DISCLAIMER

ECF-200W-25-0032
Revision 0

Radionuclide Inventory Threshold for Trench 31 and 34 Located Within the 200 West Area Low-Level Burial Grounds

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract 89303320DEM000030

CPCCo
Central Plateau
Cleanup Company

P.O. Box 1464
Richland, Washington 99352

ECF-200W-25-0032
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Radionuclide Inventory Threshold for Trench 31 and 34 Located Within the 200 West Area Low-Level Burial Grounds

Document Type: ECF Program/Project: Support to 200 West LLBG PA for Inactive Trenches

W. Zhou
INTERA, Inc.

Date Published
June 2025

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APPROVED
By Janis Aardal at 1:40 pm, Jun 23, 2025

Release Approval Date

ENVIRONMENTAL CALCULATION COVER PAGE

CPCC-PRO-EP-40205

SECTION 1 - COMPLETED PRIOR TO CALCULATION BEING PERFORMED

Calculation Number: ECF-200W-25-0032 Revision Number: 0

Project: Support to 200 West LLBG PA for Inactive Trenches

Date: 05/12/2025

Calculation Title:
Radionuclide Inventory Threshold for Trench 31 and 34 Located Within the 200 West Area Low-Level Burial Grounds

Calculation Purpose:
Update inventory thresholds for Waste Acceptance Criteria for 200 West LLBG Active Trenches 31 and 34

Will this calculation utilize an environmental model or risk assessment? ☒ Yes ☐ No

If "Yes" box is checked, forward this form **and** form A-6007-637, *Environmental Model Package Report Cover Page* to the Risk and Modeling Integration Manager with Section 1 completed for both forms.

ROLE ASSIGNMENTS AND QUALIFICATIONS SUMMARY

Preparer(s):

Name: Wei Zhou

Professional License(s): N/A

Brief Narrative of Experience: Wei Zhou's professional experience encompasses the areas of performance and safety assessment of near-surface and deep geological radioactive waste repositories; risk assessments for organic wastes including dense and light non-aqueous phase liquids and volatile organic compounds; and the geological sequestration of carbon dioxide. She has provided technical support in these areas to industrial, governmental, and international organizations such as the Electric Power Research Institute {EPRI), International Atomic Energy Agency (IAEA), Nuclear Energy Institute (NEI), Korean Hydro and Nuclear Power, Canadian Petroleum Technology Research Institute, US Environmental Protection Agency, US Department of Energy, Swedish Nuclear Inspectorate (SSM), Japan Atomic Energy Agency (JAEA), Taiwan Institute of Nuclear Energy Research {INER), International Energy Agency {IEA), Nuclear Energy Agency (NEA), and the Commission for European Communities (CEC). She specializes in modeling and simulation of radionuclide transport, coupled heat and mass transfer in fractured media, as well as multiphase and multi-component transport systems using public or commercial codes including TOUGH2, TOUGHREACT, STOMP, ECLIPSE suite codes, MATLAB, and GoldSim. Her expertise also includes developing customized software using FORTRAN and C++.

Checker(s):

ENVIRONMENTAL CALCULATION COVER PAGE (Continued)

Name: Benjing Sun

Professional License(s): N/A

Brief Narrative of Experience: Benjing Sun brings experience in performing human health risk assessment, performance assessment, air quality modeling and permitting, fate and transport modeling, and establishment of risk-based remediation goals under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), and other federal and state regulations. He has developed and applied analytical tools based on the human health risk assessment protocol (HHRAP) and risk assessment for Superfund {RAGS) for hazardous waste combustion facilities, Superfund sites, and other environmentally-impacted sites across the U.S. Benjing specializes in risk assessment for remedial investigations/feasibility studies, operation permit applications, regulatory compliance, and risk management. He conducts performance assessment and exposure dose estimation, air dispersion/deposition modeling, and vapor intrusion modeling. His experience also encompasses data evaluation, statistical analysis, and litigation support.

