1,000	2.2E-03	564	2.1E-14	1,000	1.8E-04	1,000
Cf-249	Total α	5.8E-14	980	<1.0E-30	1,000	<1.0E-30	1,000	3.7E-14	986	<1.0E-30	1,000	1.6E-21	1,000
Cf-251	Total α	6.8E-15	1,000	<1.0E-30	1,000	<1.0E-30	1,000	4.3E-15	1,000	<1.0E-30	944	1.9E-22	1,000
Cl-36	700	4.5E-02	530	1.5E-02	924	1.5E-02	926	2.0E-02	528	7.8E-03	1,000	8.6E-03	1,000
Cm-243	Total α	4.1E-11	560	<1.0E-30	1,000	<1.0E-30	1,000	2.6E-11	560	<1.0E-30	764	3.6E-21	726
Cm-244	Total α	2.2E-11	52	<1.0E-30	650	<1.0E-30	932	1.9E-10	52	<1.0E-30	556	3.7E-22	156
Cm-245	Total α	3.0E-05	1,000	<1.0E-30	1,000	9.3E-25	1,000	1.9E-05	1,000	<1.0E-30	892	8.3E-13	1,000
Cm-247	Total α	7.6E-14	1,000	<1.0E-30	1,000	<1.0E-30	1,000	4.8E-14	1,000	<1.0E-30	978	2.1E-21	1,000
Cm-248	Total α	7.9E-14	1,000	<1.0E-30	1,000	<1.0E-30	1,000	5.0E-14	1,000	<1.0E-30	1,000	2.2E-21	1,000
Co-60	100	2.9E-10	16	<1.0E-30	186	<1.0E-30	122	3.2E-10	16	<1.0E-30	118	1.7E-17	44
Cs-135	900	4.4E-02	590	4.2E-11	1,000	2.9E-03	1,000	2.3E-02	566	1.8E-12	1,000	1.2E-02	1,000
Cs-137	200	4.6E-02	546	8.7E-15	1,000	8.8E-07	838	2.8E-02	542	4.4E-17	1,000	5.6E-05	636
Eu-152	200	1.1E-11	40	<1.0E-30	486	<1.0E-30	356	6.8E-11	40	<1.0E-30	502	5.5E-23	116
Eu-154	60	1.8E-11	26	<1.0E-30	310	<1.0E-30	184	6.1E-11	26	<1.0E-30	244	1.5E-23	74
H-3	20,000	4.0E-01	60	1.5E-07	94	8.2E-04	70	1.3E+02	40	4.8E-13	570	1.6E-01	60
I-129	1	3.2E-03	530	2.0E-03	840	1.9E-03	856	1.4E-03	528	1.3E-03	886	1.4E-03	904
K-40	N/A	6.6E-03	556	6.5E-06	1,000	1.0E-03	1,000	3.3E-03	544	6.5E-07	1,000	1.5E-03	794
Nb-93m	1,000	5.8E-02	1,000	<1.0E-30	1,000	8.4E-17	1,000	3.7E-02	1,000	<1.0E-30	1,000	1.2E-08	1,000
Nb-94	N/A	5.1E-05	1,000	<1.0E-30	1,000	2.5E-15	1,000	3.1E-05	1,000	<1.0E-30	1,000	3.0E-09	1,000

Table A-9: Radiological 1-Meter Concentrations for UTRA-UZ to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	6.4E+00	570	2.1E-05	1,000	8.1E-01	1,000	3.2E+00	552	1.3E-06	1,000	1.7E+00	902
Ni-63	50	9.6E+00	556	1.3E-06	1,000	7.6E-02	876	5.3E+00	546	8.3E-08	1,000	2.6E-01	800
Np-237	Total α	7.4E-01	544	1.7E-01	1,000	2.7E-01	988	3.6E-01	536	4.0E-02	1,000	2.0E-01	686
Pa-231	Total α	9.1E-05	544	2.3E-05	1,000	4.5E-05	1,000	5.9E-05	1,000	5.2E-06	1,000	2.6E-05	690
Pb-210	N/A	6.8E-06	1,000	3.7E-25	1,000	2.0E-09	1,000	3.2E-06	1,000	3.1E-29	1,000	6.5E-08	1,000
Pd-107	N/A	9.6E-01	570	3.2E-06	1,000	1.2E-01	1,000	4.8E-01	552	2.0E-07	1,000	2.5E-01	902
Pt-193	3,000	4.5E-04	548	2.5E-12	1,000	4.3E-07	840	2.6E-04	542	1.6E-13	1,000	2.3E-06	640
Pu-238	Total α	2.4E-02	644	<1.0E-30	1,000	3.9E-20	1,000	1.5E-02	642	<1.0E-30	1,000	1.1E-09	1,000
Pu-239	Total α	2.1E-01	1,000	<1.0E-30	1,000	1.7E-18	1,000	1.3E-01	1,000	<1.0E-30	1,000	4.8E-08	1,000
Pu-240	Total α	1.2E-01	1,000	<1.0E-30	1,000	9.5E-19	1,000	7.4E-02	1,000	<1.0E-30	1,000	2.6E-08	1,000
Pu-241	300	5.2E-05	1,000	<1.0E-30	1,000	2.7E-24	1,000	3.3E-05	1,000	<1.0E-30	1,000	1.6E-12	1,000
Pu-242	Total α	3.7E-04	1,000	<1.0E-30	1,000	3.0E-21	1,000	2.4E-04	1,000	<1.0E-30	1,000	8.4E-11	1,000
Pu-244	Total α	1.7E-06	1,000	<1.0E-30	1,000	1.4E-23	1,000	1.1E-06	1,000	<1.0E-30	1,000	3.9E-13	1,000
Ra-226	Total α/Ra	5.7E-04	1,000	6.8E-23	1,000	2.6E-07	1,000	2.7E-04	1,000	8.9E-27	1,000	5.9E-06	1,000
Ra-228	Total Ra	3.0E-03	1,000	<1.0E-30	1,000	2.2E-14	1,000	1.9E-03	1,000	<1.0E-30	1,000	4.6E-09	1,000
Se-79	N/A	5.5E-03	1,000	<1.0E-30	1,000	3.7E-21	1,000	3.5E-03	1,000	<1.0E-30	992	2.2E-10	1,000
Sm-151	1,000	6.9E-02	646	<1.0E-30	1,000	4.7E-22	1,000	4.4E-02	646	<1.0E-30	1,000	4.4E-10	1,000
Sn-126	N/A	1.7E-03	1,000	<1.0E-30	1,000	2.3E-25	1,000	1.1E-03	1,000	<1.0E-30	1,000	4.3E-12	1,000
Sr-90	8	3.4E-01	538	7.2E-09	1,000	1.5E-04	706	2.0E-01	536	6.9E-10	1,000	1.3E-03	598
Tc-99	900	3.4E+02	528	2.0E+02	730	2.0E+02	742	1.7E+02	642	1.3E+02	832	1.4E+02	826
Th-229	Total α	2.9E-04	1,000	4.4E-10	1,000	9.9E-09	1,000	1.9E-04	1,000	7.7E-11	1,000	9.5E-09	1,000
Th-230	Total α	3.6E-05	1,000	<1.0E-30	1,000	8.0E-19	1,000	2.3E-05	1,000	<1.0E-30	1,000	4.5E-11	1,000
Th-232	Total α	5.6E-05	1,000	<1.0E-30	1,000	5.4E-23	1,000	3.6E-05	1,000	<1.0E-30	1,000	3.5E-12	1,000

Table A-9: Radiological 1-Meter Concentrations for UTRA-UZ to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	1.8E-08	612	<1.0E-30	1,000	3.4E-22	1,000	1.1E-08	614	<1.0E-30	920	7.3E-15	986
U-233	Total U*	1.7E-02	1,000	3.9E-07	1,000	2.5E-06	1,000	1.1E-02	1,000	7.6E-08	1,000	1.1E-06	1,000
U-234	Total U*	2.3E-02	1,000	<1.0E-30	1,000	5.6E-15	1,000	1.5E-02	1,000	<1.0E-30	972	1.1E-07	1,000
U-235	Total U*	4.6E-05	1,000	<1.0E-30	1,000	1.1E-17	1,000	3.0E-05	1,000	<1.0E-30	1,000	2.3E-10	1,000
U-236	Total U*	3.6E-04	1,000	<1.0E-30	1,000	8.7E-17	1,000	2.3E-04	1,000	<1.0E-30	1,000	1.8E-09	1,000
U-238	Total U*	4.1E-04	1,000	<1.0E-30	1,000	1.0E-16	1,000	2.6E-04	1,000	<1.0E-30	1,000	2.0E-09	1,000
Zr-93	2,000	8.7E-03	1,000	<1.0E-30	1,000	8.3E-21	1,000	5.5E-03	1,000	<1.0E-30	998	5.4E-10	1,000
Sum of beta-gamma MCL fractions		6.4E-01	NA	2.3E-01	NA	2.3E-01	NA	3.4E-01	NA	1.4E-01	NA	1.7E-01	NA
Total alpha	**15**	1.2E+00	NA	1.7E-01	NA	2.7E-01	NA	6.7E-01	NA	4.0E-02	NA	2.0E-01	NA
Total Ra	**5**	3.5E-03	NA	6.8E-23	NA	2.6E-07	NA	2.2E-03	NA	8.9E-27	NA	5.9E-06	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table A-10: Radiological 1-Meter Concentrations for UTRA-LZ to 1,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	1.4E-07	1,000	2.8E-08	1,000	8.0E-08	1,000	1.6E-07	1,000	2.5E-11	1,000	1.7E-08	748
Al-26	N/A	6.0E-23	1,000	<1.0E-30	1,000	<1.0E-30	1,000	2.5E-18	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-241	Total α	1.1E-19	1,000	<1.0E-30	1,000	<1.0E-30	1,000	6.5E-15	1,000	<1.0E-30	1,000	4.9E-30	1,000
Am-242m	Total α	2.7E-24	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.5E-19	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-243	Total α	7.5E-21	1,000	<1.0E-30	1,000	<1.0E-30	1,000	4.7E-16	1,000	<1.0E-30	1,000	<1.0E-30	1,000
C-14	2,000	1.6E-05	1,000	4.3E-10	1,000	1.2E-05	1,000	6.4E-04	1,000	1.1E-08	1,000	1.9E-05	1,000
Cf-249	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.0E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cf-251	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.6E-28	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cl-36	700	1.5E-02	770	1.2E-02	1,000	1.4E-02	946	1.4E-02	572	3.3E-03	1,000	6.7E-03	1,000
Cm-243	Total α	<1.0E-30	930	<1.0E-30	1,000	<1.0E-30	936	3.3E-26	408	<1.0E-30	1,000	<1.0E-30	1,000
Cm-244	Total α	<1.0E-30	286	<1.0E-30	1,000	<1.0E-30	588	7.5E-26	258	<1.0E-30	570	<1.0E-30	390
Cm-245	Total α	2.6E-23	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.6E-18	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-247	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	4.1E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-248	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	4.2E-27	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Co-60	100	4.2E-25	82	<1.0E-30	262	<1.0E-30	152	8.4E-19	68	<1.0E-30	158	<1.0E-30	112
Cs-135	900	1.2E-03	1,000	1.6E-08	1,000	1.9E-04	1,000	1.7E-02	978	1.2E-07	1,000	1.6E-03	1,000
Cs-137	200	3.4E-07	780	3.1E-13	1,000	9.0E-09	886	4.8E-05	682	5.3E-12	942	7.1E-08	902
Eu-152	200	<1.0E-30	214	<1.0E-30	714	<1.0E-30	442	2.7E-27	192	<1.0E-30	426	<1.0E-30	292
Eu-154	60	<1.0E-30	136	<1.0E-30	416	<1.0E-30	282	6.9E-29	124	<1.0E-30	272	<1.0E-30	186
H-3	20,000	2.9E+00	82	3.4E+00	82	1.5E+01	64	3.9E+01	50	1.5E-03	62	1.2E+00	68
I-129	1	1.5E-03	758	1.6E-03	950	1.6E-03	890	1.6E-03	560	8.3E-04	1,000	1.3E-03	986
K-40	N/A	1.5E-03	1,000	2.7E-05	1,000	1.1E-03	1,000	2.3E-03	760	4.0E-07	1,000	3.7E-04	848
Nb-93m	1,000	2.8E-17	1,000	<1.0E-30	1,000	4.5E-29	1,000	1.7E-12	1,000	<1.0E-30	1,000	1.4E-25	1,000
Nb-94	N/A	1.9E-15	1,000	<1.0E-30	1,000	5.9E-23	1,000	2.4E-11	1,000	7.2E-30	1,000	2.1E-22	1,000

Table A-10: Radiological 1-Meter Concentrations for UTRA-LZ to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	6.7E-01	1,000	4.7E-04	1,000	2.9E-01	1,000	2.5E+00	834	1.7E-04	1,000	4.2E-01	968
Ni-63	50	4.8E-02	1,000	3.1E-05	1,000	2.0E-02	1,000	6.2E-01	770	1.2E-05	1,000	4.1E-02	908
Np-237	Total α	3.1E-01	936	9.1E-02	1,000	1.8E-01	924	3.2E-01	994	5.6E-05	858	5.2E-02	716
Pa-231	Total α	4.7E-05	1,000	1.2E-05	1,000	2.9E-05	1,000	6.0E-05	1,000	8.7E-09	1,000	6.8E-06	720
Pb-210	N/A	2.2E-10	1,000	2.8E-21	1,000	6.9E-13	1,000	8.1E-08	1,000	5.0E-17	1,000	1.4E-12	1,000
Pd-107	N/A	1.0E-01	1,000	7.2E-05	1,000	4.4E-02	1,000	3.8E-01	836	2.6E-05	1,000	6.4E-02	968
Pt-193	3,000	2.2E-07	830	5.8E-11	1,000	4.3E-08	982	6.6E-06	722	2.8E-11	952	1.7E-07	862
Pu-238	Total α	3.9E-19	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.5E-14	1,000	<1.0E-30	1,000	1.4E-28	1,000
Pu-239	Total α	1.7E-17	1,000	<1.0E-30	1,000	1.2E-30	1,000	7.8E-13	1,000	<1.0E-30	1,000	6.4E-27	1,000
Pu-240	Total α	9.4E-18	1,000	<1.0E-30	1,000	<1.0E-30	1,000	4.3E-13	1,000	<1.0E-30	1,000	3.5E-27	1,000
Pu-241	300	5.8E-23	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.5E-18	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-242	Total α	3.0E-20	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.4E-15	1,000	<1.0E-30	1,000	1.1E-29	1,000
Pu-244	Total α	1.4E-22	1,000	<1.0E-30	1,000	<1.0E-30	1,000	6.3E-18	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Ra-226	Total α/Ra	2.5E-08	1,000	4.0E-19	1,000	1.0E-10	1,000	8.3E-06	1,000	7.9E-15	1,000	2.4E-10	1,000
Ra-228	Total Ra	6.3E-16	1,000	<1.0E-30	1,000	3.9E-23	1,000	2.4E-11	1,000	2.0E-28	1,000	2.1E-22	1,000
Se-79	N/A	8.8E-20	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.4E-15	1,000	<1.0E-30	1,000	5.8E-30	1,000
Sm-151	1,000	1.3E-20	1,000	<1.0E-30	1,000	<1.0E-30	1,000	7.0E-16	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sn-126	N/A	2.1E-23	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.2E-18	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sr-90	8	8.1E-05	716	2.5E-08	984	8.0E-06	814	2.9E-03	622	5.6E-09	806	3.9E-05	758
Tc-99	900	1.9E+02	678	1.7E+02	810	1.8E+02	766	2.1E+02	544	1.0E+02	898	1.3E+02	860
Th-229	Total α	1.4E-08	1,000	6.1E-10	1,000	6.6E-09	1,000	2.7E-08	1,000	2.7E-12	1,000	2.3E-09	1,000
Th-230	Total α	2.7E-18	1,000	<1.0E-30	1,000	4.8E-29	1,000	5.8E-14	1,000	<1.0E-30	1,000	1.7E-26	1,000
Th-232	Total α	1.0E-21	1,000	<1.0E-30	1,000	<1.0E-30	1,000	4.1E-17	1,000	<1.0E-30	1,000	<1.0E-30	1,000

Table A-10: Radiological 1-Meter Concentrations for UTRA-LZ to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	8.0E-22	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.4E-17	1,000	<1.0E-30	1,000	6.6E-30	1,000
U-233	Total U*	3.4E-06	1,000	3.4E-07	1,000	1.8E-06	1,000	4.3E-06	1,000	6.5E-10	1,000	2.8E-07	1,000
U-234	Total U*	1.3E-14	1,000	<1.0E-30	1,000	2.3E-25	1,000	2.5E-10	1,000	<1.0E-30	1,000	1.1E-22	1,000
U-235	Total U*	2.6E-17	1,000	<1.0E-30	1,000	7.8E-28	1,000	5.8E-13	1,000	<1.0E-30	1,000	2.3E-25	1,000
U-236	Total U*	2.1E-16	1,000	<1.0E-30	1,000	6.0E-27	1,000	4.5E-12	1,000	<1.0E-30	1,000	1.8E-24	1,000
U-238	Total U*	2.3E-16	1,000	<1.0E-30	1,000	7.0E-27	1,000	5.2E-12	1,000	<1.0E-30	1,000	2.0E-24	1,000
Zr-93	2,000	1.6E-19	1,000	<1.0E-30	1,000	<1.0E-30	1,000	6.4E-15	1,000	<1.0E-30	1,000	1.6E-29	1,000
Sum of beta-gamma MCL fractions		2.2E-01	NA	2.0E-01	NA	2.0E-01	NA	2.6E-01	NA	1.1E-01	NA	1.5E-01	NA
Total alpha	**15**	3.1E-01	NA	9.1E-02	NA	1.8E-01	NA	3.2E-01	NA	5.6E-05	NA	5.2E-02	NA
Total Ra	**5**	2.5E-08	NA	4.0E-19	NA	1.0E-10	NA	8.3E-06	NA	7.9E-15	NA	2.4E-10	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table A-11: Radiological 1-Meter Concentrations for Gordon Aquifer to 1,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	1.8E-13	1,000	1.7E-12	1,000	2.1E-12	1,000	2.0E-12	1,000	5.2E-22	1,000	2.0E-16	1,000
Al-26	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-241	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-242m	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Am-243	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
C-14	2,000	6.4E-19	1,000	2.3E-16	1,000	2.7E-15	1,000	9.5E-15	1,000	1.1E-28	1,000	3.4E-20	1,000
Cf-249	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cf-251	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cl-36	700	2.8E-06	1,000	4.0E-06	1,000	3.2E-06	1,000	1.4E-06	1,000	4.1E-12	1,000	7.9E-09	1,000
Cm-243	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	898	<1.0E-30	1,000	<1.0E-30	1,000
Cm-244	Total α	<1.0E-30	596	<1.0E-30	1,000	<1.0E-30	896	<1.0E-30	566	<1.0E-30	880	<1.0E-30	702
Cm-245	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-247	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cm-248	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Co-60	100	<1.0E-30	168	<1.0E-30	324	<1.0E-30	230	<1.0E-30	152	<1.0E-30	246	<1.0E-30	198
Cs-135	900	2.7E-15	1,000	1.1E-12	1,000	1.1E-11	1,000	4.6E-11	1,000	1.7E-25	1,000	2.7E-16	1,000
Cs-137	200	5.2E-20	1,000	2.2E-17	1,000	2.6E-16	986	1.2E-15	936	3.4E-30	1,000	5.1E-21	1,000
Eu-152	200	<1.0E-30	446	<1.0E-30	974	<1.0E-30	670	<1.0E-30	422	<1.0E-30	660	<1.0E-30	524
Eu-154	60	<1.0E-30	284	<1.0E-30	624	<1.0E-30	430	<1.0E-30	270	<1.0E-30	420	<1.0E-30	334
H-3	20,000	2.9E-03	116	8.1E-03	96	7.8E-03	96	5.9E-03	90	1.7E-11	120	7.3E-06	122
I-129	1	1.3E-06	1,000	1.7E-06	1,000	1.3E-06	1,000	5.3E-07	1,000	7.3E-12	1,000	9.8E-09	1,000
K-40	N/A	1.2E-11	1,000	3.6E-10	1,000	8.6E-10	1,000	9.3E-10	1,000	7.8E-21	1,000	2.0E-13	1,000
Nb-93m	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Nb-94	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000