Senior Reviewer(s):

Name: Sunil Mehta

Professional License(s): N/A

Brief Narrative of Experience: Sunil Mehta's professional experience as a hydrogeologist has been focused on flow and transport modeling under variably saturated conditions, reactive transport modeling, performance assessment, and uncertainty analysis. He has gained this experience on projects involving deep geologic isolation of high-level radioactive wastes, shallow disposal of low-level radioactive waste, and environmental restoration activities in accordance with local and federal regulations. Sunil's experience includes designing, developing, and applying numerical models to evaluate the performance of radioactive waste storage and disposal facilities. His work has encompassed developing flow and reactive transport models for transuranics, conducting process and component modeling (e.g., unsaturated and saturated zone flow, colloid facilitated transport, waste form degradation) and combining these models into a comprehensive probabilistic assessment tool used to forecast post-closure performance of a storage facility. In the area of environmental restoration, he has performed hydrogeological studies and groundwater flow and contaminant transport modeling to support the design of remedial systems to sequester and capture contaminants such as uranium and hexavalent chromium in periodically rewetted zones influenced by aquifer-river interactions. In addition, Sunil's water resources experience includes evaluating aquifer resource potential for agricultural needs through the interpretation of geophysical logs and analysis of pumping test data, and using remote sensing techniques to support groundwater exploration.

Responsible Manager:

Amanda Ramirez	AMANDA RAMIREZ (Affiliate) Digitally signed by AMANDA RAMIREZ (Affiliate) Date: 2025.05.14 15:08:15 -07'00'
Print First and Last Name	*Signature / Date*

ENVIRONMENTAL CALCULATION COVER PAGE (Continued)

Revision No.	Description	Date

SECTIONS 2 - REVISION HISTORY

Revision No.	Description	Date
0	Initial Issue	

SECTION 3 - DOCUMENT REVIEW AND APPROVAL

Preparer(s):

Print First and Last Name	Position	Signature	Date
Wei Zhou	Principal Engineer	Wei Zhou (Affiliation) Digitally signed by Wei Zhou (Affiliation) Date: 2025.06.02 13:56:06 -04'00'	

Checker(s):

Print First and Last Name	Position	Signature	Date
Benjing Sun	Sr Risk Assessment Specialist	Benjing Sun Digitally signed by Benjing Sun Date: 2025.06.02 11:53:33 -07'00'	

Senior Reviewer(s):

Print First and Last Name	Position	Signature	Date
Sunil Mehta	Principal Scientist	Sunil Mehta Digitally signed by Sunil Mehta Date: 2025.06.02 11:19:25 -07'00'	

Responsible Manager:

Print First and Last Name	Position	Signature	Date
Amanda Ramirez	CPCCo RM	AMANDA RAMIREZ (Affiliate) Digitally signed by AMANDA RAMIREZ (Affiliate) Date: 2025.06.10 11:38:36 -07'00'	

ENVIRONMENTAL MODEL/RISK ASSESSMENT COVER PAGE

CPCC-PRO-EP-40253

This cover page is to be appended to Form A-6005-812, *Environmental Calculation Cover Page*, for all environmental calculations that document use of an environmental model or risk assessment.

SECTION 1 - Completed PRIOR to calculation being performed.

When this section is completed, forward to Risk and Modeling Integration Manager along with initiated Form A-6005-812, *Environmental Calculation Cover Page*.

Calculation Number: ECF-200W-25-0032 | Revision Number: 0

Preparer(s):

Wei Zhou

Checker(s):

Benjing Sun

Senior Reviewer(s):

NOTE: Risk & Modeling Integration Manager must approve the Senior Review before calculation is performed.

Sunil Mehta

List all controlled use software graded Level D or higher and platforms to be used in this calculation:

HISI Number	Software Name	Platform
2461	GoldSim	PSC-3VBH814

SECTION 2 - Completed by the Risk & Modeling Integration Manager *(or Training Coordinator Designee)* PRIOR to calculation being performed.