Table A-11: Radiological 1-Meter Concentrations for Gordon Aquifer to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	1.2E-10	1,000	2.1E-08	1,000	6.0E-08	1,000	1.3E-07	1,000	2.5E-20	1,000	1.4E-11	1,000
Ni-63	50	7.5E-12	1,000	1.3E-09	1,000	3.8E-09	1,000	8.1E-09	1,000	1.6E-21	1,000	7.9E-13	1,000
Np-237	Total α	8.0E-07	1,000	6.7E-06	1,000	7.4E-06	1,000	7.1E-06	1,000	2.6E-15	1,000	5.8E-10	1,000
Pa-231	Total α	1.0E-10	1,000	8.6E-10	1,000	9.6E-10	1,000	9.3E-10	1,000	3.2E-19	1,000	8.3E-14	1,000
Pb-210	N/A	1.4E-28	1,000	1.5E-25	1,000	5.7E-23	1,000	3.3E-21	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pd-107	N/A	1.9E-11	1,000	3.2E-09	1,000	9.1E-09	1,000	2.0E-08	1,000	3.8E-21	1,000	2.1E-12	1,000
Pt-193	3,000	1.4E-17	1,000	2.2E-15	1,000	7.0E-15	1,000	1.5E-14	990	3.0E-27	1,000	1.4E-18	1,000
Pu-238	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-239	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-240	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-241	300	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-242	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Pu-244	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Ra-226	Total α/Ra	2.1E-26	1,000	2.1E-23	1,000	9.8E-21	1,000	5.3E-19	1,000	<1.0E-30	1,000	1.2E-28	1,000
Ra-228	Total Ra	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Se-79	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sm-151	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sn-126	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sr-90	8	2.0E-14	1,000	6.5E-13	926	1.8E-12	920	4.3E-12	810	1.3E-23	1,000	4.5E-16	932
Tc-99	900	6.2E-01	1,000	6.7E-01	1,000	4.3E-01	1,000	1.8E-01	1,000	1.1E-04	1,000	3.2E-02	1,000
Th-229	Total α	2.3E-15	1,000	2.9E-14	1,000	4.6E-14	1,000	4.6E-14	1,000	5.1E-24	1,000	8.0E-18	1,000
Th-230	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Th-232	Total α	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000

Table A-11: Radiological 1-Meter Concentrations for Gordon Aquifer to 1,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-233	Total U*	1.8E-12	1,000	1.9E-11	1,000	2.6E-11	1,000	2.5E-11	1,000	4.9E-21	1,000	3.4E-15	1,000
U-234	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-235	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-236	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
U-238	Total U*	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Zr-93	2,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Sum of beta-gamma MCL fractions		6.9E-04	NA	7.5E-04	NA	4.8E-04	NA	2.0E-04	NA	1.2E-07	NA	3.6E-05	NA
Total alpha	**15**	8.0E-07	NA	6.7E-06	NA	7.4E-06	NA	7.1E-06	NA	2.6E-15	NA	5.8E-10	NA
Total Ra	**5**	2.1E-26	NA	2.1E-23	NA	9.8E-21	NA	5.3E-19	NA	<1.0E-30	NA	1.2E-28	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table A-12: Chemical 1-Meter Concentrations for UTRA-UZ to 1,000 Years

Chemical	MCL (µg/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	8.3E-03	590	8.1E-11	1,000	8.8E-04	1,000	4.2E-03	566	5.4E-13	1,000	2.7E-03	998
Al	2.0E+02	1.3E-03	1,000	<1.0E-30	1,000	4.9E-23	1,000	8.2E-04	1,000	<1.0E-30	910	1.8E-11	1,000
As	1.0E+01	2.1E-05	1,000	<1.0E-30	1,000	3.7E-13	1,000	1.1E-05	988	<1.0E-30	1,000	7.4E-09	1,000
B	N/A	2.3E+00	534	2.1E+00	568	2.1E+00	572	4.1E+01	146	1.7E+00	576	1.9E+00	580
Ba	2.0E+03	1.3E-02	622	6.6E-15	1,000	2.4E-04	1,000	6.8E-03	588	5.7E-18	1,000	1.7E-03	1,000
Cd	5.0E+00	1.5E-02	626	8.7E-15	1,000	8.9E-04	1,000	7.6E-03	590	2.1E-17	1,000	3.8E-03	1,000
Cl	2.5E+05	9.5E-01	530	3.2E-01	926	3.2E-01	926	4.3E-01	528	1.7E-01	998	1.8E-01	1,000
Co	N/A	1.0E-04	806	2.0E-27	1,000	9.4E-09	1,000	5.0E-05	702	<1.0E-30	1,000	7.8E-07	1,000
Cr	1.0E+02	3.3E-05	1,000	<1.0E-30	1,000	5.5E-23	1,000	2.1E-05	1,000	<1.0E-30	998	1.3E-12	1,000
Cu	1.0E+03	1.1E-03	904	1.7E-28	1,000	2.6E-08	1,000	5.7E-04	754	<1.0E-30	1,000	4.7E-06	1,000
F	2.0E+03	1.9E-01	534	1.7E-01	568	1.7E-01	572	2.3E-01	534	1.4E-01	576	1.5E-01	580
Fe	3.0E+02	1.1E-01	1,000	<1.0E-30	1,000	1.4E-12	1,000	6.8E-02	1,000	<1.0E-30	980	2.7E-06	1,000
Hg	2.0E+00	1.0E-03	1,000	<1.0E-30	1,000	6.3E-21	1,000	6.5E-04	1,000	<1.0E-30	974	1.0E-10	1,000
I	N/A	7.9E-03	530	4.8E-03	842	4.7E-03	856	3.5E-03	528	3.2E-03	886	3.5E-03	906
Mn	5.0E+01	2.5E-01	622	4.0E-14	1,000	2.3E-03	1,000	1.3E-01	588	5.5E-17	1,000	1.7E-02	1,000
Mo	N/A	2.3E-04	1,000	<1.0E-30	1,000	1.5E-22	1,000	1.5E-04	1,000	<1.0E-30	998	9.4E-12	1,000
N	1.0E+04	1.3E+01	532	1.2E+01	568	1.2E+01	572	1.6E+01	534	5.5E-19	1,000	5.0E+00	522
Ni	N/A	1.9E-01	570	9.6E-07	1,000	2.5E-02	1,000	9.7E-02	552	4.0E-08	1,000	5.0E-02	902
Pb	1.5E+01	2.7E-05	1,000	<1.0E-30	1,000	3.6E-27	1,000	1.7E-05	1,000	<1.0E-30	988	6.8E-14	1,000
PO_4	N/A	3.4E-01	534	3.1E-01	568	3.1E-01	572	1.0E+01	144	2.5E-01	576	2.7E-01	580
Sb	6.0E+00	3.0E-06	1,000	<1.0E-30	1,000	8.8E-29	1,000	1.9E-06	1,000	<1.0E-30	880	3.1E-15	1,000
Se	5.0E+01	3.3E-07	1,000	<1.0E-30	1,000	2.2E-25	1,000	2.1E-07	1,000	<1.0E-30	940	1.4E-14	1,000
SO_4	2.5E+05	2.3E+00	154	9.7E-01	568	9.6E-01	572	1.2E+02	136	8.0E-01	576	8.6E-01	580
Sr	N/A	1.0E-02	556	7.4E-05	1,000	2.3E-03	1,000	5.1E-03	544	1.5E-06	1,000	2.7E-03	782
U	3.0E+01	1.2E-03	1,000	<1.0E-30	1,000	2.9E-16	1,000	7.5E-04	1,000	<1.0E-30	974	5.8E-09	1,000
Zn	5.0E+03	5.0E-03	628	7.8E-14	1,000	3.0E-04	1,000	2.5E-03	588	7.0E-18	1,000	1.3E-03	1,000

Table A-13: Chemical 1-Meter Concentrations for UTRA-LZ to 1,000 Years

Chemical	MCL (µg/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	3.4E-04	1,000	4.4E-09	1,000	4.1E-05	1,000	3.7E-03	928	2.3E-08	1,000	4.4E-04	1,000
Al	2.0E+02	1.9E-21	1,000	<1.0E-30	1,000	<1.0E-30	1,000	8.0E-17	1,000	<1.0E-30	1,000	<1.0E-30	1,000
As	1.0E+01	1.3E-13	1,000	<1.0E-30	1,000	4.2E-20	1,000	8.7E-10	1,000	2.5E-26	1,000	1.0E-19	1,000
B	N/A	9.1E+01	94	2.5E+01	236	2.8E+01	194	2.9E+01	178	1.2E+00	604	4.1E+00	192
Ba	2.0E+03	4.2E-05	1,000	2.6E-12	1,000	2.0E-06	1,000	2.6E-03	1,000	6.3E-10	1,000	1.9E-05	1,000
Cd	5.0E+00	1.4E-04	1,000	5.0E-12	1,000	5.7E-06	1,000	6.6E-03	1,000	7.2E-10	1,000	7.0E-05	1,000
Cl	2.5E+05	3.2E-01	772	2.5E-01	1,000	2.9E-01	948	3.0E-01	572	6.9E-02	1,000	1.4E-01	1,000
Co	N/A	1.2E-09	1,000	2.6E-22	1,000	2.4E-13	1,000	1.4E-06	1,000	2.3E-18	1,000	1.4E-13	1,000
Cr	1.0E+02	1.3E-21	1,000	<1.0E-30	1,000	<1.0E-30	1,000	4.7E-17	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cu	1.0E+03	3.8E-09	1,000	8.0E-24	1,000	1.3E-13	1,000	7.4E-06	1,000	5.4E-19	1,000	5.2E-14	1,000
F	2.0E+03	1.7E-01	546	1.5E-01	588	1.5E-01	588	2.1E-01	536	1.0E-01	604	1.4E-01	592
Fe	3.0E+02	1.6E-12	1,000	<1.0E-30	1,000	2.8E-21	1,000	2.5E-08	1,000	2.1E-28	1,000	7.0E-20	1,000
Hg	2.0E+00	9.6E-20	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.5E-15	1,000	<1.0E-30	1,000	1.5E-29	1,000
I	N/A	3.7E-03	662	3.9E-03	950	4.0E-03	890	3.9E-03	560	2.1E-03	1,000	3.1E-03	988
Mn	5.0E+01	4.2E-04	1,000	4.4E-11	1,000	2.4E-05	1,000	2.6E-02	1,000	1.2E-08	1,000	1.8E-04	1,000
Mo	N/A	3.7E-21	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.4E-16	1,000	<1.0E-30	1,000	<1.0E-30	1,000
N	1.0E+04	1.2E+01	546	1.0E+01	588	1.0E+01	588	1.5E+01	536	2.7E-03	548	1.3E+00	524
Ni	N/A	2.0E-02	1,000	1.4E-05	1,000	8.8E-03	1,000	7.5E-02	836	5.1E-06	1,000	1.3E-02	966
Pb	1.5E+01	3.3E-25	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.9E-20	1,000	<1.0E-30	1,000	<1.0E-30	1,000
PO_4	N/A	2.2E+01	94	7.4E+00	206	8.6E+00	192	8.6E+00	174	1.8E-01	604	1.5E+00	188
Sb	6.0E+00	1.3E-26	1,000	<1.0E-30	1,000	<1.0E-30	1,000	6.4E-22	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Se	5.0E+01	5.3E-24	1,000	<1.0E-30	1,000	<1.0E-30	1,000	2.0E-19	1,000	<1.0E-30	1,000	<1.0E-30	1,000
SO_4	2.5E+05	1.7E+02	218	1.1E+02	196	1.4E+02	178	1.4E+02	174	5.7E-01	604	3.4E+01	182
Sr	N/A	3.1E-03	1,000	4.7E-05	1,000	1.8E-03	1,000	4.2E-03	736	6.9E-07	1,000	6.9E-04	832
U	3.0E+01	6.8E-16	1,000	<1.0E-30	1,000	2.0E-26	1,000	1.5E-11	1,000	<1.0E-30	1,000	5.8E-24	1,000
Zn	5.0E+03	4.6E-05	1,000	1.7E-12	1,000	1.9E-06	1,000	2.2E-03	1,000	2.4E-10	1,000	2.3E-05	1,000

Table A-14: Chemical 1-Meter Concentrations for Gordon Aquifer to 1,000 Years

Chemical	MCL (µg/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	2.2E-15	1,000	9.0E-13	1,000	9.0E-12	1,000	3.6E-11	1,000	3.9E-26	1,000	2.8E-16	1,000
Al	2.0E+02	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
As	1.0E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	1.8E-28	1,000	<1.0E-30	1,000	<1.0E-30	1,000
B	N/A	5.6E-01	346	5.5E-01	346	3.1E-01	312	1.4E-01	296	1.6E-05	698	3.2E-03	384
Ba	2.0E+03	2.7E-19	1,000	1.3E-16	1,000	9.7E-15	1,000	9.6E-14	1,000	1.1E-30	1,000	7.3E-21	1,000
Cd	5.0E+00	4.4E-18	1,000	3.6E-15	1,000	3.6E-13	1,000	3.6E-12	1,000	1.4E-29	1,000	6.9E-19	1,000
Cl	2.5E+05	5.9E-05	1,000	8.4E-05	1,000	6.7E-05	1,000	2.9E-05	1,000	8.6E-11	1,000	1.6E-07	1,000
Co	N/A	4.2E-29	1,000	1.2E-25	1,000	1.5E-22	1,000	5.0E-21	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cr	1.0E+02	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Cu	1.0E+03	2.6E-30	1,000	7.5E-27	1,000	8.1E-23	1,000	5.6E-21	1,000	<1.0E-30	1,000	<1.0E-30	1,000
F	2.0E+03	5.0E-04	642	5.6E-04	636	2.9E-04	614	1.1E-04	602	1.3E-06	698	1.8E-04	686
Fe	3.0E+02	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	3.9E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Hg	2.0E+00	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
I	N/A	3.0E-06	1,000	3.9E-06	1,000	2.9E-06	1,000	1.1E-06	1,000	1.8E-11	1,000	2.4E-08	1,000
Mn	5.0E+01	1.3E-18	1,000	4.9E-16	1,000	2.5E-14	1,000	2.4E-13	1,000	5.3E-30	1,000	1.4E-20	1,000
Mo	N/A	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
N	1.0E+04	3.6E-02	640	4.0E-02	636	2.1E-02	614	7.5E-03	602	8.4E-10	644	2.1E-04	664
Ni	N/A	3.7E-12	1,000	6.4E-10	1,000	1.8E-09	1,000	4.0E-09	1,000	7.5E-22	1,000	4.1E-13	1,000
Pb	1.5E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
PO_4	N/A	1.6E-01	340	1.6E-01	336	9.2E-02	308	4.1E-02	292	2.3E-06	696	1.2E-03	368
Sb	6.0E+00	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Se	5.0E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
SO_4	2.5E+05	2.4E+00	324	2.4E+00	322	1.4E+00	290	6.3E-01	280	7.2E-06	698	3.0E-02	356
Sr	N/A	4.1E-11	1,000	1.3E-09	1,000	2.9E-09	1,000	3.2E-09	1,000	2.7E-20	1,000	9.2E-13	1,000
U	3.0E+01	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000	<1.0E-30	1,000
Zn	5.0E+03	1.5E-18	1,000	1.2E-15	1,000	1.2E-13	1,000	1.2E-12	1,000	4.6E-30	1,000	2.3E-19	1,000