Required training *(CPCC-00172 Appendix E)* for modelers completed for Preparer(s), Checker(s), and Senior Review(s):

Risk & Modeling Integration Manager or Designee Training Coordinator:

Chris Farrow — *Print First and Last Name*

CHRISTOPHER FARROW (Affiliate) Digitally signed by CHRISTOPHER FARROW (Affiliate) Date: 2025.05.14 17:58:32 -05'00' — *Signature / Date*

SECTION 3 - Completed by the Risk & Modeling Integration Manager *(or Integration Lead Designee)* PRIOR to calculation being performed.

Software Checkout and Installation for controlled use software listed in Section 1 confirmed.

Risk & Modeling Integration Manager or Designee Integration Lead:

Chris Farrow — *Print First and Last Name*

CHRISTOPHER FARROW (Affiliate) Digitally signed by CHRISTOPHER FARROW (Affiliate) Date: 2025.05.14 18:00:47 -05'00' — *Signature / Date*

(Return form to Responsible Manager)

SECTION 4 - Completed by the Risk & Modeling Integration Manager *(or Integration Lead Designee)* AFTER calculation is performed.

Application of controlled use software utilized in environmental calculation file is compliant.

List any changes in controlled use software listed in Section 1 for the completed calculation:

None

Risk & Modeling Integration Manager or Designee Integration Lead:

Chris Farrow — *Print First and Last Name*

CHRISTOPHER FARROW (Affiliate) Digitally signed by CHRISTOPHER FARROW (Affiliate) Date: 2025.06.10 10:50:25 -05'00' — *Signature / Date*

ENVIRONMENTAL MODEL/RISK ASSESSMENT COVER PAGE (Continued)	
SECTION 5 - Completed by the Risk & Modeling Integration Manager AFTER Environmental Calculation using an environmental model or risk assessment is completed.	
Environmental calculation using environmental model or risk assessment conforms with requirements of CPCC-PRO-EP-40253.	
Risk & Modeling Integration Manager:	
Sunil Mehta signing for Will Nichols	SUNIL MEHTA (Affiliate) Digitally signed by SUNIL MEHTA (Affiliate) Date: 2025.06.10 09:26:08 -07'00'
Print First and Last Name	*Signature / Date*

Contents

Figures

Tables

Appendix

Terms

CAT1	Category 1
CAT3	Category 3 and Greater Than Category 3
DAS	Disposal Authorization Statement
ECF	environmental calculation file
LLBG	low-level burial ground
PA	performance assessment
WAC	Waste Acceptance Criteria

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1 Introduction

Trenches 31 and 34 located in the 200 West Area Low-Level Burial Ground (LLBG) are authorized for disposal of low-level and mixed low-level radioactive waste under DOE Order 435.1, *Radioactive Waste Management*. A revised Disposal Authorization Statement (DAS) was issued in October 2023 (Ellis, 2023) following the approval of the performance assessment (PA) (DOE/RL-2021-26, *Performance Assessment of the Active Trenches in 200 East and 200 West Low-Level Burial Grounds at the Hanford Site*) and supporting technical basis documents.

To be consistent with the approved PA calculations, the waste acceptance criteria (WAC), HNF-EP-0063, 2023, *Hanford Site Solid Waste Acceptance Criteria*, Rev. 22, needs to be updated to include concentration limits for Category 1 (CAT1) and Category 3 (CAT3) waste along with the inventory limits. This environmental calculation file (ECF) provides the inventory limits for Category 1 and Category 3 waste disposal of radionuclides at Trench 31 and 34 based on the PA calculations. The concentration limits are not calculated as they are provided in the PA itself.

The inventory thresholds (or limits) are calculated for only those radionuclides that are identified in the PA as the primary dose contributors. The primary dose contributors for the groundwater pathway are technetium-99, iodine-129, niobium-94, chlorine-36, molybdenum-93, and niobium-93m while those for the air pathway are tritium and carbon-14.

2 Software Applications

Software programs used for this ECF were Microsoft® Excel® and GoldSim®. The dose calculation for separate CAT1 and CAT3 waste packages used GoldSim Pro[1] Version 14. The inventory threshold was calculated using Excel.

2.1 GoldSim

The Approved Utility Calculation Software used in this ECF, which complies with requirements of CPCC-PRO-IRM-309, *Controlled Software Management,* is GoldSim Pro Version 14 (hereafter referred to as GoldSim). GoldSim used at the Hanford Site is managed and controlled such that the computational needs filled by use of GoldSim and the specific roles and responsibilities for management, the modeling staff, and subcontractors have been identified and traced.