APPENDIX B

RADIOLOGICAL AND CHEMICAL CONCENTRATION TABLES TO 10,000 YEARS

Table B-1: Radiological 100-Meter Concentrations for UTRA-UZ to 10,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	1.4E-08	1,436	4.5E-07	10,000	1.3E-05	10,000	3.8E-08	1,798	3.7E-08	1,846	4.4E-08	1,494
Al-26	N/A	4.2E-14	10,000	<1.0E-30	10,000	5.5E-16	10,000	3.9E-18	10,000	9.1E-19	10,000	6.6E-15	10,000
Am-241	Total α	7.9E-14	10,000	<1.0E-30	10,000	3.3E-16	10,000	9.2E-19	10,000	8.0E-19	10,000	1.8E-14	10,000
Am-242m	Total α	3.4E-25	2,862	<1.0E-30	7,188	<1.0E-30	3,480	1.1E-29	2,678	<1.0E-30	5,108	3.0E-27	3,394
Am-243	Total α	1.9E-11	10,000	<1.0E-30	10,000	8.0E-14	10,000	2.2E-16	10,000	1.9E-16	10,000	4.4E-12	10,000
C-14	2,000	8.5E-05	1,638	4.2E-02	6,800	1.4E+00	6,564	1.1E-03	9,526	2.5E-05	4,186	8.2E-04	10,000
Cf-249	Total α	4.4E-29	6,078	<1.0E-30	10,000	<1.0E-30	9,002	<1.0E-30	5,720	<1.0E-30	9,788	3.7E-30	7,170
Cf-251	Total α	3.3E-26	10,000	<1.0E-30	10,000	1.4E-28	10,000	6.0E-30	10,000	<1.0E-30	10,000	7.7E-27	10,000
Cl-36	700	1.2E-03	658	1.2E-02	952	1.2E-01	3,834	1.8E-03	1,242	1.8E-03	1,254	1.9E-03	1,166
Cm-243	Total α	<1.0E-30	1,018	<1.0E-30	2,056	<1.0E-30	538	<1.0E-30	454	<1.0E-30	1,662	<1.0E-30	1,096
Cm-244	Total α	<1.0E-30	338	<1.0E-30	1,464	<1.0E-30	338	<1.0E-30	284	<1.0E-30	798	<1.0E-30	388
Cm-245	Total α	7.3E-14	10,000	<1.0E-30	10,000	3.1E-16	10,000	8.6E-19	10,000	7.4E-19	10,000	<1.0E-30	10,000
Cm-247	Total α	3.9E-22	10,000	<1.0E-30	10,000	1.6E-24	10,000	4.5E-27	10,000	3.9E-27	10,000	8.9E-23	10,000
Cm-248	Total α	3.9E-22	10,000	<1.0E-30	10,000	1.6E-24	10,000	5.0E-27	10,000	4.0E-27	10,000	9.1E-23	10,000
Co-60	100	2.8E-29	96	<1.0E-30	270	<1.0E-30	110	<1.0E-30	80	<1.0E-30	192	<1.0E-30	116
Cs-135	900	1.4E-03	2,796	1.8E-02	2,760	1.9E-01	5,172	2.9E-03	3,816	2.9E-03	3,946	3.2E-03	2,992
Cs-137	200	9.9E-09	846	2.7E-15	1,494	1.0E-10	924	2.5E-12	936	5.1E-11	1,024	1.0E-08	852
Eu-152	200	<1.0E-30	252	<1.0E-30	770	<1.0E-30	252	<1.0E-30	214	<1.0E-30	562	<1.0E-30	292
Eu-154	60	<1.0E-30	162	<1.0E-30	450	<1.0E-30	162	<1.0E-30	136	<1.0E-30	322	<1.0E-30	186
H-3	20,000	3.6E-05	74	5.4E-09	106	1.9E-02	64	1.1E-03	58	2.6E-09	80	4.4E-04	70
I-129	1	1.1E-04	898	1.5E-03	892	1.2E-02	3,842	2.6E-04	1,016	2.6E-04	1,032	5.9E-04	3,790
K-40	N/A	1.9E-04	1,866	2.5E-03	1,848	1.7E-02	4,448	4.1E-04	2,406	4.0E-04	2,478	4.4E-04	1,934
Nb-93m	1,000	1.7E-09	10,000	1.7E-26	10,000	7.4E-11	10,000	5.5E-14	10,000	2.5E-13	10,000	7.8E-10	10,000
Nb-94	N/A	3.5E-07	10,000	2.8E-09	10,000	2.3E-07	10,000	4.2E-09	10,000	1.3E-07	10,000	2.9E-06	9,262

Table B-1: Radiological 100-Meter Concentrations for UTRA-UZ to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	2.1E-01	2,194	2.7E+00	2,156	2.9E+00	5,970	4.4E-01	2,888	4.3E-01	2,988	4.9E-01	2,344
Ni-63	50	5.1E-03	990	4.9E-04	1,664	1.4E-03	1,208	2.7E-05	1,670	5.5E-04	1,066	1.6E-02	988
Np-237	Total α	2.7E-02	1,356	3.6E-01	1,340	1.3E-01	1,464	6.2E-02	1,652	6.0E-02	1,694	7.2E-02	1,378
Pa-231	Total α	4.9E-06	1,402	1.6E-04	10,000	4.6E-03	10,000	1.3E-05	1,762	1.3E-05	1,806	1.5E-05	1,464
Pb-210	N/A	4.2E-06	10,000	4.4E-05	10,000	2.1E-04	8,168	4.3E-06	10,000	3.8E-06	10,000	1.5E-05	10,000
Pd-107	N/A	3.2E-02	2,194	4.2E-01	2,164	5.5E-01	6,010	6.9E-02	2,892	6.7E-02	2,984	7.6E-02	2,352
Pt-193	3,000	1.6E-08	902	2.1E-11	1,478	1.1E-09	1,066	1.2E-11	950	8.4E-10	988	3.9E-08	936
Pu-238	Total α	2.5E-21	1,992	<1.0E-30	4,792	3.7E-27	2,356	5.8E-26	1,864	<1.0E-30	3,518	2.6E-23	2,324
Pu-239	Total α	9.2E-08	10,000	5.7E-23	10,000	3.6E-09	10,000	2.4E-12	10,000	4.5E-11	10,000	7.6E-08	10,000
Pu-240	Total α	2.5E-08	10,000	1.6E-23	10,000	9.9E-10	10,000	6.5E-13	10,000	1.2E-11	10,000	2.1E-08	10,000
Pu-241	300	1.3E-13	10,000	<1.0E-30	10,000	5.3E-16	10,000	1.5E-18	10,000	1.3E-18	10,000	2.9E-14	10,000
Pu-242	Total α	2.1E-10	10,000	1.3E-25	10,000	8.1E-12	10,000	5.3E-15	10,000	9.9E-14	10,000	1.7E-10	10,000
Pu-244	Total α	9.6E-13	10,000	5.9E-28	10,000	3.8E-14	10,000	2.5E-17	10,000	4.6E-16	10,000	7.9E-13	10,000
Ra-226	Total α/Ra	3.4E-04	10,000	3.5E-03	10,000	1.6E-02	8,104	3.4E-04	10,000	3.0E-04	10,000	1.2E-03	10,000
Ra-228	Total Ra	9.0E-11	10,000	1.1E-20	10,000	4.7E-12	10,000	3.2E-15	10,000	4.0E-14	10,000	5.6E-11	10,000
Se-79	N/A	6.8E-11	10,000	1.4E-28	10,000	3.5E-12	10,000	4.5E-15	10,000	9.1E-15	10,000	2.7E-11	10,000
Sm-151	1,000	3.4E-23	2,032	<1.0E-30	5,012	1.4E-29	2,418	1.6E-27	1,908	<1.0E-30	3,708	9.0E-26	2,394
Sn-126	N/A	2.5E-14	10,000	<1.0E-30	10,000	1.1E-17	10,000	1.7E-18	10,000	6.9E-21	10,000	1.4E-15	10,000
Sr-90	8	3.7E-06	764	2.2E-10	1,230	1.6E-07	862	2.4E-09	808	1.2E-07	840	6.8E-06	808
Tc-99	900	1.2E+01	772	1.6E+02	768	5.8E+01	800	2.7E+01	882	2.7E+01	890	2.9E+01	840
Th-229	Total α	2.9E-07	10,000	1.2E-06	10,000	6.9E-07	10,000	3.0E-07	10,000	3.3E-07	10,000	9.9E-06	10,000
Th-230	Total α	3.0E-08	10,000	2.4E-15	10,000	3.8E-08	10,000	1.1E-10	10,000	5.3E-09	10,000	1.2E-06	10,000
Th-232	Total α	1.8E-12	10,000	2.1E-22	10,000	7.4E-14	10,000	6.7E-17	10,000	7.7E-16	10,000	8.6E-13	10,000

Table B-1: Radiological 100-Meter Concentrations for UTRA-UZ to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	4.8E-25	1,634	<1.0E-30	3,742	2.0E-29	1,906	4.0E-29	1,536	<1.0E-30	2,744	1.9E-26	1,868
U-233	Total U*	5.2E-06	10,000	6.3E-06	3,470	9.5E-06	10,000	1.6E-06	3,720	3.0E-06	10,000	2.5E-04	10,000
U-234	Total U*	6.6E-06	10,000	1.8E-12	10,000	9.4E-06	10,000	3.2E-08	10,000	1.7E-06	10,000	3.0E-04	10,000
U-235	Total U*	1.4E-08	10,000	3.8E-15	10,000	2.0E-08	10,000	6.7E-11	10,000	4.1E-09	10,000	7.2E-07	10,000
U-236	Total U*	1.1E-07	10,000	3.0E-14	10,000	1.6E-07	10,000	5.3E-10	10,000	3.2E-08	10,000	5.7E-06	10,000
U-238	Total U*	1.2E-07	10,000	3.4E-14	10,000	1.7E-07	10,000	5.8E-10	10,000	3.5E-08	10,000	6.2E-06	10,000
Zr-93	2,000	2.8E-10	10,000	2.0E-27	10,000	1.1E-11	10,000	8.8E-15	10,000	3.6E-14	10,000	1.1E-10	10,000
Sum of beta-gamma MCL fractions		1.4E-02	NA	1.9E-01	NA	8.7E-02	NA	3.2E-02	NA	3.2E-02	NA	3.5E-02	NA
Total alpha	**15**	2.8E-02	NA	3.6E-01	NA	1.5E-01	NA	6.2E-02	NA	6.0E-02	NA	7.3E-02	NA
Total Ra	**5**	3.4E-04	NA	3.5E-03	NA	1.6E-02	NA	3.4E-04	NA	3.0E-04	NA	1.2E-03	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table B-2: Radiological 100-Meter Concentrations for UTRA-LZ to 10,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	5.5E-04	10,000	1.1E-03	10,000	1.1E-03	10,000	9.3E-07	10,000	1.3E-07	1,846	7.2E-07	10,000
Al-26	N/A	4.1E-20	10,000	<1.0E-30	10,000	4.1E-13	10,000	5.6E-15	10,000	3.1E-21	10,000	1.2E-18	10,000
Am-241	Total α	5.5E-20	10,000	<1.0E-30	10,000	2.6E-13	10,000	1.9E-15	10,000	1.8E-20	10,000	4.1E-18	10,000
Am-242m	Total α	<1.0E-30	4,532	<1.0E-30	9,176	3.5E-28	4,462	8.9E-29	3,862	<1.0E-30	7,252	<1.0E-30	6,740
Am-243	Total α	1.3E-17	10,000	<1.0E-30	10,000	6.3E-11	10,000	4.6E-13	10,000	4.3E-18	10,000	9.7E-16	10,000
C-14	2,000	1.9E+01	7,530	1.1E+02	6,638	1.1E+02	6,582	9.8E-01	9,844	6.0E-05	3,888	1.3E-01	10,000
Cf-249	Total α	<1.0E-30	9,860	<1.0E-30	10,000	2.2E-29	8,770	<1.0E-30	7,336	<1.0E-30	10,000	<1.0E-30	10,000
Cf-251	Total α	<1.0E-30	10,000	<1.0E-30	10,000	1.1E-25	10,000	7.8E-28	10,000	<1.0E-30	10,000	1.6E-30	10,000
Cl-36	700	4.5E+00	4,110	1.1E+01	3,854	1.1E+01	3,838	5.0E-01	3,740	6.7E-03	1,262	4.5E-01	3,872
Cm-243	Total α	<1.0E-30	1,386	<1.0E-30	2,496	<1.0E-30	926	<1.0E-30	796	<1.0E-30	2,018	<1.0E-30	1,472
Cm-244	Total α	<1.0E-30	570	<1.0E-30	1,732	<1.0E-30	584	<1.0E-30	506	<1.0E-30	1,030	<1.0E-30	622
Cm-245	Total α	5.0E-20	10,000	<1.0E-30	10,000	2.4E-13	10,000	1.7E-15	10,000	1.6E-20	10,000	3.7E-18	10,000
Cm-247	Total α	2.6E-28	10,000	<1.0E-30	10,000	1.3E-21	10,000	9.2E-24	10,000	8.6E-29	10,000	1.9E-26	10,000
Cm-248	Total α	2.7E-28	10,000	<1.0E-30	10,000	1.3E-21	10,000	9.4E-24	10,000	8.8E-29	10,000	2.0E-26	10,000
Co-60	100	<1.0E-30	158	<1.0E-30	340	1.0E-29	146	2.4E-30	124	<1.0E-30	274	<1.0E-30	172
Cs-135	900	3.5E+00	8,422	1.7E+01	5,270	1.7E+01	5,216	3.8E-01	5,496	9.1E-03	3,888	3.6E-01	6,482
Cs-137	200	2.9E-10	984	5.9E-15	1,336	5.5E-07	854	3.7E-10	890	1.8E-09	1,006	9.3E-09	984
Eu-152	200	<1.0E-30	426	<1.0E-30	966	<1.0E-30	438	<1.0E-30	380	<1.0E-30	732	<1.0E-30	466
Eu-154	60	<1.0E-30	272	<1.0E-30	574	<1.0E-30	282	<1.0E-30	244	<1.0E-30	432	<1.0E-30	296
H-3	20,000	6.1E-01	100	2.9E+00	86	1.0E+01	68	6.7E-01	66	5.2E-07	78	9.0E-02	90
I-129	1	2.6E+01	2,614	1.0E+01	3,914	1.3E+01	3,858	8.4E-01	3,836	8.8E-04	1,014	9.9E-01	3,954
K-40	N/A	3.5E-01	3,906	1.5E+00	4,502	1.5E+00	4,472	2.0E-02	4,470	1.3E-03	2,440	1.2E-02	5,216
Nb-93m	1,000	1.8E-14	10,000	<1.0E-30	10,000	5.1E-08	10,000	1.6E-10	10,000	6.2E-14	10,000	8.0E-12	10,000
Nb-94	N/A	6.7E-08	10,000	9.1E-12	10,000	1.7E-05	9,994	3.2E-08	10,000	2.4E-06	10,000	5.0E-06	9,288

Table B-2: Radiological 100-Meter Concentrations for UTRA-LZ to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	6.1E+01	6,722	2.4E+02	6,070	2.3E+02	5,982	1.6E-01	3,114	1.4E+00	2,890	1.4E+00	2,822
Ni-63	50	4.4E-03	1,172	3.6E-04	1,586	1.7E-01	890	5.6E-04	1,080	1.1E-02	1,018	2.8E-02	982
Np-237	Total α	2.7E-01	10,000	9.9E-01	10,000	9.6E-01	10,000	2.3E-02	2,348	2.0E-01	1,646	2.0E-01	1,606
Pa-231	Total α	1.9E-01	10,000	3.7E-01	10,000	3.6E-01	10,000	3.2E-04	10,000	4.5E-05	1,810	2.5E-04	10,000
Pb-210	N/A	6.4E-03	10,000	1.4E-02	8,580	3.7E-02	10,000	2.3E-03	10,000	1.8E-05	10,000	9.8E-05	10,000
Pd-107	N/A	1.2E+01	6,756	4.5E+01	6,108	4.4E+01	6,024	6.2E-01	10,000	2.1E-01	2,898	2.2E-01	10,000
Pt-193	3,000	4.9E-09	1,036	2.5E-11	1,400	8.0E-07	840	1.1E-09	962	2.1E-08	966	7.0E-08	932
Pu-238	Total α	<1.0E-30	3,026	<1.0E-30	6,044	2.9E-24	2,948	6.3E-25	2,576	<1.0E-30	4,838	<1.0E-30	4,528
Pu-239	Total α	3.7E-12	10,000	3.5E-27	10,000	1.9E-06	10,000	1.9E-09	10,000	1.1E-10	10,000	5.9E-09	10,000
Pu-240	Total α	1.0E-12	10,000	9.6E-28	10,000	5.1E-07	10,000	5.2E-10	10,000	2.9E-11	10,000	1.6E-09	10,000
Pu-241	300	8.8E-20	10,000	<1.0E-30	10,000	4.2E-13	10,000	3.0E-15	10,000	2.9E-20	10,000	6.5E-18	10,000
Pu-242	Total α	8.2E-15	10,000	7.9E-30	10,000	4.2E-09	10,000	4.2E-12	10,000	2.4E-13	10,000	1.3E-11	10,000
Pu-244	Total α	3.8E-17	10,000	<1.0E-30	10,000	1.9E-11	10,000	2.0E-14	10,000	1.1E-15	10,000	6.1E-14	10,000
Ra-226	Total α/Ra	5.1E-01	10,000	1.1E+00	8,550	3.0E+00	10,000	1.8E-01	10,000	1.5E-03	10,000	7.9E-03	10,000
Ra-228	Total Ra	3.1E-15	10,000	4.0E-24	10,000	3.0E-09	10,000	8.1E-12	10,000	7.9E-13	10,000	7.7E-12	10,000
Se-79	N/A	5.7E-16	10,000	<1.0E-30	10,000	2.4E-09	10,000	1.1E-11	10,000	6.4E-16	10,000	1.2E-13	10,000
Sm-151	1,000	<1.0E-30	3,140	<1.0E-30	6,346	8.0E-28	3,162	7.7E-28	2,776	<1.0E-30	4,760	<1.0E-30	3,390
Sn-126	N/A	2.8E-22	10,000	<1.0E-30	10,000	6.3E-15	10,000	4.5E-16	10,000	1.3E-25	10,000	1.9E-22	10,000
Sr-90	8	8.9E-07	862	1.1E-09	1,096	2.4E-04	724	2.1E-07	778	3.3E-06	830	1.2E-05	804
Tc-99	900	1.1E+03	8,780	2.3E+02	9,512	3.0E+02	9,474	1.9E+01	9,460	9.9E+01	876	9.9E+01	870
Th-229	Total α	1.7E-06	10,000	4.5E-06	10,000	6.5E-05	10,000	1.9E-07	10,000	2.7E-06	10,000	1.4E-05	10,000
Th-230	Total α	5.0E-10	10,000	8.8E-19	10,000	8.0E-06	10,000	2.0E-09	10,000	1.9E-07	10,000	1.7E-06	10,000
Th-232	Total α	6.1E-17	10,000	7.6E-26	10,000	5.1E-11	10,000	1.6E-13	10,000	1.9E-14	10,000	1.8E-13	10,000