The Safety Software Classification of GoldSim, per CP-68009, *GoldSim: Version 14 Software Management Plan* states the express intent is to use GoldSim to calculate transport of radionuclide (and other) contaminants in the groundwater pathway for use in estimating radioactive released to the vadose zone at Hanford waste sites. These estimates therefore constitute safety management and administrative controls software per DOE O 414.1D, *Quality Assurance*.

2.1.1 Description

GoldSim Pro Version 14 is registered in the Hanford Information Systems Inventory (HISI) under identification number 2461. The simulation software is qualified for use and controlled by Central Plateau Cleanup Company. The HISI registration information lists the documents associated with software grading (it is graded as Level C Safety Software), minimum system requirements, software functional requirements, software management, software testing, and software installation plans. The HISI database

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® Microsoft and Excel are registered trademarks of the Microsoft Corporation in the United States and other countries.

® GoldSim is a registered trademark of GoldSim Technology Group, LLC, Issaquah, Washington.

[1] "GoldSim Pro" refers to commercial version of GoldSim as opposed to GoldSim Academic or GoldSim Research versions. In this report, "GoldSim" is frequently used but the functionalities are equivalent to "GoldSim Pro."

also contains information on approved installations and user training. The applicable software quality assurance documents include CP-68009.

Acceptance and installation tests of the GoldSim simulation software demonstrate that it is appropriate for its intended uses for the inventory threshold calculation and that it has been successfully installed on the computing systems used to conduct the inventory calculation. Appendix A includes the installation test reports and the workstation type and property number (from which software is run).

2.1.2 Software Installation and Checkout

Appendix A provides the Software Installation and Checkout form for the workstation used.

2.1.3 Statement of Valid Software Application

GoldSim is used to carry out decay and ingrowth calculations of the screened-in radionuclides. The calculation is within the capabilities and limits of the software.

3 Calculation Methodology

While the PA provided the inventory thresholds for each trench (see Tables 9-5 and 9-6 in DOE/RL-2021-26), it did not differentiate it by waste category type; instead the PA provided the inventory threshold for combined CAT1 and CAT3 waste based on the closure inventory for each trench. In this ECF the inventory thresholds are calculated for each waste category by rerunning the PA calculations for each waste category separately, without changing the PA methodology or assumptions.

Since the peak dose for the groundwater pathway occurs in the post-compliance period, the inventory thresholds are calculated using the peak of the mean dose from the probabilistic analysis (consisting of 300 realizations), consistent with the approach adopted in the PA (Section 9.2.2 and 9.2.3 of DOE/RL-2021-26). For the air pathway, since the peak dose occurs within the compliance period the deterministic base case value is used for inventory threshold.

The groundwater pathway calculation is performed by starting with the GoldSim file used for the PA system model probabilistic calculations (*LLBG_T3134_system_model_1.013_Probabilistic_300Rlz.gsm*) and modifying it such that releases from a single waste category (either Category 1 or Category 3) is simulated per calculation. This is achieved by inactivating the source-release containers (GoldSim modeling elements) and then activating them in a systematic manner. As shown in Figure 1 and Figure 2, the red containers are inactivate and generate zero release rates so that release rates from only CAT1 waste packages (Figure 1) or CAT3 waste packages (Figure 2) are calculated. The two-step modification is summarized in Table 1.

The air pathway peak dose estimates are calculated by starting with the PA system model deterministic base case (*LLBG_T3134_system_model_1.013_Deterministic_BaseCase_DiffSources.gsm*). The dose from CAT1 or CAT3 waste packages are calculated separately using the “scenario” capability of GoldSim.

Note that for these calculations the uranium billet source in Trench 34 (U_billets container) is always inactivated because this is the one-time special waste (containing 141 Ci technetium-99) and will not be disposed in the future. Including uranium billets release would generate an unrealistically large threshold for technetium-99 in Trench 34.