Table B-2: Radiological 100-Meter Concentrations for UTRA-LZ to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	<1.0E-30	2,400	<1.0E-30	4,652	1.3E-25	2,232	5.9E-27	1,954	<1.0E-30	3,654	<1.0E-30	3,432
U-233	Total U*	2.7E-05	10,000	9.4E-05	10,000	1.6E-03	10,000	1.4E-06	10,000	6.0E-05	10,000	4.0E-04	10,000
U-234	Total U*	1.7E-07	10,000	6.8E-16	10,000	1.8E-03	10,000	3.9E-07	10,000	6.5E-05	10,000	4.7E-04	10,000
U-235	Total U*	3.6E-10	10,000	1.4E-18	10,000	4.4E-06	10,000	9.0E-10	10,000	1.6E-07	10,000	1.1E-06	10,000
U-236	Total U*	2.8E-09	10,000	1.1E-17	10,000	3.5E-05	10,000	7.2E-09	10,000	1.2E-06	10,000	9.0E-06	10,000
U-238	Total U*	3.1E-09	10,000	1.2E-17	10,000	3.8E-05	10,000	7.8E-09	10,000	1.4E-06	10,000	9.9E-06	10,000
Zr-93	2,000	2.6E-15	10,000	<1.0E-30	10,000	7.7E-09	10,000	2.5E-11	10,000	7.6E-15	10,000	1.0E-12	10,000
Sum of beta-gamma MCL fractions		2.7E+01	NA	1.1E+01	NA	1.4E+01	NA	8.6E-01	NA	1.2E-01	NA	1.1E+00	NA
Total alpha	**15**	9.7E-01	NA	2.5E+00	NA	4.3E+00	NA	2.1E-01	NA	2.0E-01	NA	2.1E-01	NA
Total Ra	**5**	5.1E-01	NA	1.1E+00	NA	3.0E+00	NA	1.8E-01	NA	1.5E-03	NA	7.9E-03	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table B-3: Radiological 100-Meter Concentrations for Gordon Aquifer to 10,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	2.9E-07	10,000	8.4E-07	10,000	1.9E-07	10,000	4.4E-10	10,000	3.2E-10	10,000	1.2E-09	10,000
Al-26	N/A	<1.0E-30	10,000	<1.0E-30	10,000	1.5E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Am-241	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Am-242m	Total α	<1.0E-30	6,646	<1.0E-30	10,000	<1.0E-30	6,814	<1.0E-30	6,312	<1.0E-30	9,506	<1.0E-30	8,852
Am-243	Total α	<1.0E-30	10,000	<1.0E-30	10,000	3.8E-29	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
C-14	2,000	1.2E-04	10,000	6.4E-04	10,000	1.6E-04	10,000	5.1E-07	10,000	5.5E-10	10,000	1.8E-08	10,000
Cf-249	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Cf-251	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Cl-36	700	1.4E-02	5,036	1.4E-02	4,990	4.8E-03	4,744	5.3E-05	4,792	4.3E-06	2,344	1.2E-04	5,578
Cm-243	Total α	<1.0E-30	1,868	<1.0E-30	2,488	<1.0E-30	1,422	<1.0E-30	1,270	<1.0E-30	2,518	<1.0E-30	1,950
Cm-244	Total α	<1.0E-30	874	<1.0E-30	1,572	<1.0E-30	892	<1.0E-30	798	<1.0E-30	1,346	<1.0E-30	924
Cm-245	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Cm-247	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Cm-248	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Co-60	100	<1.0E-30	238	<1.0E-30	388	<1.0E-30	234	<1.0E-30	214	<1.0E-30	358	<1.0E-30	252
Cs-135	900	9.5E-03	10,000	1.2E-02	9,996	4.3E-03	10,000	4.8E-05	10,000	4.4E-06	9,998	7.2E-05	10,000
Cs-137	200	4.5E-20	1,224	1.0E-17	1,196	3.8E-16	1,052	1.2E-19	1,172	5.0E-20	1,232	7.5E-20	1,244
Eu-152	200	<1.0E-30	654	<1.0E-30	1,184	<1.0E-30	672	<1.0E-30	598	<1.0E-30	964	<1.0E-30	694
Eu-154	60	<1.0E-30	418	<1.0E-30	758	<1.0E-30	428	<1.0E-30	382	<1.0E-30	580	<1.0E-30	442
H-3	20,000	2.6E-03	118	6.6E-03	102	6.2E-03	96	6.9E-05	92	1.9E-11	120	8.8E-06	122
I-129	1	7.1E-02	4,556	6.9E-02	4,532	2.2E-02	4,318	2.9E-04	4,322	7.3E-07	1,600	7.2E-04	4,732
K-40	N/A	9.0E-04	9,106	9.4E-04	8,530	3.3E-04	7,922	2.8E-06	8,024	7.0E-07	6,160	5.1E-06	9,994
Nb-93m	1,000	<1.0E-30	10,000	<1.0E-30	10,000	7.1E-24	10,000	8.7E-27	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Nb-94	N/A	2.2E-17	10,000	5.9E-15	10,000	2.6E-13	10,000	5.0E-17	10,000	5.2E-16	10,000	7.6E-16	10,000

Table B-3: Radiological 100-Meter Concentrations for Gordon Aquifer to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	3.8E-02	10,000	1.5E-01	9,994	2.6E-02	9,992	8.6E-05	8,822	7.3E-04	7,436	1.5E-03	8,278
Ni-63	50	2.5E-09	1,734	2.4E-08	1,520	3.9E-08	1,378	2.6E-10	1,478	9.1E-11	1,340	1.8E-10	1,354
Np-237	Total α	6.6E-04	3,156	1.6E-03	10,000	3.0E-04	10,000	1.8E-05	3,860	1.5E-04	3,292	3.1E-04	3,652
Pa-231	Total α	1.0E-04	10,000	3.0E-04	10,000	6.7E-05	10,000	1.5E-07	10,000	1.1E-07	9,998	4.0E-07	10,000
Pb-210	N/A	4.5E-08	10,000	2.8E-07	10,000	2.9E-07	10,000	3.8E-09	10,000	6.9E-12	10,000	2.6E-11	10,000
Pd-107	N/A	9.4E-03	10,000	3.6E-02	10,000	8.1E-03	10,000	3.9E-05	10,000	1.2E-04	7,508	2.5E-04	8,662
Pt-193	3,000	1.3E-16	1,386	5.0E-15	1,198	2.2E-14	1,068	5.1E-17	1,236	2.7E-17	1,196	4.9E-17	1,208
Pu-238	Total α	<1.0E-30	4,356	<1.0E-30	6,968	<1.0E-30	4,416	<1.0E-30	4,164	<1.0E-30	6,236	<1.0E-30	5,844
Pu-239	Total α	<1.0E-30	10,000	<1.0E-30	10,000	1.3E-21	10,000	1.0E-24	10,000	2.0E-29	10,000	1.1E-28	10,000
Pu-240	Total α	<1.0E-30	10,000	<1.0E-30	10,000	3.6E-22	10,000	2.8E-25	10,000	5.4E-30	10,000	3.1E-29	10,000
Pu-241	300	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Pu-242	Total α	<1.0E-30	10,000	<1.0E-30	10,000	2.9E-24	10,000	2.3E-27	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Pu-244	Total α	<1.0E-30	10,000	<1.0E-30	10,000	1.4E-26	10,000	1.1E-29	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Ra-226	Total α/Ra	3.7E-06	10,000	2.2E-05	10,000	2.3E-05	10,000	3.0E-07	10,000	5.5E-10	10,000	2.2E-09	10,000
Ra-228	Total Ra	1.1E-28	10,000	2.6E-25	10,000	6.9E-21	10,000	6.9E-25	10,000	1.7E-25	10,000	5.9E-25	10,000
Se-79	N/A	<1.0E-30	10,000	<1.0E-30	10,000	3.5E-25	10,000	7.1E-28	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Sm-151	1,000	<1.0E-30	4,544	<1.0E-30	7,588	<1.0E-30	4,682	<1.0E-30	4,312	<1.0E-30	6,244	<1.0E-30	4,794
Sn-126	N/A	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Sr-90	8	9.9E-15	1,088	6.9E-13	962	4.6E-12	876	6.4E-15	988	3.2E-15	976	5.7E-15	984
Tc-99	900	3.9E+00	8,132	3.9E+00	8,110	1.2E+00	7,936	1.5E-02	7,944	9.5E-02	1,252	2.0E-01	1,328
Th-229	Total α	2.5E-08	10,000	2.7E-08	10,000	1.1E-08	10,000	7.1E-10	10,000	5.6E-09	10,000	1.3E-08	10,000
Th-230	Total α	2.0E-23	10,000	5.0E-20	10,000	1.8E-15	10,000	2.3E-19	10,000	4.9E-20	10,000	1.4E-19	10,000
Th-232	Total α	2.0E-30	10,000	5.0E-27	10,000	1.8E-22	10,000	2.4E-26	10,000	4.9E-27	10,000	1.4E-26	10,000

Table B-3: Radiological 100-Meter Concentrations for Gordon Aquifer to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	<1.0E-30	3,372	<1.0E-30	5,040	<1.0E-30	3,360	<1.0E-30	3,182	<1.0E-30	4,700	<1.0E-30	4,424
U-233	Total U*	2.4E-07	10,000	3.1E-07	10,000	1.1E-07	10,000	7.0E-09	10,000	5.2E-08	9,998	1.2E-07	10,000
U-234	Total U*	1.7E-20	10,000	3.9E-17	10,000	9.7E-13	10,000	1.4E-16	10,000	4.1E-17	10,000	9.6E-17	10,000
U-235	Total U*	4.1E-23	10,000	9.1E-20	10,000	2.3E-15	10,000	3.2E-19	10,000	9.8E-20	10,000	2.3E-19	10,000
U-236	Total U*	3.2E-22	10,000	7.1E-19	10,000	1.8E-14	10,000	2.5E-18	10,000	7.7E-19	10,000	1.8E-18	10,000
U-238	Total U*	3.6E-22	10,000	8.0E-19	10,000	2.0E-14	10,000	2.8E-18	10,000	8.6E-19	10,000	2.0E-18	10,000
Zr-93	2,000	<1.0E-30	10,000	<1.0E-30	10,000	9.4E-25	10,000	1.5E-27	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Sum of beta-gamma MCL fractions		7.5E-02	NA	7.4E-02	NA	2.4E-02	NA	3.1E-04	NA	1.1E-04	NA	9.5E-04	NA
Total alpha	**15**	7.6E-04	NA	1.9E-03	NA	3.9E-04	NA	1.8E-05	NA	1.5E-04	NA	3.2E-04	NA
Total Ra	**5**	3.7E-06	NA	2.2E-05	NA	2.3E-05	NA	3.0E-07	NA	5.5E-10	NA	2.2E-09	NA

* Total uranium is evaluated in Tables A-4 through A-6
** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr
† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table B-4: Chemical 100-Meter Concentrations for UTRA-UZ to 10,000 Years

Chemical	MCL (µg/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	3.3E-04	2,618	4.4E-03	2,564	4.3E-03	6,624	7.2E-04	3,466	7.0E-04	3,596	9.0E-04	2,620
Al	2.0E+02	1.4E-12	10,000	<1.0E-30	10,000	1.8E-14	10,000	1.3E-16	10,000	3.0E-17	10,000	2.2E-13	10,000
As	1.0E+01	5.3E-07	10,000	1.9E-06	10,000	1.8E-06	10,000	1.1E-07	10,000	1.1E-07	10,000	1.4E-06	5,804
B	N/A	1.2E-01	580	1.6E+00	580	5.7E-01	588	3.3E-01	600	3.2E-01	604	4.0E-01	582
Ba	2.0E+03	3.6E-04	3,898	4.7E-03	3,834	1.4E-02	6,438	7.1E-04	5,576	7.0E-04	5,774	7.3E-04	4,232
Cd	5.0E+00	6.8E-04	3,164	9.0E-03	3,202	5.7E-03	7,558	1.5E-03	4,396	1.4E-03	4,584	2.3E-03	3,178
Cl	2.5E+05	2.6E-02	658	2.6E-01	954	1.2E+00	3,834	3.8E-02	1,244	3.8E-02	1,256	4.0E-02	1,168
Co	N/A	4.3E-06	6,916	5.7E-05	7,024	6.1E-05	10,000	9.2E-06	10,000	8.8E-06	10,000	1.3E-05	6,996
Cr	1.0E+02	4.3E-13	10,000	2.2E-30	10,000	5.2E-14	10,000	4.4E-17	10,000	1.0E-16	10,000	3.1E-13	10,000
Cu	1.0E+03	5.4E-05	7,810	7.4E-04	7,924	2.4E-04	9,930	1.1E-04	9,994	1.1E-04	9,948	2.1E-04	7,640
F	2.0E+03	1.0E-02	580	1.3E-01	580	1.2E-01	3,698	2.7E-02	600	2.6E-02	604	3.3E-02	582
Fe	3.0E+02	3.8E-04	10,000	2.3E-07	10,000	4.3E-04	10,000	2.6E-06	10,000	2.2E-04	10,000	9.8E-03	10,000
Hg	2.0E+00	9.3E-11	10,000	1.0E-26	10,000	1.1E-11	10,000	4.6E-15	10,000	5.5E-14	10,000	1.3E-10	10,000
I	N/A	2.8E-04	898	3.7E-03	894	1.1E-02	3,842	6.5E-04	1,016	6.4E-04	1,032	7.4E-04	908
Mn	5.0E+01	5.9E-03	2,216	5.1E-02	4,472	1.4E-01	5,570	7.1E-03	6,710	7.1E-03	7,008	9.3E-03	1,724
Mo	N/A	2.9E-12	10,000	6.2E-30	10,000	1.5E-13	10,000	1.9E-16	10,000	3.9E-16	10,000	1.1E-12	10,000
N	1.0E+04	7.2E-01	580	9.4E+00	580	3.0E+01	3,698	2.3E-01	3,560	5.4E-02	530	8.9E-01	528
Ni	N/A	6.4E-03	2,194	8.4E-02	2,158	3.0E-02	2,432	1.4E-02	2,880	1.3E-02	2,978	1.5E-02	2,350
Pb	1.5E+01	4.0E-16	10,000	<1.0E-30	10,000	1.9E-19	10,000	2.7E-20	10,000	1.1E-22	10,000	2.2E-17	10,000
PO_4	N/A	1.8E-02	580	2.4E-01	580	5.4E-01	3,676	4.9E-02	600	4.7E-02	604	5.8E-02	582
Sb	6.0E+00	4.7E-18	10,000	<1.0E-30	10,000	1.4E-21	10,000	9.8E-22	10,000	4.4E-25	10,000	1.5E-19	10,000
Se	5.0E+01	4.2E-15	10,000	<1.0E-30	10,000	2.2E-16	10,000	2.8E-19	10,000	5.6E-19	10,000	1.7E-15	10,000
SO_4	2.5E+05	5.6E-02	580	7.4E-01	580	3.8E-01	3,676	1.5E-01	600	1.5E-01	604	1.8E-01	582
Sr	N/A	3.6E-04	1,770	4.9E-03	1,712	7.8E-03	4,582	8.1E-04	2,248	7.9E-04	2,312	9.8E-04	1,842
U	3.0E+01	3.4E-07	10,000	9.7E-14	10,000	4.9E-07	10,000	1.7E-09	10,000	1.0E-07	10,000	1.8E-05	10,000
Zn	5.0E+03	2.3E-04	3,160	3.2E-03	3,174	3.2E-02	7,550	5.1E-04	4,398	4.8E-04	4,584	7.5E-04	3,184

Table B-5: Chemical 100-Meter Concentrations for UTRA-LZ to 10,000 Years

Chemical	MCL (µg/L)	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	2.0E-01	10,000	3.6E-01	6,752	3.5E-01	6,634	1.2E-02	10,000	2.2E-03	3,148	2.4E-03	3,072
Al	2.0E+02	1.3E-18	10,000	<1.0E-30	10,000	1.3E-11	10,000	1.8E-13	10,000	1.0E-19	10,000	3.9E-17	10,000
As	1.0E+01	1.7E-06	10,000	2.9E-07	10,000	2.9E-05	10,000	2.7E-06	10,000	1.2E-06	6,390	2.4E-06	5,922
B	N/A	5.3E+01	134	3.4E+01	3,678	3.4E+01	3,678	1.2E+00	178	1.1E+00	598	1.2E+00	596
Ba	2.0E+03	1.4E+00	10,000	1.2E+00	6,596	1.8E+00	9,148	1.0E-01	8,840	2.3E-03	5,840	4.3E-02	10,000
Cd	5.0E+00	3.6E-01	10,000	4.8E-01	7,750	4.6E-01	7,590	1.8E-02	10,000	4.8E-03	3,846	5.5E-03	3,440
Cl	2.5E+05	1.1E+02	2,588	1.1E+02	3,854	1.5E+02	3,698	8.4E+00	3,684	1.4E-01	1,260	3.0E+00	3,874
Co	N/A	7.4E-05	10,000	1.7E-03	10,000	4.5E-03	10,000	1.1E-05	10,000	2.9E-05	8,946	3.2E-05	8,164
Cr	1.0E+02	8.9E-18	10,000	<1.0E-30	10,000	2.8E-11	10,000	1.2E-13	10,000	8.8E-18	10,000	2.1E-15	10,000
Cu	1.0E+03	1.1E-03	10,000	1.2E-03	10,000	1.1E-02	10,000	3.0E-05	10,000	3.9E-04	9,070	4.8E-04	8,374
F	2.0E+03	4.2E+01	2,290	3.9E+01	3,596	5.2E+01	3,580	2.9E+00	3,574	9.4E-02	598	2.1E+00	3,606
Fe	3.0E+02	5.8E-05	10,000	2.0E-10	10,000	5.1E-02	10,000	3.0E-05	10,000	6.2E-03	10,000	1.7E-02	9,998
Hg	2.0E+00	3.8E-15	10,000	<1.0E-30	10,000	6.7E-09	10,000	1.3E-11	10,000	3.2E-14	10,000	3.2E-12	10,000
I	N/A	4.9E-01	2,614	1.0E+00	3,854	1.0E+00	3,846	2.6E-02	3,756	2.2E-03	1,014	1.5E-02	3,942
Mn	5.0E+01	2.5E+02	7,296	4.0E+01	8,422	7.2E+01	5,812	4.2E+00	5,646	2.5E-02	8,628	9.6E-01	8,440
Mo	N/A	2.4E-17	10,000	<1.0E-30	10,000	1.0E-10	10,000	4.9E-13	10,000	2.7E-17	10,000	5.0E-15	10,000
N	1.0E+04	3.4E+03	3,648	3.5E+03	3,596	4.5E+03	3,580	2.5E+02	3,576	7.4E-01	528	2.0E+02	3,606
Ni	N/A	1.1E-01	9,982	3.9E-01	9,996	3.8E-01	10,000	7.0E-03	10,000	4.3E-02	2,900	4.4E-02	2,816
Pb	1.5E+01	4.6E-24	10,000	<1.0E-30	10,000	1.0E-16	10,000	7.3E-18	10,000	2.1E-27	10,000	3.1E-24	10,000
PO_4	N/A	1.3E+01	136	4.5E+01	3,678	4.4E+01	3,678	3.7E-01	178	1.7E-01	598	3.7E-01	212
Sb	6.0E+00	1.9E-26	10,000	<1.0E-30	10,000	5.5E-19	10,000	8.7E-20	10,000	1.0E-30	10,000	2.4E-27	10,000
Se	5.0E+01	3.5E-20	10,000	<1.0E-30	10,000	1.5E-13	10,000	7.1E-16	10,000	3.9E-20	10,000	7.3E-18	10,000
SO_4	2.5E+05	1.2E+02	232	8.7E+01	194	1.0E+02	182	6.0E+00	172	5.3E-01	598	8.5E+00	206
Sr	N/A	1.1E+00	5,954	1.5E+00	4,708	2.3E+00	4,366	1.3E-01	4,254	3.4E-03	2,230	6.6E-02	4,866
U	3.0E+01	9.0E-09	10,000	3.6E-17	10,000	1.1E-04	10,000	2.2E-08	10,000	3.9E-06	10,000	2.8E-05	10,000
Zn	5.0E+03	6.8E-01	9,028	2.7E+00	7,748	2.6E+00	7,586	1.0E-02	10,000	1.7E-03	4,374	1.8E-03	3,576

Table B-6: Chemical 100-Meter Concentrations for Gordon Aquifer to 10,000 Years

Chemical	MCL (µg/L)	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	9.1E-05	10,000	2.8E-04	10,000	7.1E-05	10,000	4.9E-07	10,000	1.4E-06	8,542	2.9E-06	9,618
Al	2.0E+02	<1.0E-30	10,000	<1.0E-30	10,000	4.9E-29	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
As	1.0E+01	1.4E-13	10,000	1.9E-11	10,000	4.9E-11	10,000	9.7E-14	10,000	2.4E-13	10,000	4.9E-13	10,000
B	N/A	6.5E-01	350	6.2E-01	348	2.1E-01	308	1.9E-03	302	1.7E-03	674	4.4E-03	704
Ba	2.0E+03	1.5E-04	10,000	4.2E-04	10,000	3.0E-04	10,000	3.1E-06	10,000	3.8E-07	10,000	7.3E-07	10,000
Cd	5.0E+00	7.9E-05	10,000	2.7E-04	10,000	7.6E-05	10,000	6.0E-07	10,000	3.6E-06	9,994	7.2E-06	10,000
Cl	2.5E+05	2.0E-01	5,008	1.9E-01	4,986	7.1E-02	4,712	5.8E-04	4,732	9.1E-05	2,352	7.7E-04	5,540
Co	N/A	3.7E-09	10,000	1.4E-08	10,000	1.4E-08	10,000	6.8E-11	10,000	1.9E-10	10,000	3.2E-10	10,000
Cr	1.0E+02	<1.0E-30	10,000	<1.0E-30	10,000	3.0E-26	10,000	5.9E-29	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Cu	1.0E+03	2.7E-08	10,000	1.9E-07	10,000	1.9E-07	10,000	1.0E-09	10,000	1.5E-09	10,000	2.7E-09	10,000
F	2.0E+03	5.5E-01	3,682	5.4E-01	3,680	2.2E-01	3,634	2.0E-03	3,630	1.4E-04	674	3.2E-03	3,690
Fe	3.0E+02	8.8E-15	10,000	3.5E-12	10,000	9.0E-10	10,000	7.6E-14	10,000	6.9E-13	10,000	1.1E-12	10,000
Hg	2.0E+00	<1.0E-30	10,000	<1.0E-30	10,000	1.4E-23	10,000	1.8E-26	10,000	<1.0E-30	10,000	<1.0E-30	10,000
I	N/A	2.3E-03	4,520	2.3E-03	4,504	8.9E-04	4,270	7.3E-06	4,260	1.8E-06	1,598	9.4E-06	4,698
Mn	5.0E+01	9.5E-03	10,000	7.1E-03	10,000	5.0E-03	10,000	4.4E-05	10,000	9.1E-07	10,000	9.2E-06	10,000
Mo	N/A	<1.0E-30	10,000	<1.0E-30	10,000	1.5E-26	10,000	3.0E-29	10,000	<1.0E-30	10,000	<1.0E-30	10,000
N	1.0E+04	4.8E+01	3,682	4.8E+01	3,680	1.9E+01	3,634	1.8E-01	3,632	3.4E-05	10,000	3.1E-01	3,690
Ni	N/A	2.0E-04	10,000	5.2E-04	10,000	1.2E-04	10,000	3.0E-06	10,000	2.4E-05	7,548	4.9E-05	8,580
Pb	1.5E+01	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
PO_4	N/A	1.9E-01	342	1.8E-01	344	6.0E-02	306	5.9E-04	298	2.5E-04	674	1.3E-03	376
Sb	6.0E+00	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Se	5.0E+01	<1.0E-30	10,000	<1.0E-30	10,000	2.2E-29	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
SO_4	2.5E+05	2.7E+00	336	2.6E+00	330	8.2E-01	292	9.9E-03	286	7.8E-04	676	3.0E-02	360
Sr	N/A	5.3E-03	7,934	5.4E-03	7,854	2.2E-03	6,806	2.0E-05	6,810	1.8E-06	4,998	3.0E-05	8,888
U	3.0E+01	1.0E-21	10,000	2.3E-18	10,000	5.8E-14	10,000	8.2E-18	10,000	2.5E-18	10,000	5.8E-18	10,000
Zn	5.0E+03	2.6E-04	10,000	1.4E-03	10,000	3.2E-04	10,000	2.6E-07	10,000	1.3E-06	9,980	2.5E-06	10,000

Table B-7: Upper Three Runs Seepline Concentrations to 10,000 Years

Radionuclide	Unit	Peak Seepline Concentration in 10,000 Yrs	Year Largest Contribution in 10,000 Years Occurs
Ac-227	pCi/L	5.5E-06	10,000
Al-26	pCi/L	2.2E-20	10,000
Am-241	pCi/L	3.3E-20	10,000
Am-242m	pCi/L	1.6E-30	2,490
Am-243	pCi/L	8.1E-18	10,000
C-14	pCi/L	2.6E-01	9,558
Cf-249	pCi/L	<1.0E-30	10,000
Cf-251	pCi/L	4.5E-27	10,000
Cl-36	pCi/L	6.4E-02	4,140
Cm-243	pCi/L	<1.0E-30	936
Cm-244	pCi/L	<1.0E-30	286
Cm-245	pCi/L	3.1E-20	10,000
Cm-247	pCi/L	8.6E-27	10,000
Cm-248	pCi/L	3.5E-25	10,000
Co-60	pCi/L	<1.0E-30	82
Cs-135	pCi/L	6.4E-02	8,066
Cs-137	pCi/L	2.3E-14	968
Eu-152	pCi/L	<1.0E-30	214
Eu-154	pCi/L	<1.0E-30	136
H-3	pCi/L	2.8E-03	118
I-129	pCi/L	1.2E-01	2,786
K-40	pCi/L	4.6E-03	5,862
Nb-93m	pCi/L	5.7E-16	10,000
Nb-94	pCi/L	1.8E-10	10,000
Ni-59	pCi/L	1.0E+00	8,128
Ni-63	pCi/L	5.6E-06	1,598
Np-237	pCi/L	8.5E-03	2,050

Table B-7: Upper Three Runs Seepline Concentrations to 10,000 Years (Continued)

Radionuclide	Unit	Peak Seepline Concentration in 10,000 Yrs	Year Largest Contribution in 10,000 Years Occurs
Pa-231	pCi/L	1.9E-03	10,000
Pb-210	pCi/L	3.6E-06	10,000
Pd-107	pCi/L	2.1E-01	8,236
Pt-193	pCi/L	3.7E-13	1,434
Pu-238	pCi/L	1.1E-26	1,762
Pu-239	pCi/L	2.0E-14	10,000
Pu-240	pCi/L	5.5E-15	10,000
Pu-241	pCi/L	5.3E-20	10,000
Pu-242	pCi/L	4.5E-17	10,000
Pu-244	pCi/L	2.1E-19	10,000
Ra-226	pCi/L	2.9E-04	10,000
Ra-228	pCi/L	2.9E-17	10,000
Se-79	pCi/L	3.2E-17	10,000
Sm-151	pCi/L	3.8E-28	1,792
Sn-126	pCi/L	2.6E-20	10,000
Sr-90	pCi/L	3.5E-11	830
Tc-99	pCi/L	9.7E+00	8,934
Th-229	pCi/L	8.3E-08	10,000
Th-230	pCi/L	1.8E-14	10,000
Th-232	pCi/L	6.0E-19	10,000
U-232	pCi/L	<1.0E-30	1,470
U-233	pCi/L	7.7E-07	10,000
U-234	pCi/L	5.9E-12	10,000
U-235	pCi/L	1.2E-14	10,000
U-236	pCi/L	9.7E-14	10,000
U-238	pCi/L	1.1E-13	10,000
Zr-93	pCi/L	9.2E-17	10,000

Table B-7: Upper Three Runs Seepline Concentrations to 10,000 Years (Continued)

Chemical	Unit	Peak Seepline Concentration in 10,000 Yrs	Year Largest Contribution in 10,000 Years Occurs
Ag	(μg/L)	2.2E-03	10,000
Al	(μg/L)	7.3E-19	10,000
As	(μg/L)	3.3E-08	10,000
B	(μg/L)	4.4E-01	206
Ba	(μg/L)	7.5E-03	10,000
Cd	(μg/L)	1.6E-03	10,000
Cl	(μg/L)	6.6E-01	4,130
Co	(μg/L)	4.1E-07	6,772
Cr	(μg/L)	2.1E-18	10,000
Cu	(μg/L)	6.9E-06	7,266
F	(μg/L)	3.4E-01	3,644
Fe	(μg/L)	3.5E-08	10,000
Hg	(μg/L)	4.4E-17	10,000
I	(μg/L)	4.6E-03	4,164
Mn	(μg/L)	1.3E+00	9,998
Mo	(μg/L)	1.1E-18	10,000
N	(μg/L)	3.1E+01	3,644
Ni	(μg/L)	2.6E-03	9,998
Pb	(μg/L)	4.9E-22	10,000
PO4	(μg/L)	2.0E-01	2,868
Sb	(μg/L)	8.1E-24	10,000
Se	(μg/L)	1.8E-21	10,000
SO4	(μg/L)	1.5E+00	236
Sr	(μg/L)	9.9E-03	5,940
U	(μg/L)	3.1E-13	10,000
Zn	(μg/L)	6.0E-03	10,000

Table B-8: Fourmile Branch Seepline Concentrations to 10,000 Years

Radionuclide	Unit	Peak Seepline Concentration in 10,000 Yrs	Year Largest Contribution in 10,000 Years Occurs
Ac-227	pCi/L	2.7E-05	10,000
Al-26	pCi/L	2.0E-15	10,000
Am-241	pCi/L	2.0E-14	10,000
Am-242m	pCi/L	2.1E-26	2,300
Am-243	pCi/L	3.8E-14	10,000
C-14	pCi/L	1.7E+00	7,720
Cf-249	pCi/L	3.6E-23	10,000
Cf-251	pCi/L	6.0E-18	10,000
Cl-36	pCi/L	2.0E-01	3,916
Cm-243	pCi/L	<1.0E-30	894
Cm-244	pCi/L	<1.0E-30	260
Cm-245	pCi/L	1.9E-14	10,000
Cm-247	pCi/L	1.2E-16	10,000
Cm-248	pCi/L	5.2E-15	10,000
Co-60	pCi/L	1.6E-30	74
Cs-135	pCi/L	2.5E-01	6,046
Cs-137	pCi/L	7.3E-13	780
Eu-152	pCi/L	<1.0E-30	194
Eu-154	pCi/L	<1.0E-30	124
H-3	pCi/L	9.3E-02	86
I-129	pCi/L	1.7E-01	3,952
K-40	pCi/L	2.3E-02	4,894
Nb-93m	pCi/L	1.4E-12	10,000
Nb-94	pCi/L	1.3E-06	10,000
Ni-59	pCi/L	5.0E+00	6,958
Ni-63	pCi/L	1.4E-04	1,538
Np-237	pCi/L	3.2E-02	1,234

Table B-8: Fourmile Branch Seepline Concentrations to 10,000 Years (Continued)

Radionuclide	Unit	Peak Seepline Concentration in 10,000 Yrs	Year Largest Contribution in 10,000 Years Occurs
Pa-231	pCi/L	9.3E-03	10,000
Pb-210	pCi/L	3.0E-04	10,000
Pd-107	pCi/L	1.0E+00	7,032
Pt-193	pCi/L	1.2E-11	1,402
Pu-238	pCi/L	1.3E-22	1,644
Pu-239	pCi/L	3.6E-11	10,000
Pu-240	pCi/L	9.9E-12	10,000
Pu-241	pCi/L	3.2E-14	10,000
Pu-242	pCi/L	8.1E-14	10,000
Pu-244	pCi/L	3.9E-16	10,000
Ra-226	pCi/L	2.4E-02	10,000
Ra-228	pCi/L	6.7E-14	10,000
Se-79	pCi/L	2.4E-12	10,000
Sm-151	pCi/L	7.4E-24	1,666
Sn-126	pCi/L	1.2E-16	10,000
Sr-90	pCi/L	3.5E-10	906
Tc-99	pCi/L	1.3E+01	738
Th-229	pCi/L	2.0E-07	10,000
Th-230	pCi/L	2.4E-11	10,000
Th-232	pCi/L	1.4E-15	10,000
U-232	pCi/L	6.2E-27	1,380
U-233	pCi/L	2.8E-06	10,000
U-234	pCi/L	6.6E-09	10,000
U-235	pCi/L	1.0E-11	10,000
U-236	pCi/L	1.7E-10	10,000
U-238	pCi/L	1.3E-10	10,000
Zr-93	pCi/L	2.2E-13	10,000

Table B-8: Fourmile Branch Seepline Concentrations to 10,000 Years (Continued)

Chemical	Unit	Peak Seepline Concentration in 10,000 Yrs	Year Largest Contribution in 10,000 Years Occurs
Ag	(µg/L)	7.6E-03	8,038
Al	(µg/L)	2.4E-15	10,000
As	(µg/L)	7.5E-07	10,000
B	(µg/L)	7.1E-01	200
Ba	(µg/L)	4.4E-02	10,000
Cd	(µg/L)	1.0E-02	9,972
Cl	(µg/L)	2.6E+00	3,860
Co	(µg/L)	5.4E-06	5,734
Cr	(µg/L)	1.7E-13	10,000
Cu	(µg/L)	7.1E-05	6,380
F	(µg/L)	1.1E+00	3,596
Fe	(µg/L)	2.8E-06	10,000
Hg	(µg/L)	2.6E-12	10,000
I	(µg/L)	2.2E-02	3,932
Mn	(µg/L)	1.6E+00	7,074
Mo	(µg/L)	2.3E-14	10,000
N	(µg/L)	9.7E+01	3,598
Ni	(µg/L)	1.2E-02	10,000
Pb	(µg/L)	4.4E-17	10,000
PO4	(µg/L)	8.5E-01	2,828
Sb	(µg/L)	5.9E-19	10,000
Se	(µg/L)	9.7E-18	10,000
SO4	(µg/L)	2.1E+00	206
Sr	(µg/L)	4.4E-02	4,816
U	(µg/L)	3.8E-10	10,000
Zn	(µg/L)	5.2E-02	9,464

Table B-9: Radiological 1-Meter Concentrations for UTRA-UZ to 10,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	4.3E-07	10,000	2.9E-07	10,000	6.0E-04	10,000	8.5E-04	10,000	1.8E-07	1,444	2.0E-07	1,488
Al-26	N/A	3.2E-04	9,992	1.4E-27	10,000	3.7E-07	10,000	1.2E+00	10,000	2.9E-29	10,000	1.9E-06	10,000
Am-241	Total α	1.3E-01	1,092	1.5E-26	10,000	5.7E-08	10,000	3.9E-01	10,000	3.4E-28	10,000	3.9E-07	3,368
Am-242m	Total α	5.7E-06	714	<1.0E-30	7,886	4.2E-19	3,196	3.6E-06	716	<1.0E-30	7,918	2.5E-13	1,492
Am-243	Total α	3.1E-02	4,714	3.6E-24	10,000	1.4E-05	10,000	8.6E-01	10,000	7.9E-26	10,000	8.9E-05	10,000
C-14	2,000	4.9E-01	9,762	1.9E-02	6,428	6.5E+01	5,946	9.1E+01	5,926	1.3E-04	2,698	1.8E-01	9,712
Cf-249	Total α	5.8E-14	980	<1.0E-30	10,000	3.2E-19	9,994	2.1E-09	9,894	<1.0E-30	10,000	8.0E-20	2,840
Cf-251	Total α	8.7E-15	1,590	<1.0E-30	10,000	5.4E-14	10,000	3.5E-04	10,000	<1.0E-30	10,000	3.2E-19	5,758
Cl-36	700	3.0E-01	3,680	1.5E-02	924	6.5E+00	3,762	2.1E+01	3,552	8.2E-03	1,164	1.1E-01	3,668
Cm-243	Total α	4.1E-11	560	<1.0E-30	1,516	<1.0E-30	1,218	2.6E-11	560	<1.0E-30	1,066	3.6E-21	726
Cm-244	Total α	2.2E-11	52	<1.0E-30	650	<1.0E-30	932	1.9E-10	52	<1.0E-30	556	3.7E-22	156
Cm-245	Total α	1.1E-04	4,916	1.4E-26	10,000	5.3E-08	10,000	3.7E-01	10,000	3.0E-28	10,000	3.4E-07	10,000
Cm-247	Total α	4.3E-13	8,168	<1.0E-30	10,000	1.1E-12	10,000	1.3E-03	10,000	<1.0E-30	10,000	1.8E-15	10,000
Cm-248	Total α	4.4E-13	8,048	<1.0E-30	10,000	4.7E-11	10,000	5.6E-02	10,000	<1.0E-30	10,000	1.8E-15	10,000
Co-60	100	2.9E-10	16	<1.0E-30	186	<1.0E-30	122	3.2E-10	16	<1.0E-30	118	1.7E-17	44
Cs-135	900	2.2E-01	4,954	2.4E-02	2,304	1.1E+01	4,568	1.6E+01	4,336	1.4E-02	3,014	8.1E-02	4,850
Cs-137	200	4.6E-02	546	1.3E-12	1,352	8.8E-07	838	2.8E-02	542	1.4E-13	1,382	5.6E-05	636
Eu-152	200	1.1E-11	40	<1.0E-30	486	<1.0E-30	356	6.8E-11	40	<1.0E-30	502	5.5E-23	116
Eu-154	60	1.8E-11	26	<1.0E-30	310	<1.0E-30	184	6.1E-11	26	<1.0E-30	244	1.5E-23	74
H-3	20,000	4.0E-01	60	1.5E-07	94	8.2E-04	70	1.3E+02	40	4.8E-13	570	1.6E-01	60
I-129	1	3.4E-01	3,758	2.0E-03	840	6.2E-01	3,770	2.3E+01	3,682	1.3E-03	886	1.3E-01	3,752
K-40	N/A	1.1E-02	4,396	3.2E-03	1,632	8.9E-01	4,146	1.3E+00	4,130	1.9E-03	1,982	3.9E-03	4,374
Nb-93m	1,000	2.5E-01	7,726	1.4E-19	10,000	2.1E-03	10,000	1.2E-01	4,782	3.2E-21	10,000	1.3E-02	10,000
Nb-94	N/A	6.4E-05	1,606	1.7E-06	10,000	2.3E-02	10,000	3.6E+00	10,000	2.5E-07	10,000	2.1E-05	5,764