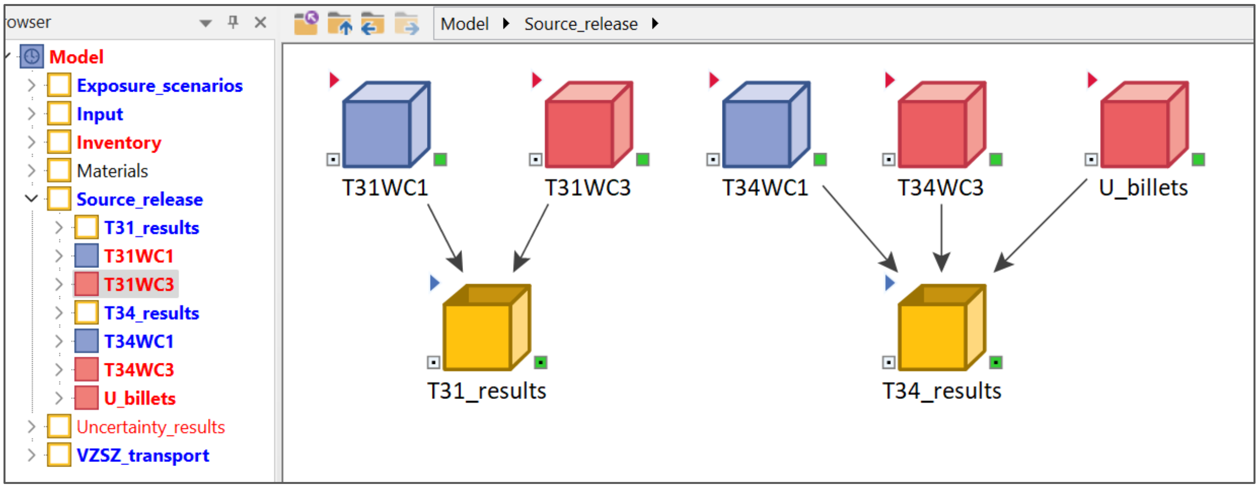

Figure 1. Modification of 200 West LLBG Active Trench Probabilistic Performance Assessment System Model to Calculate CAT1 Waste Package Groundwater Pathway Dose

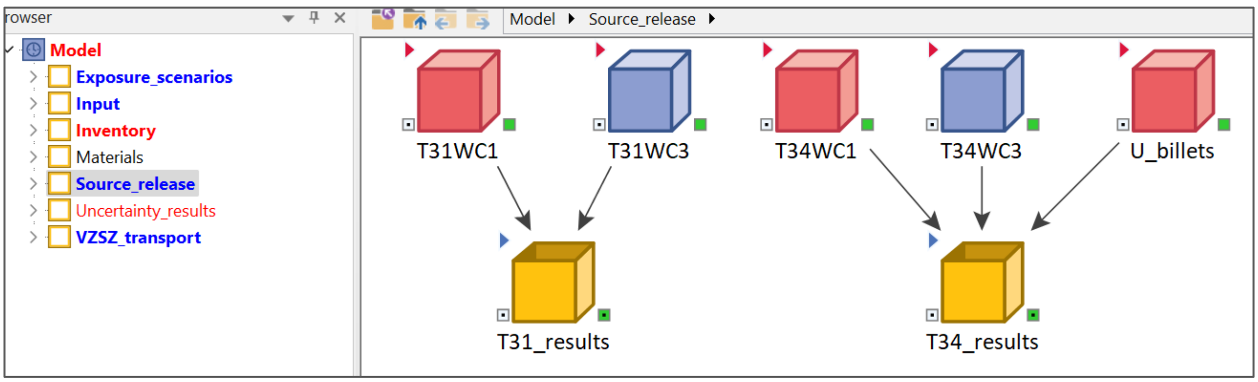

Figure 2. Modification of 200 West LLBG Active Trench Probabilistic Performance Assessment System Model to Calculate CAT3 Waste Package Groundwater Pathway Dose

Table 1. GoldSim Model File Configuration for the Inventory Threshold Calculation

Inactivated Containers	Active Containers	Modified GoldSim Filename
T31WC3, T34WC3, and U_billets	T31WC1 and T34WC1	*LLBG_T3134_PA_1.013_UA_CAT1.gsm*
T31WC1, T34WC1, and U_billets	T31WC3 and T34WC3	*LLBG_T3134_PA_1.013_UA_CAT3.gsm*

T31: Trench 31
T34: Trench 34
WC1: CAT1 Waste package
WC3: CAT3 waste package
U_billets: uranium billets that were disposed of in Trench 34 (the only uranium billets disposed of in Trench 34)

The inventory threshold is calculated as follows:

$$I_{i,j} = \frac{PO}{P_{i,j}/I_{i,j}} \qquad \textbf{Eq. 1}$$

where:

$I_{i,j}$ = inventory threshold (Ci) for the *i*th category of waste packages (*i* = 1 or 3) and the *j*th radionuclide;

PO = performance objective for dose equal to 25 mrem/yr for groundwater pathway and 10 mrem/yr for air pathway;

$P_{i,j}$ = peak of mean dose (mrem/yr) from probabilistic analysis for the groundwater pathway or peak dose from the deterministic analysis for the air pathway predicted at the compliance location for the *i*th category of waste packages (*i* = 1 or 3) and the *j*th radionuclide;

$I_{i,j}$ = inventory (Ci) at closure for the *i*th category of waste packages (*i* = 1 or 3) and the *j*th radionuclide.

The GoldSim simulation results are saved to a Microsoft Excel® file "200 West LLBG Active Trench Inventory threshold Apr 2025.xlsx" where the peak mean dose for each radionuclide, peak mean dose time, and mean dose history plot are processed.

4 Results

The mean dose histories for primary dose-contributing radionuclides for the groundwater pathway based on probabilistic analysis (300 realizations) are shown in Figure 3 for Trench 31 CAT1 waste packages, in Figure 4 for Trench 34 CAT1 waste packages, in Figure 5 for Trench 31 CAT3 waste packages, and in Figure 6 for Trench 34 CAT3 waste packages, respectively. These figures show that the peak of the mean dose occurs after 1,000 years postclosure for each of the radionuclides in all waste categories in all trenches. The peak values of the mean dose estimates will be used for calculating the inventory thresholds, which are reported in the next chapter.

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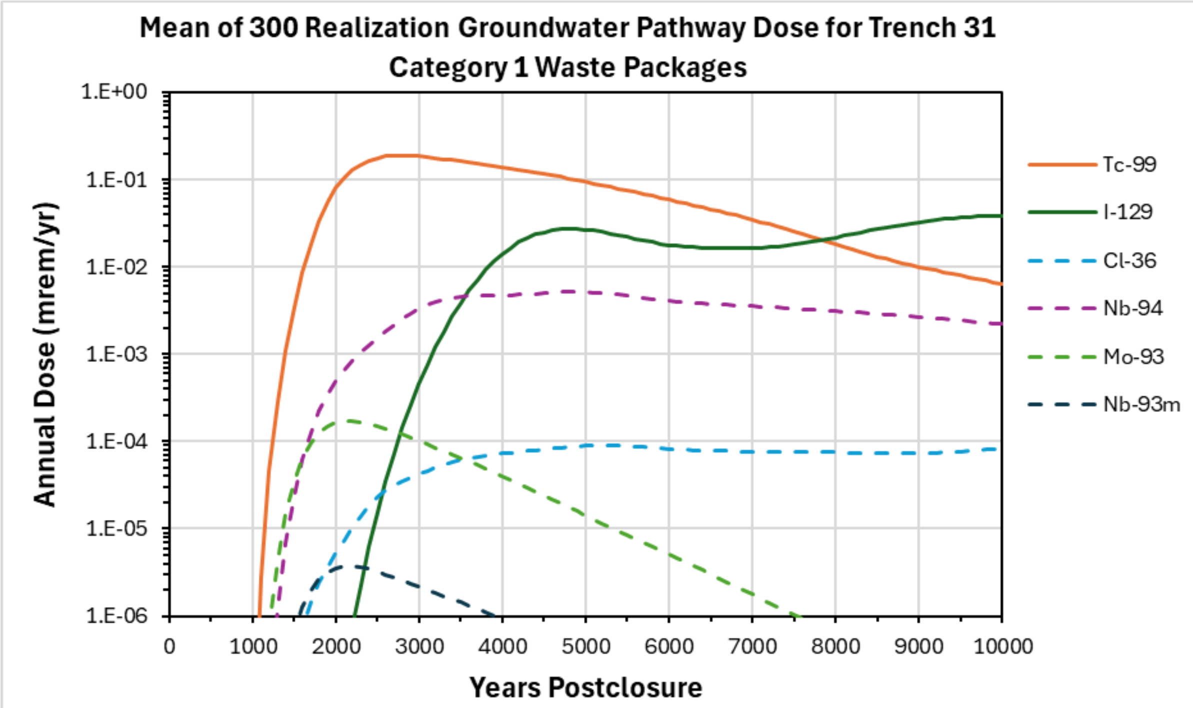