Table B-9: Radiological 1-Meter Concentrations for UTRA-UZ to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	6.4E+00	570	3.6E+00	1,838	1.3E+02	5,518	1.8E+02	5,500	2.1E+00	2,194	2.4E+00	2,276
Ni-63	50	9.6E+00	556	5.3E-03	1,420	7.6E-02	876	5.3E+00	546	1.3E-03	1,466	2.6E-01	800
Np-237	Total α	7.4E-01	544	4.8E-01	1,204	5.4E-01	10,000	7.5E-01	10,000	3.1E-01	1,316	3.4E-01	1,366
Pa-231	Total α	1.5E-04	10,000	9.9E-05	10,000	2.1E-01	10,000	2.9E-01	10,000	6.2E-05	1,408	6.8E-05	1,452
Pb-210	N/A	1.5E-03	10,000	1.0E-04	10,000	1.6E-02	6,694	4.2E-01	7,708	5.4E-05	10,000	5.7E-04	10,000
Pd-107	N/A	9.6E-01	570	5.5E-01	1,840	2.4E+01	5,554	3.4E+01	5,540	3.3E-01	2,198	3.6E-01	2,278
Pt-193	3,000	4.5E-04	548	9.1E-10	1,318	4.3E-07	840	2.6E-04	542	1.7E-10	1,354	2.3E-06	640
Pu-238	Total α	2.4E-02	644	<1.0E-30	5,290	6.4E-16	2,316	1.5E-02	642	<1.0E-30	5,324	1.3E-09	1,138
Pu-239	Total α	6.8E-01	4,556	3.8E-15	10,000	7.1E-03	10,000	3.6E-01	3,280	3.1E-17	10,000	4.2E-02	10,000
Pu-240	Total α	2.9E-01	3,534	4.8E-16	10,000	1.9E-03	10,000	1.7E-01	2,778	8.6E-18	10,000	1.1E-02	10,000
Pu-241	300	1.9E-04	4,952	2.5E-26	10,000	9.1E-08	10,000	6.4E-01	10,000	5.4E-28	10,000	5.8E-07	10,000
Pu-242	Total α	1.3E-03	4,946	2.5E-18	10,000	1.6E-05	10,000	6.6E-04	3,440	7.0E-20	10,000	9.4E-05	10,000
Pu-244	Total α	6.0E-06	5,078	1.2E-20	10,000	7.3E-08	10,000	3.1E-06	3,422	3.3E-22	10,000	4.4E-07	10,000
Ra-226	Total α/Ra	1.2E-01	10,000	8.3E-03	10,000	1.3E+00	6,660	3.4E+01	7,676	4.3E-03	10,000	4.5E-02	10,000
Ra-228	Total Ra	1.0E-02	7,444	2.2E-15	10,000	1.0E-04	10,000	5.0E-03	4,622	1.1E-16	10,000	5.9E-04	10,000
Se-79	N/A	3.6E-02	9,974	8.1E-22	10,000	2.7E-04	10,000	3.8E+02	10,000	1.8E-23	10,000	1.3E-03	10,000
Sm-151	1,000	6.9E-02	646	<1.0E-30	3,578	1.6E-17	2,396	4.4E-02	646	<1.0E-30	5,564	5.2E-10	1,150
Sn-126	N/A	1.6E-02	9,998	<1.0E-30	10,000	2.3E-07	10,000	8.7E-03	9,940	<1.0E-30	10,000	5.3E-06	10,000
Sr-90	8	3.4E-01	538	1.6E-08	1,134	1.5E-04	706	2.0E-01	536	2.6E-09	1,156	1.3E-03	598
Tc-99	900	3.4E+02	528	2.0E+02	730	2.0E+02	742	9.5E+02	9,364	1.3E+02	832	1.4E+02	826
Th-229	Total α	6.0E-03	10,000	1.7E-06	10,000	1.8E-03	10,000	4.2E+00	10,000	1.5E-06	10,000	1.7E-03	10,000
Th-230	Total α	1.2E-03	10,000	5.5E-10	10,000	3.1E-04	10,000	7.6E-01	10,000	2.8E-11	10,000	2.6E-04	10,000
Th-232	Total α	2.9E-04	7,842	4.8E-17	10,000	2.3E-06	10,000	1.4E-04	4,880	2.4E-18	10,000	1.4E-05	10,000

Table B-9: Radiological 1-Meter Concentrations for UTRA-UZ to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	1.8E-08	612	<1.0E-30	4,132	2.2E-19	1,874	1.1E-08	614	<1.0E-30	4,178	7.3E-15	986
U-233	Total U*	3.6E-02	3,400	1.0E-05	10,000	1.5E-02	10,000	6.6E+01	9,686	8.5E-06	10,000	1.4E-02	8,658
U-234	Total U*	5.0E-02	3,404	3.1E-07	10,000	2.0E-02	10,000	1.8E+02	10,000	1.6E-08	10,000	1.7E-02	8,724
U-235	Total U*	1.0E-04	3,702	6.3E-10	10,000	4.4E-05	10,000	1.2E-01	10,000	3.4E-11	10,000	4.2E-05	8,742
U-236	Total U*	8.5E-04	3,906	5.0E-09	10,000	3.6E-04	10,000	2.8E+00	10,000	2.6E-10	10,000	3.4E-04	8,742
U-238	Total U*	8.9E-04	3,446	5.6E-09	10,000	3.7E-04	10,000	1.6E-02	10,000	2.9E-10	10,000	3.5E-04	8,726
Zr-93	2,000	4.5E-02	7,850	1.5E-20	10,000	3.5E-04	10,000	2.2E-02	4,872	3.6E-22	10,000	2.1E-03	10,000
Sum of beta-gamma MCL fractions		9.7E-01	NA	2.4E-01	NA	1.3E+00	NA	2.5E+01	NA	1.5E-01	NA	2.9E-01	NA
Total alpha	**15**	2.0E+00	NA	4.9E-01	NA	2.0E+00	NA	4.2E+01	NA	3.1E-01	NA	4.4E-01	NA
Total Ra	**5**	1.3E-01	NA	8.3E-03	NA	1.3E+00	NA	3.4E+01	NA	4.3E-03	NA	4.6E-02	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table B-10: Radiological 1-Meter Concentrations for UTRA-LZ to 10,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	1.0E-03	10,000	1.6E-03	10,000	2.1E-03	10,000	1.3E-03	10,000	1.4E-07	1,922	3.0E-06	10,000
Al-26	N/A	1.2E-10	10,000	8.9E-28	10,000	1.1E-15	10,000	6.6E-07	10,000	6.2E-22	10,000	3.9E-13	10,000
Am-241	Total α	2.2E-11	10,000	5.7E-27	10,000	3.3E-14	10,000	1.1E-07	10,000	4.3E-21	10,000	2.8E-13	10,000
Am-242m	Total α	1.7E-21	2,472	<1.0E-30	7,128	<1.0E-30	4,692	3.6E-17	2,374	<1.0E-30	4,524	4.3E-29	3,278
Am-243	Total α	5.4E-09	10,000	1.1E-24	10,000	1.5E-13	10,000	2.7E-05	10,000	1.0E-18	10,000	6.6E-11	10,000
C-14	2,000	2.2E+01	10,000	1.6E+02	6,314	2.3E+02	5,930	1.4E+02	5,852	6.5E-04	9,486	1.1E+00	10,000
Cf-249	Total α	4.0E-26	5,146	<1.0E-30	10,000	4.5E-23	10,000	9.2E-20	10,000	<1.0E-30	10,000	1.9E-29	9,760
Cf-251	Total α	9.3E-24	10,000	<1.0E-30	10,000	7.6E-18	10,000	1.5E-14	10,000	<1.0E-30	10,000	1.1E-25	10,000
Cl-36	700	8.2E+00	3,984	1.6E+01	3,804	2.4E+01	3,758	1.9E+01	3,618	6.6E-03	1,286	2.4E+00	3,792
Cm-243	Total α	<1.0E-30	930	<1.0E-30	2,030	<1.0E-30	936	3.3E-26	408	<1.0E-30	1,388	<1.0E-30	1,102
Cm-244	Total α	<1.0E-30	286	<1.0E-30	1,438	<1.0E-30	588	7.5E-26	258	<1.0E-30	570	<1.0E-30	390
Cm-245	Total α	2.1E-11	10,000	5.1E-27	10,000	3.0E-14	10,000	1.0E-07	10,000	4.0E-21	10,000	2.5E-13	10,000
Cm-247	Total α	1.1E-19	10,000	4.0E-30	10,000	1.4E-16	10,000	3.1E-14	10,000	2.1E-29	10,000	1.3E-21	10,000
Cm-248	Total α	1.1E-19	10,000	1.7E-28	10,000	6.2E-15	10,000	1.3E-12	10,000	2.1E-29	10,000	1.4E-21	10,000
Co-60	100	4.2E-25	82	<1.0E-30	262	<1.0E-30	152	8.4E-19	68	<1.0E-30	158	<1.0E-30	112
Cs-135	900	6.1E+00	7,384	2.6E+01	4,890	3.9E+01	4,548	2.4E+01	4,478	9.4E-03	4,284	2.0E+00	5,852
Cs-137	200	3.4E-07	780	1.0E-12	1,194	9.0E-09	886	4.8E-05	682	5.3E-12	942	7.1E-08	902
Eu-152	200	<1.0E-30	214	<1.0E-30	714	<1.0E-30	442	2.7E-27	192	<1.0E-30	426	<1.0E-30	292
Eu-154	60	<1.0E-30	136	<1.0E-30	416	<1.0E-30	282	6.9E-29	124	<1.0E-30	272	<1.0E-30	186
H-3	20,000	2.9E+00	82	3.4E+00	82	1.5E+01	64	3.9E+01	50	1.5E-03	62	1.2E+00	68
I-129	1	5.1E+01	2,460	1.2E+01	3,916	1.7E+01	3,834	2.4E+01	3,696	1.2E-02	3,764	4.9E+00	3,902
K-40	N/A	7.5E-01	3,278	2.2E+00	4,306	3.3E+00	4,132	2.0E+00	4,094	1.4E-03	2,632	6.4E-02	4,878
Nb-93m	1,000	1.1E-06	10,000	1.9E-20	10,000	1.9E-10	10,000	3.5E-03	10,000	5.4E-16	10,000	8.5E-08	10,000
Nb-94	N/A	4.9E-05	10,000	3.8E-06	10,000	6.4E-02	10,000	3.2E-02	10,000	6.7E-10	10,000	4.5E-06	7,230

Table B-10: Radiological 1-Meter Concentrations for UTRA-LZ to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	4.6E+02	10,000	3.4E+02	5,764	4.5E+02	5,506	2.6E+02	5,462	1.5E+00	3,164	2.0E+00	2,790
Ni-63	50	4.8E-02	1,018	1.3E-03	1,402	2.6E-02	1,090	6.2E-01	770	1.3E-05	1,042	4.1E-02	908
Np-237	Total α	3.1E-01	1,092	1.5E+00	10,000	1.9E+00	10,000	1.1E+00	10,000	2.1E-01	1,748	3.0E-01	1,584
Pa-231	Total α	3.4E-01	10,000	5.6E-01	10,000	7.3E-01	10,000	4.3E-01	10,000	4.7E-05	1,886	1.0E-03	10,000
Pb-210	N/A	1.1E-01	10,000	3.0E-02	7,528	7.5E-02	10,000	1.3E-01	9,998	4.5E-06	10,000	2.8E-03	10,000
Pd-107	N/A	1.2E+01	6,506	6.5E+01	5,808	8.5E+01	5,544	5.0E+01	5,490	2.3E-01	3,166	1.7E+00	10,000
Pt-193	3,000	2.2E-07	830	3.2E-10	1,230	4.3E-08	982	6.6E-06	722	2.8E-11	952	1.7E-07	862
Pu-238	Total α	9.6E-18	1,740	<1.0E-30	4,756	1.3E-27	3,076	1.7E-13	1,668	<1.0E-30	3,030	2.9E-25	2,248
Pu-239	Total α	8.3E-06	10,000	5.2E-17	10,000	1.7E-08	10,000	1.3E-02	10,000	2.9E-13	10,000	6.5E-06	10,000
Pu-240	Total α	2.3E-06	10,000	1.4E-17	10,000	4.6E-09	10,000	3.5E-03	10,000	7.8E-14	10,000	1.8E-06	10,000
Pu-241	300	3.5E-11	10,000	9.2E-27	10,000	5.2E-14	10,000	1.8E-07	10,000	6.9E-21	10,000	4.4E-13	10,000
Pu-242	Total α	1.8E-08	10,000	1.2E-19	10,000	3.7E-11	10,000	2.9E-05	10,000	6.4E-16	10,000	1.5E-08	10,000
Pu-244	Total α	8.6E-11	10,000	5.4E-22	10,000	1.7E-13	10,000	1.3E-07	10,000	3.0E-18	10,000	6.8E-11	10,000
Ra-226	Total α/Ra	9.0E+00	10,000	2.3E+00	7,496	6.0E+00	10,000	1.1E+01	10,000	3.6E-04	10,000	2.2E-01	10,000
Ra-228	Total Ra	5.4E-08	10,000	1.4E-17	10,000	1.5E-11	10,000	1.6E-04	10,000	5.8E-17	10,000	5.4E-09	10,000
Se-79	N/A	1.2E-07	10,000	1.9E-22	10,000	7.2E-12	10,000	3.7E-04	10,000	8.5E-18	10,000	5.0E-09	10,000
Sm-151	1,000	4.1E-19	1,784	<1.0E-30	4,980	<1.0E-30	3,274	9.9E-15	1,732	<1.0E-30	3,138	1.7E-27	2,298
Sn-126	N/A	6.6E-11	10,000	<1.0E-30	10,000	6.1E-18	10,000	8.3E-07	10,000	9.7E-24	10,000	2.1E-15	10,000
Sr-90	8	8.1E-05	716	2.5E-08	984	8.0E-06	814	2.9E-03	622	5.6E-09	806	3.9E-05	758
Tc-99	900	2.1E+03	8,658	2.6E+02	9,508	4.2E+02	9,444	8.9E+02	9,374	1.0E+02	898	1.3E+02	860
Th-229	Total α	2.4E-05	10,000	6.3E-06	10,000	1.3E-05	10,000	1.8E-03	10,000	1.5E-06	10,000	1.7E-04	10,000
Th-230	Total α	3.4E-06	10,000	3.4E-12	10,000	6.5E-07	10,000	2.8E-04	10,000	6.0E-12	10,000	2.3E-05	10,000
Th-232	Total α	1.2E-09	10,000	3.0E-19	10,000	2.4E-13	10,000	3.8E-06	10,000	1.0E-18	10,000	8.3E-11	10,000

Table B-10: Radiological 1-Meter Concentrations for UTRA-LZ to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	4.6E-21	1,446	<1.0E-30	3,692	8.9E-29	2,354	4.9E-17	1,354	<1.0E-30	2,400	2.8E-27	2,762
U-233	Total U*	4.5E-04	10,000	1.4E-04	10,000	3.2E-04	10,000	4.5E-02	10,000	9.1E-06	8,130	2.9E-03	10,000
U-234	Total U*	5.9E-04	10,000	1.8E-09	10,000	1.9E-04	10,000	5.5E-02	10,000	1.9E-09	10,000	3.5E-03	10,000
U-235	Total U*	1.2E-06	10,000	3.6E-12	10,000	3.9E-07	10,000	6.2E-05	10,000	4.0E-12	10,000	8.5E-06	10,000
U-236	Total U*	9.9E-06	10,000	2.9E-11	10,000	3.1E-06	10,000	7.0E-04	10,000	3.2E-11	10,000	6.8E-05	10,000
U-238	Total U*	1.0E-05	10,000	3.2E-11	10,000	3.4E-06	10,000	4.6E-04	10,000	3.5E-11	10,000	7.3E-05	10,000
Zr-93	2,000	1.9E-07	10,000	2.2E-21	10,000	2.8E-11	10,000	5.8E-04	10,000	7.7E-17	10,000	1.2E-08	10,000
Sum of beta-gamma MCL fractions		5.4E+01	NA	1.3E+01	NA	1.9E+01	NA	2.6E+01	NA	1.3E-01	NA	5.1E+00	NA
Total alpha	**15**	9.6E+00	NA	4.4E+00	NA	8.6E+00	NA	1.2E+01	NA	2.1E-01	NA	5.2E-01	NA
Total Ra	**5**	9.0E+00	NA	2.3E+00	NA	6.0E+00	NA	1.1E+01	NA	3.6E-04	NA	2.2E-01	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide’s peak, such that these totals are not associated with any one specific time

Table B-11: Radiological 1-Meter Concentrations for Gordon Aquifer to 10,000 Years

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ac-227	N/A	1.7E-07	10,000	5.5E-07	10,000	2.0E-07	10,000	3.4E-08	10,000	3.2E-12	10,000	6.8E-10	10,000
Al-26	N/A	<1.0E-30	10,000	<1.0E-30	10,000	8.0E-29	10,000	3.3E-24	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Am-241	Total α	<1.0E-30	10,000	<1.0E-30	10,000	7.4E-30	10,000	6.0E-26	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Am-242m	Total α	<1.0E-30	4,774	<1.0E-30	9,194	<1.0E-30	6,712	<1.0E-30	4,606	<1.0E-30	6,890	<1.0E-30	7,492
Am-243	Total α	<1.0E-30	10,000	<1.0E-30	10,000	1.7E-27	10,000	1.5E-23	10,000	<1.0E-30	10,000	<1.0E-30	10,000
C-14	2,000	6.3E-05	10,000	4.1E-04	10,000	1.7E-04	10,000	4.8E-05	10,000	1.8E-12	10,000	1.7E-08	10,000
Cf-249	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Cf-251	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Cl-36	700	1.3E-02	4,984	1.3E-02	4,914	8.3E-03	4,766	3.6E-03	4,710	3.5E-08	2,800	1.2E-04	5,620
Cm-243	Total α	<1.0E-30	1,426	<1.0E-30	2,052	<1.0E-30	1,420	<1.0E-30	898	<1.0E-30	1,886	<1.0E-30	1,598
Cm-244	Total α	<1.0E-30	596	<1.0E-30	1,296	<1.0E-30	896	<1.0E-30	566	<1.0E-30	880	<1.0E-30	702
Cm-245	Total α	<1.0E-30	10,000	<1.0E-30	10,000	6.7E-30	10,000	5.6E-26	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Cm-247	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Cm-248	Total α	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Co-60	100	<1.0E-30	168	<1.0E-30	324	<1.0E-30	230	<1.0E-30	152	<1.0E-30	246	<1.0E-30	198
Cs-135	900	9.1E-03	10,000	1.1E-02	9,998	7.4E-03	10,000	3.3E-03	9,998	3.0E-08	9,998	6.8E-05	10,000
Cs-137	200	1.4E-19	1,236	3.2E-17	1,090	2.6E-16	986	1.2E-15	936	5.0E-29	1,328	1.6E-20	1,154
Eu-152	200	<1.0E-30	446	<1.0E-30	974	<1.0E-30	670	<1.0E-30	422	<1.0E-30	660	<1.0E-30	524
Eu-154	60	<1.0E-30	284	<1.0E-30	624	<1.0E-30	430	<1.0E-30	270	<1.0E-30	420	<1.0E-30	334
H-3	20,000	2.9E-03	116	8.1E-03	96	7.8E-03	96	5.9E-03	90	1.7E-11	120	7.3E-06	122
I-129	1	6.4E-02	4,516	6.4E-02	4,500	4.1E-02	4,342	1.9E-02	4,280	6.2E-09	1,790	7.3E-04	4,736
K-40	N/A	7.8E-04	8,932	8.3E-04	8,666	4.8E-04	8,014	2.0E-04	7,818	5.8E-09	7,574	4.1E-06	10,000
Nb-93m	1,000	1.1E-28	10,000	1.1E-29	10,000	2.8E-22	10,000	3.6E-19	10,000	<1.0E-30	10,000	1.3E-27	10,000
Nb-94	N/A	8.6E-17	10,000	2.5E-14	10,000	1.1E-13	10,000	3.3E-13	10,000	5.8E-27	10,000	1.4E-16	10,000

Table B-11: Radiological 1-Meter Concentrations for Gordon Aquifer to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
Ni-59	300	1.6E-02	9,998	8.9E-02	9,998	2.3E-02	9,996	1.4E-03	9,996	5.9E-06	9,028	9.0E-04	8,202
Ni-63	50	3.6E-09	1,704	3.1E-08	1,534	4.2E-08	1,428	4.1E-08	1,412	4.6E-16	2,804	6.4E-12	1,276
Np-237	Total α	5.4E-04	3,076	9.7E-04	10,000	3.1E-04	2,754	1.3E-04	3,376	1.2E-06	3,868	1.9E-04	3,558
Pa-231	Total α	6.0E-05	10,000	1.9E-04	10,000	7.0E-05	10,000	1.2E-05	10,000	1.1E-09	10,000	2.4E-07	10,000
Pb-210	N/A	4.9E-08	10,000	3.9E-07	10,000	4.1E-07	10,000	3.7E-07	10,000	2.1E-15	10,000	2.8E-11	10,000
Pd-107	N/A	4.7E-03	10,000	2.2E-02	10,000	8.4E-03	10,000	2.5E-03	10,000	9.7E-07	9,246	1.5E-04	8,264
Pt-193	3,000	2.5E-16	1,340	4.7E-15	1,238	1.2E-14	1,176	1.5E-14	990	4.1E-25	1,476	3.0E-18	1,134
Pu-238	Total α	<1.0E-30	3,182	<1.0E-30	5,874	<1.0E-30	4,354	<1.0E-30	3,056	<1.0E-30	4,486	<1.0E-30	4,996
Pu-239	Total α	2.0E-27	10,000	5.4E-26	10,000	2.9E-20	10,000	8.2E-18	10,000	<1.0E-30	10,000	1.4E-25	10,000
Pu-240	Total α	5.5E-28	10,000	1.5E-26	10,000	7.9E-21	10,000	2.2E-18	10,000	<1.0E-30	10,000	3.8E-26	10,000
Pu-241	300	<1.0E-30	10,000	<1.0E-30	10,000	1.2E-29	10,000	9.6E-26	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Pu-242	Total α	4.5E-30	10,000	1.2E-28	10,000	6.5E-23	10,000	1.8E-20	10,000	<1.0E-30	10,000	3.1E-28	10,000
Pu-244	Total α	<1.0E-30	10,000	<1.0E-30	10,000	3.0E-25	10,000	8.5E-23	10,000	<1.0E-30	10,000	1.4E-30	10,000
Ra-226	Total α/Ra	4.0E-06	10,000	3.1E-05	10,000	3.3E-05	10,000	3.0E-05	10,000	1.7E-13	10,000	2.3E-09	10,000
Ra-228	Total Ra	6.7E-26	10,000	1.2E-22	10,000	2.9E-20	10,000	2.7E-19	10,000	<1.0E-30	10,000	5.7E-24	10,000
Se-79	N/A	1.8E-29	10,000	<1.0E-30	10,000	1.5E-23	10,000	4.9E-20	10,000	<1.0E-30	10,000	1.3E-28	10,000
Sm-151	1,000	<1.0E-30	3,280	<1.0E-30	6,384	<1.0E-30	4,644	<1.0E-30	3,196	<1.0E-30	4,654	<1.0E-30	5,292
Sn-126	N/A	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	2.6E-27	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Sr-90	8	2.2E-14	1,054	6.5E-13	926	1.8E-12	920	4.3E-12	810	2.4E-23	1,130	4.5E-16	932
Tc-99	900	3.6E+00	8,096	3.6E+00	8,074	2.2E+00	7,958	9.7E-01	7,922	8.1E-04	1,376	1.2E-01	1,306
Th-229	Total α	2.2E-08	10,000	2.5E-08	10,000	1.5E-08	10,000	6.2E-09	10,000	4.8E-11	10,000	7.6E-09	10,000
Th-230	Total α	1.4E-20	10,000	2.6E-17	10,000	6.9E-15	10,000	7.4E-14	10,000	<1.0E-30	10,000	1.7E-18	10,000
Th-232	Total α	1.4E-27	10,000	2.6E-24	10,000	7.0E-22	10,000	7.8E-21	10,000	<1.0E-30	10,000	1.7E-25	10,000

Table B-11: Radiological 1-Meter Concentrations for Gordon Aquifer to 10,000 Years (Continued)

Radionuclide	MCL (pCi/L)**	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs	(pCi/L)	Year Peak Occurs
U-232	Total U*	<1.0E-30	2,532	<1.0E-30	4,294	<1.0E-30	3,270	<1.0E-30	2,470	<1.0E-30	3,528	<1.0E-30	3,878
U-233	Total U*	2.0E-07	10,000	2.6E-07	10,000	1.4E-07	10,000	5.5E-08	10,000	5.5E-10	10,000	7.2E-08	9,998
U-234	Total U*	8.9E-18	10,000	1.5E-14	10,000	2.8E-12	10,000	3.0E-11	10,000	3.0E-29	10,000	1.0E-15	10,000
U-235	Total U*	2.1E-20	10,000	3.6E-17	10,000	6.6E-15	10,000	7.1E-14	10,000	<1.0E-30	10,000	2.4E-18	10,000
U-236	Total U*	1.6E-19	10,000	2.8E-16	10,000	5.2E-14	10,000	5.6E-13	10,000	<1.0E-30	10,000	1.9E-17	10,000
U-238	Total U*	1.8E-19	10,000	3.2E-16	10,000	5.7E-14	10,000	6.2E-13	10,000	<1.0E-30	10,000	2.1E-17	10,000
Zr-93	2,000	1.9E-29	10,000	1.1E-30	10,000	3.5E-23	10,000	5.6E-20	10,000	<1.0E-30	10,000	2.0E-28	10,000
Sum of beta-gamma MCL fractions		6.8E-02	NA	6.9E-02	NA	4.4E-02	NA	2.0E-02	NA	9.2E-07	NA	8.7E-04	NA
Total alpha	**15**	6.0E-04	NA	1.2E-03	NA	4.1E-04	NA	1.7E-04	NA	1.2E-06	NA	1.9E-04	NA
Total Ra	**5**	4.0E-06	NA	3.1E-05	NA	3.3E-05	NA	3.0E-05	NA	1.7E-13	NA	2.3E-09	NA

* Total uranium is evaluated in Tables A-4 through A-6

** MCL values for beta and photon emitters are calculated in Radionuclides in Drinking Water: A Small Entity Compliance Guide (EPA 815-R-02-001) based on a beta-gamma dose of 4 mrem/yr

† The summed totals in the table conservatively used the peak radionuclide concentrations regardless of the timing of each radionuclide's peak, such that these totals are not associated with any one specific time

Table B-12: Chemical 1-Meter Concentrations for UTRA-UZ to 10,000 Years

Chemical	MCL (µg/L)	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	8.3E-03	590	6.0E-03	2,132	1.9E-01	5,980	7.0E-01	9,634	3.9E-03	2,444	4.2E-03	2,592
Al	2.0E+02	1.0E-02	9,968	4.5E-26	10,000	1.2E-05	10,000	1.3E+00	10,000	9.4E-28	10,000	6.2E-05	10,000
As	1.0E+01	3.8E-05	10,000	2.1E-05	9,980	2.4E-04	10,000	2.5E-02	6,346	7.6E-06	10,000	1.4E-05	10,000
B	N/A	2.3E+00	534	2.1E+00	568	2.1E+01	3,662	4.1E+01	146	1.7E+00	576	1.9E+00	580
Ba	2.0E+03	5.1E-02	8,800	5.9E-03	3,304	6.8E-01	5,538	6.6E+00	7,346	3.2E-03	4,362	1.9E-02	8,734
Cd	5.0E+00	1.5E-02	626	1.4E-02	2,372	2.6E-01	6,596	2.0E+00	9,678	9.6E-03	2,928	1.0E-02	2,882
Cl	2.5E+05	4.3E+00	3,678	3.2E-01	926	6.2E+01	3,762	7.6E+02	3,548	1.7E-01	1,164	1.6E+00	3,666
Co	N/A	2.5E-04	10,000	8.3E-05	4,818	5.2E-03	9,754	9.3E-02	10,000	5.5E-05	6,368	9.4E-05	10,000
Cr	1.0E+02	2.7E-04	9,546	1.8E-22	10,000	4.1E-06	10,000	5.4E-01	9,650	2.7E-25	10,000	1.1E-05	10,000
Cu	1.0E+03	1.1E-03	904	1.2E-03	5,256	2.7E-02	10,000	9.6E-01	10,000	8.6E-04	6,772	9.1E-04	6,668
F	2.0E+03	1.5E+00	3,566	1.7E-01	568	5.5E+00	3,684	1.2E+02	3,538	1.4E-01	576	5.4E-01	3,566
Fe	3.0E+02	1.7E-01	2,126	1.1E-03	10,000	8.5E-02	10,000	4.7E+01	10,000	1.1E-04	10,000	7.0E-02	6,290
Hg	2.0E+00	5.2E-03	8,320	1.2E-19	10,000	1.3E-04	10,000	1.4E+01	10,000	2.8E-21	10,000	6.0E-04	10,000
I	N/A	1.3E-02	3,744	4.8E-03	842	5.9E-01	3,768	1.2E+00	3,612	3.2E-03	886	4.8E-03	3,740
Mn	5.0E+01	2.0E+00	5,584	6.4E-02	4,692	2.5E+00	5,236	4.4E+02	4,110	3.2E-02	6,518	7.6E-01	5,426
Mo	N/A	1.5E-03	9,940	3.4E-23	10,000	1.2E-05	10,000	1.1E+00	10,000	7.8E-25	10,000	5.7E-05	10,000
N	1.0E+04	1.3E+02	3,568	1.2E+01	568	1.4E+03	3,684	1.0E+04	3,538	7.1E-03	10,000	4.7E+01	3,566
Ni	N/A	1.9E-01	570	1.1E-01	1,838	2.0E-01	9,948	2.8E-01	9,976	6.6E-02	2,204	7.3E-02	2,280
Pb	1.5E+01	2.6E-04	9,998	<1.0E-30	10,000	3.7E-09	10,000	4.9E-01	10,000	<1.0E-30	10,000	8.6E-08	10,000
PO_4	N/A	3.4E-01	534	3.1E-01	568	2.8E+01	3,662	4.0E+01	3,662	2.5E-01	576	2.7E-01	580
Sb	6.0E+00	3.6E-05	9,996	<1.0E-30	10,000	1.5E-10	10,000	4.4E-02	10,000	<1.0E-30	10,000	4.8E-09	10,000
Se	5.0E+01	2.2E-06	9,962	1.4E-25	10,000	1.7E-08	10,000	6.2E-04	10,000	1.1E-27	10,000	8.2E-08	10,000
SO_4	2.5E+05	2.3E+00	154	9.7E-01	568	2.0E+01	3,662	1.2E+02	136	8.0E-01	576	8.6E-01	580
Sr	N/A	6.6E-02	4,218	8.5E-03	1,382	3.9E-01	4,266	1.0E+01	3,670	4.1E-03	1,740	2.5E-02	4,162
U	3.0E+01	2.6E-03	3,360	1.6E-08	10,000	1.1E-03	9,980	1.6E-01	10,000	8.5E-10	10,000	1.0E-03	8,708
Zn	5.0E+03	7.3E-03	10,000	4.7E-03	2,536	1.4E+00	6,594	2.0E+00	6,566	3.2E-03	2,922	4.0E-03	3,086

Table B-13: Chemical 1-Meter Concentrations for UTRA-LZ to 10,000 Years

Chemical	MCL (µg/L)	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	5.9E-01	10,000	5.2E-01	6,324	6.7E-01	5,948	4.0E-01	5,876	2.4E-03	3,748	2.3E-02	10,000
Al	2.0E+02	3.9E-09	10,000	2.9E-26	10,000	2.3E-14	10,000	2.2E-05	10,000	2.0E-20	10,000	1.3E-11	10,000
As	1.0E+01	8.3E-04	10,000	1.5E-05	10,000	1.3E-03	10,000	8.9E-03	10,000	1.0E-07	10,000	4.5E-06	10,000
B	N/A	9.1E+01	94	5.4E+01	3,670	7.8E+01	3,662	4.7E+01	3,660	1.2E+00	604	4.1E+00	192
Ba	2.0E+03	5.4E+00	9,550	1.7E+00	6,098	2.5E+00	5,510	2.9E+00	7,884	2.3E-03	6,570	2.1E-01	9,898
Cd	5.0E+00	1.2E+00	10,000	6.9E-01	7,112	9.1E-01	6,568	9.6E-01	10,000	5.1E-03	4,708	3.2E-02	10,000
Cl	2.5E+05	2.2E+02	2,442	1.6E+02	3,804	2.3E+02	3,758	2.7E+02	3,598	1.4E-01	1,282	1.6E+01	3,766
Co	N/A	3.6E-03	10,000	1.0E-02	10,000	1.9E-02	9,672	4.0E-02	10,000	2.6E-05	10,000	1.2E-04	10,000
Cr	1.0E+02	1.7E-09	10,000	3.8E-24	10,000	9.9E-14	10,000	3.3E-06	10,000	1.0E-19	10,000	1.5E-10	10,000
Cu	1.0E+03	1.5E-01	10,000	2.3E-02	10,000	1.0E-01	9,998	1.7E-01	10,000	2.4E-04	10,000	6.6E-04	7,814
F	2.0E+03	8.3E+01	2,260	4.6E+01	3,600	6.4E+01	3,574	6.9E+01	3,570	1.0E-01	604	1.0E+01	3,588
Fe	3.0E+02	1.0E-02	10,000	4.1E-06	10,000	1.4E-02	10,000	9.4E-02	7,526	4.7E-07	10,000	1.7E-02	8,106
Hg	2.0E+00	8.8E-08	10,000	1.1E-20	10,000	3.5E-11	10,000	1.7E-04	10,000	6.7E-17	10,000	2.0E-08	10,000
I	N/A	9.7E-01	2,462	1.5E+00	3,814	2.2E+00	3,766	1.3E+00	3,756	2.3E-03	1,048	7.2E-02	3,830
Mn	5.0E+01	4.9E+02	5,334	4.9E+01	7,500	7.9E+01	5,500	1.5E+02	4,628	2.3E-02	9,094	4.7E+00	6,702
Mo	N/A	5.0E-09	10,000	8.0E-24	10,000	3.1E-13	10,000	1.6E-05	10,000	3.6E-19	10,000	2.1E-10	10,000
N	1.0E+04	6.7E+03	2,260	4.1E+03	3,600	5.6E+03	3,574	6.0E+03	3,570	1.7E+00	3,568	9.5E+02	3,588
Ni	N/A	2.9E-01	10,000	5.5E-01	9,988	7.1E-01	9,996	4.1E-01	9,974	4.5E-02	3,172	6.3E-02	2,796
Pb	1.5E+01	1.1E-12	10,000	<1.0E-30	10,000	9.9E-20	10,000	1.4E-08	10,000	1.6E-25	10,000	3.4E-17	10,000
PO_4	N/A	2.2E+01	94	7.1E+01	3,670	1.0E+02	3,662	6.2E+01	3,660	1.8E-01	604	1.5E+00	188
Sb	6.0E+00	4.9E-14	10,000	<1.0E-30	10,000	4.5E-22	10,000	8.0E-10	10,000	2.9E-28	10,000	1.3E-19	10,000
Se	5.0E+01	7.3E-12	10,000	1.2E-26	10,000	4.4E-16	10,000	2.3E-08	10,000	5.2E-22	10,000	3.1E-13	10,000
SO_4	2.5E+05	1.7E+02	218	1.1E+02	196	1.4E+02	178	1.4E+02	174	5.7E-01	604	3.4E+01	182
Sr	N/A	1.9E+00	5,392	1.4E+00	4,658	2.7E+00	4,274	4.2E+00	3,884	2.7E-03	2,404	3.6E-01	4,558
U	3.0E+01	3.0E-05	10,000	9.2E-11	10,000	9.8E-06	10,000	1.3E-03	10,000	1.0E-10	10,000	2.1E-04	10,000
Zn	5.0E+03	6.9E-01	8,486	3.9E+00	7,100	5.1E+00	6,566	3.0E+00	6,456	1.7E-03	4,706	3.4E-02	10,000

Table B-14: Chemical 1-Meter Concentrations for Gordon Aquifer to 10,000 Years

Chemical	MCL (µg/L)	Sector A Concentration		Sector B Concentration		Sector C Concentration		Sector D Concentration		Sector E Concentration		Sector F Concentration	
		(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs	(µg/L)	Year Peak Occurs
Ag	N/A	5.2E-05	10,000	1.8E-04	10,000	7.8E-05	10,000	3.2E-05	10,000	1.2E-08	9,994	1.7E-06	9,376
Al	2.0E+02	<1.0E-30	10,000	<1.0E-30	10,000	2.6E-27	10,000	1.1E-22	10,000	<1.0E-30	10,000	<1.0E-30	10,000
As	1.0E+01	3.2E-13	10,000	1.2E-11	10,000	2.7E-11	10,000	3.0E-11	10,000	1.9E-22	10,000	1.6E-14	10,000
B	N/A	5.6E-01	346	5.5E-01	346	3.1E-01	312	1.4E-01	296	1.6E-05	698	3.2E-03	384
Ba	2.0E+03	1.5E-04	10,000	4.2E-04	10,000	3.9E-04	10,000	2.5E-04	10,000	1.3E-09	10,000	5.1E-07	10,000
Cd	5.0E+00	5.3E-05	10,000	1.9E-04	10,000	8.4E-05	10,000	3.3E-05	10,000	2.6E-08	10,000	4.3E-06	9,998
Cl	2.5E+05	1.7E-01	4,944	1.8E-01	4,946	1.0E-01	4,712	4.5E-02	4,658	7.5E-07	2,792	6.2E-04	5,638
Co	N/A	4.7E-09	10,000	1.7E-08	10,000	1.7E-08	10,000	8.5E-09	10,000	1.8E-14	10,000	8.1E-11	10,000
Cr	1.0E+02	3.2E-29	10,000	<1.0E-30	10,000	1.2E-24	10,000	3.7E-21	10,000	<1.0E-30	10,000	2.5E-29	10,000
Cu	1.0E+03	3.7E-08	10,000	1.9E-07	10,000	1.8E-07	10,000	1.2E-07	10,000	3.0E-14	10,000	5.4E-10	10,000
F	2.0E+03	5.1E-01	3,674	5.1E-01	3,672	3.2E-01	3,640	1.5E-01	3,626	1.3E-06	698	2.9E-03	3,690
Fe	3.0E+02	1.3E-13	10,000	5.8E-11	10,000	6.5E-10	10,000	2.6E-09	10,000	1.1E-24	10,000	7.1E-13	10,000
Hg	2.0E+00	1.4E-27	10,000	6.5E-29	10,000	4.5E-22	10,000	3.7E-19	10,000	<1.0E-30	10,000	6.5E-27	10,000
I	N/A	2.0E-03	4,492	2.1E-03	4,446	1.3E-03	4,302	5.5E-04	4,234	1.5E-08	1,782	8.0E-06	4,716
Mn	5.0E+01	6.0E-03	10,000	7.1E-03	10,000	6.4E-03	10,000	3.6E-03	10,000	2.3E-09	10,000	7.6E-06	10,000
Mo	N/A	<1.0E-30	10,000	<1.0E-30	10,000	6.2E-25	10,000	2.1E-21	10,000	<1.0E-30	10,000	5.6E-30	10,000
N	1.0E+04	4.5E+01	3,674	4.5E+01	3,674	2.8E+01	3,642	1.3E+01	3,628	8.4E-07	3,670	2.8E-01	3,692
Ni	N/A	1.3E-04	10,000	3.5E-04	10,000	1.4E-04	10,000	4.1E-05	10,000	1.9E-07	9,242	2.9E-05	8,300
Pb	1.5E+01	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	4.2E-29	10,000	<1.0E-30	10,000	<1.0E-30	10,000
PO_4	N/A	1.6E-01	340	1.6E-01	336	9.2E-02	308	4.1E-02	292	2.3E-06	696	1.2E-03	368
Sb	6.0E+00	<1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000	1.0E-30	10,000	<1.0E-30	10,000	<1.0E-30	10,000
Se	5.0E+01	<1.0E-30	10,000	<1.0E-30	10,000	9.0E-28	10,000	3.0E-24	10,000	<1.0E-30	10,000	<1.0E-30	10,000
SO_4	2.5E+05	2.4E+00	324	2.4E+00	322	1.4E+00	290	6.3E-01	280	7.2E-06	698	3.0E-02	356
Sr	N/A	4.9E-03	7,784	5.0E-03	7,718	3.2E-03	6,930	1.4E-03	6,624	1.3E-08	6,010	2.7E-05	8,972
U	3.0E+01	5.3E-19	10,000	9.2E-16	10,000	1.7E-13	10,000	1.8E-12	10,000	1.6E-30	10,000	6.2E-17	10,000
Zn	5.0E+03	1.3E-04	10,000	9.1E-04	10,000	3.0E-04	10,000	2.7E-05	10,000	8.6E-09	10,000	1.5E-06	9,996

APPENDIX C

BETA-GAMMA PEAK CONCENTRATIONS RATIOED TO MCLS FOR INDIVIDUAL CONSTITUENTS RELATED BY TIMING AT THE 100-METER BOUNDARY

Appendix B Tables B-1 and B-2 provide a summary of beta-gamma MCL fractions summed by peak concentration in 10,000 years, regardless of timing. This approach provides conservative results as not all constituents peak at the same time within 10,000 years. Four radionuclides make up approximately 99 % of the beta-gamma inputs for the individual aquifers and sectors (C-14, I-129, Ni-59 and Tc-99) within 10,000 years.

For this appendix, the peak concentrations for these four radionuclides were analyzed individually by time of occurrence against the concentration at the same time for the remaining radionuclides. For example, in UTRA-LZ Sector A, C-14 peaked in 10,000 years at 7,530 years. The remaining four radionuclides did not peak in that year, so the beta-gamma value at 7,530 years for each of these remaining radionuclides was added to the beta-gamma value for C-14 to produce an estimated beta-gamma value for the year 7,530, resulting in a beta-gamma MCL fraction of 35 % for the UTRA-LZ Sector A (Table C-1).

Tables C-1 and C-2 present the beta-gamma peak concentrations in 10,000 years by aquifer ratio to MCLs for the four radionuclides that comprise the majority of the total beta-gamma contribution utilizing concurrent time for Sectors D and E, respectively.

Table C-1: Beta-Gamma Peak Concentrations at the 100-Meter Boundary in the UTRA-LZ in 10,000 Years Ratioed to MCLs for Selected Constituents Related by Timing for Sector A

Radionuclide	MCL (pCi/L)	UTR-LZ		
		Conc. (pCi/L)	Beta-gamma fraction	Peak (yr)
C-14	2,000	1.9E+01	9.5E-03	7,530
I-129	1	3.8E-02	3.8E-02	7,530
Ni-59	300	4.1E+01	1.4E-01	7,530
Tc-99	900	1.7E+02	1.9E-01	7,530
Total			**3.7E-01**	

C-14	2,000	8.7E-05	4.4E-08	2,614
I-129	1	2.6E+01	2.6E+01	2,614
Ni-59	300	1.5E+00	5.1E-03	2,614
Tc-99	900	9.4E+00	1.0E-02	2,614
Total			**2.6E+01**	

C-14	2,000	8.3E-00	2.0E-09	6,722
I-129	1	1.3E-01	6.0E-04	6,722
Ni-59	300	6.1E+01	2.0E-01	6,722
Tc-99	900	4.3E+01	4.8E-02	6,722
Total			**3.8E-01**	

C-14	2,000	1.1E+01	5.5E-03	8,780
I-129	1	6.5E-02	6.5E-02	8,780
Ni-59	300	1.5E+01	5.0E-02	8,780
Tc-99	900	1.1E+03	1.2E+00	8,780
Total			**1.3E+00**	

(Peak Radionuclide Indicated in Green Shading)

Table C-2: Beta-Gamma Peak Concentrations at the 100-Meter Boundary in the UTRA-LZ in 10,000 Years Ratioed to MCLs for Selected Constituents Related by Timing for Sector B

Radionuclide	MCL (pCi/L)	UTR-LZ		
		Conc. (pCi/L)	Beta-gamma fraction	Peak (yr)
C-14	2,000	1.1E+02	5.5E-02	6,638
I-129	1	7.8E-02	7.8E-02	6,638
Ni-59	300	1.8E+02	6.1E-01	6,638
Tc-99	900	3.6E+01	4.0E-02	6,638
Total			**7.8E-01**	
C-14	2,000	1.9E-04	9.6E-08	3,914
I-129	1	1.0E+01	1.0E+01	3,914
Ni-59	300	8.1E-01	2.7E-03	3,914
Tc-99	900	2.5E+01	2.7E-02	3,914
Total			**1.0E+01**	
C-14	2,000	5.6E+01	2.8E-02	6,070
I-129	1	1.3E-01	1.3E-01	6,070
Ni-59	300	2.4E+02	8.0E-01	6,070
Tc-99	900	2.3E+01	2.6E-02	6,070
Total			**9.8E-01**	
C-14	2,000	1.0E+01	5.1E-03	9,512
I-129	1	6.5E-02	6.5E-02	9,512
Ni-59	300	1.8E+01	6.0E-02	9,512
Tc-99	900	2.3E+02	2.6E-01	9,512
Total			**3.9E-01**	

(Peak Radionuclide Indicated in Green Shading)

APPENDIX D

BETA-GAMMA PEAK CONCENTRATIONS CALCULATED FOR INDIVIDUAL CONSTITUENTS USING UPDATED DOSE CONVERSION FACTORS AT THE 100-METER BOUNDARY AND AT THE SEEPLINES FOR 1,000 YEARS AND 10,000 YEARS

Tables D-1 and D-2 provide a summary of beta-gamma summed peak concentrations in 1,000 years and 10,000 years, respectively, using updated WIPDCFs presented in *Dose Calculation Methodology for Liquid Waste Performance Assessments at the Savannah River Site* (SRR-CWDA-2013-00058) as an alternative MCL calculation. Two radionuclides make up approximately 99% of the beta-gamma dose for the individual aquifers and sectors (Tc-99 within 1,000 years, I-129 and Tc-99 within 10,000 years).

For this appendix, the peak concentrations from sectors and seeplines presented in Appendices A and B are multiplied by the updated WIPDCFs and by a conversion to account for an ingestion rate of 2 liters of water consumed per day (ingestion rate = 2 L/day ÷ 0.931 L/day [assumed consumption rate, described in Section B.1 of *Dose Calculation Methodology for Liquid Waste Performance Assessments at the Savannah River Site,* SRR-CWDA-2013-00058]).

For example, in the UTRA-LZ, Sector A, for I-129 in 10,000 years the equation would be as follows: 26 pCi/L × 0.152 (WIPDCF) (mrem/yr ÷ pCi/L) × 2.15 = 8.4 mrem/yr. These values are calculated for each beta-gamma emitting radionuclide and summed to determine the total dose for each groundwater exposure point.

Table D-1: Beta-Gamma Peak Dose in 1,000 Years Calculated for Individual Groundwater Exposure Points

Radionuclide	New WIPDCF $\left(\frac{\text{mrem/yr}}{\text{pCi/L}}\right)$	1,000 Years					
		100 M (Sect B, UTRA-LZ) (pCi/L)	Dose (mrem/yr)	Upper Three Runs (pCi/L)	Dose (mrem/yr)	Fourmile Branch (pCi/L)	Dose (mrem/yr)
C-14	7.96E-04	2.9E-12	5.0E-15	5.6E-11	9.6E-14	2.2E-10	3.8E-13
Cl-36	1.56E-03	1.2E-02	4.0E-05	1.8E-04	6.1E-07	9.7E-04	3.2E-06
Co-60	6.90E-03	4.1E-66	6.0E-68	1.3E-34	1.9E-36	1.6E-30	2.4E-32
Cs-135	3.32E-03	3.0E-11	2.2E-13	6.1E-10	4.3E-12	2.9E-09	2.1E-11
Cs-137	1.67E-02	2.1E-15	7.7E-17	2.3E-14	8.3E-16	7.3E-13	2.6E-14
Eu-152	2.19E-03	2.5E-113	1.2E-115	3.3E-45	1.5E-47	4.2E-40	2.0E-42
Eu-154	3.28E-03	4.8E-122	3.4E-124	9.5E-47	6.7E-49	1.9E-41	1.3E-43
H-3	2.64E-05	2.9E+00	1.6E-04	2.8E-03	1.6E-07	9.3E-02	5.3E-06
I-129	1.52E-01	1.5E-03	4.9E-04	2.4E-05	7.9E-06	1.3E-04	4.2E-05
Nb-93m	2.24E-04	1.5E-67	7.1E-71	1.8E-26	8.8E-30	3.3E-22	1.6E-25
Ni-59	1.00E-04	3.6E-06	7.7E-10	1.4E-06	3.0E-10	1.9E-05	4.0E-09
Ni-63	2.49E-04	2.0E-07	1.1E-10	9.8E-08	5.2E-11	1.1E-06	6.0E-10
Pt-193	6.19E-05	3.3E-13	4.3E-17	2.0E-13	2.7E-17	2.0E-12	2.6E-16
Pu-241	6.56E-03	4.4E-93	6.2E-95	5.3E-32	7.5E-34	2.5E-27	3.5E-29
Sm-151	1.70E-04	3.1E-91	1.1E-94	1.2E-29	4.2E-33	5.6E-25	2.0E-28
Sr-90	5.00E-02	7.3E-10	7.8E-11	3.5E-11	3.8E-12	3.5E-10	3.8E-11
Tc-99	1.13E-03	1.6E+02	3.9E-01	4.9E+00	1.2E-02	1.3E+01	3.2E-02
Zr-93	1.26E-03	2.8E-87	7.5E-90	4.0E-29	1.1E-31	1.6E-24	4.3E-27
Total Dose (mrem/yr)			**4.0E-01**		**1.2E-02**		**3.3E-02**

Table D-2: Beta-Gamma Peak Dose in 10,000 Years Calculated for Individual Groundwater Exposure Points

Radionuclide	New WIPDCF $\left(\frac{mrem/yr}{pCi/L}\right)$	10,000 Years					
		100 M (Sect A, UTRA-LZ) (pCi/L)	Dose (mrem/yr)	Upper Three Runs (pCi/L)	Dose (mrem/yr)	Fourmile Branch (pCi/L)	Dose (mrem/yr)
C-14	7.96E-04	1.9E+01	3.3E-02	2.6E-01	4.5E-04	1.7E+00	2.9E-03
Cl-36	1.56E-03	4.5E+00	1.5E-02	6.4E-02	2.1E-04	2.0E-01	6.7E-04
Co-60	6.90E-03	5.4E-39	8.0E-41	1.3E-34	1.9E-36	1.6E-30	2.4E-32
Cs-135	3.32E-03	3.5E+00	2.5E-02	6.4E-02	4.5E-04	2.5E-01	1.8E-03
Cs-137	1.67E-02	2.9E-10	1.0E-11	2.3E-14	8.3E-16	7.3E-13	2.6E-14
Eu-152	2.19E-03	6.6E-61	3.1E-63	3.3E-45	1.5E-47	4.2E-40	2.0E-42
Eu-154	3.28E-03	1.4E-64	9.6E-67	9.5E-47	6.7E-49	1.9E-41	1.3E-43
H-3	2.64E-05	6.1E-01	3.5E-05	2.8E-03	1.6E-07	9.3E-02	5.3E-06
I-129	1.52E-01	2.6E+01	8.4E+00	1.2E-01	3.9E-02	1.7E-01	5.6E-02
Nb-93m	2.24E-04	1.8E-14	8.7E-18	5.7E-16	2.8E-19	1.4E-12	6.5E-16
Ni-59	1.00E-04	6.1E+01	1.3E-02	1.0E+00	2.2E-04	5.0E+00	1.1E-03
Ni-63	2.49E-04	4.4E-03	2.4E-06	5.6E-06	3.0E-09	1.4E-04	7.4E-08
Pt-193	6.19E-05	4.9E-09	6.5E-13	3.7E-13	4.9E-17	1.2E-11	1.5E-15
Pu-241	6.56E-03	8.8E-20	1.2E-21	5.3E-20	7.5E-22	3.2E-14	4.5E-16
Sm-151	1.70E-04	4.9E-35	1.8E-38	3.8E-28	1.4E-31	7.4E-24	2.7E-27
Sr-90	5.00E-02	8.9E-07	9.6E-08	3.5E-11	3.8E-12	3.5E-10	3.8E-11
Tc-99	1.13E-03	1.1E+03	2.6E+00	9.7E+00	2.4E-02	1.3E+01	3.2E-02
Zr-93	1.26E-03	2.6E-15	7.0E-18	9.2E-17	2.5E-19	2.2E-13	5.9E-16
Total Dose (mrem/yr)			**1.1E+01**		**6.4E-02**		**9.5E-02**