Figure 3. Mean Groundwater Pathway Dose for Selected Radionuclides in Trench 31 CAT1 Waste Packages

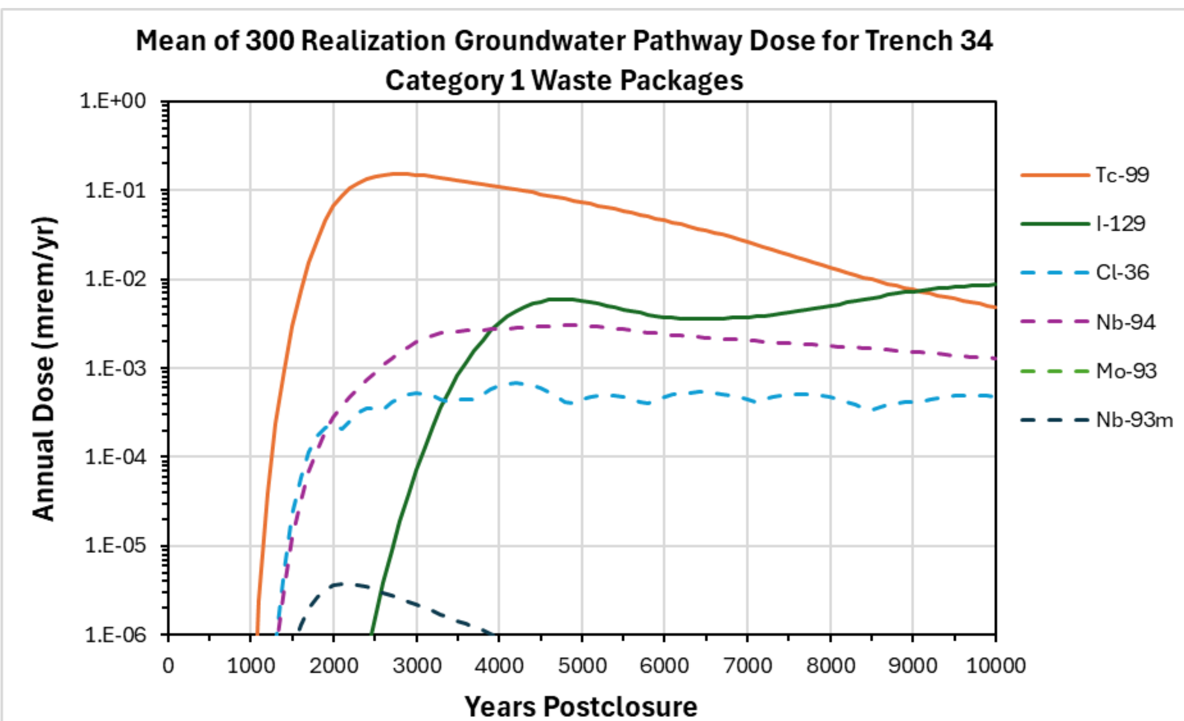

Figure 4. Mean Groundwater Pathway Dose for Selected Radionuclides in Trench 34 CAT1 Waste Packages

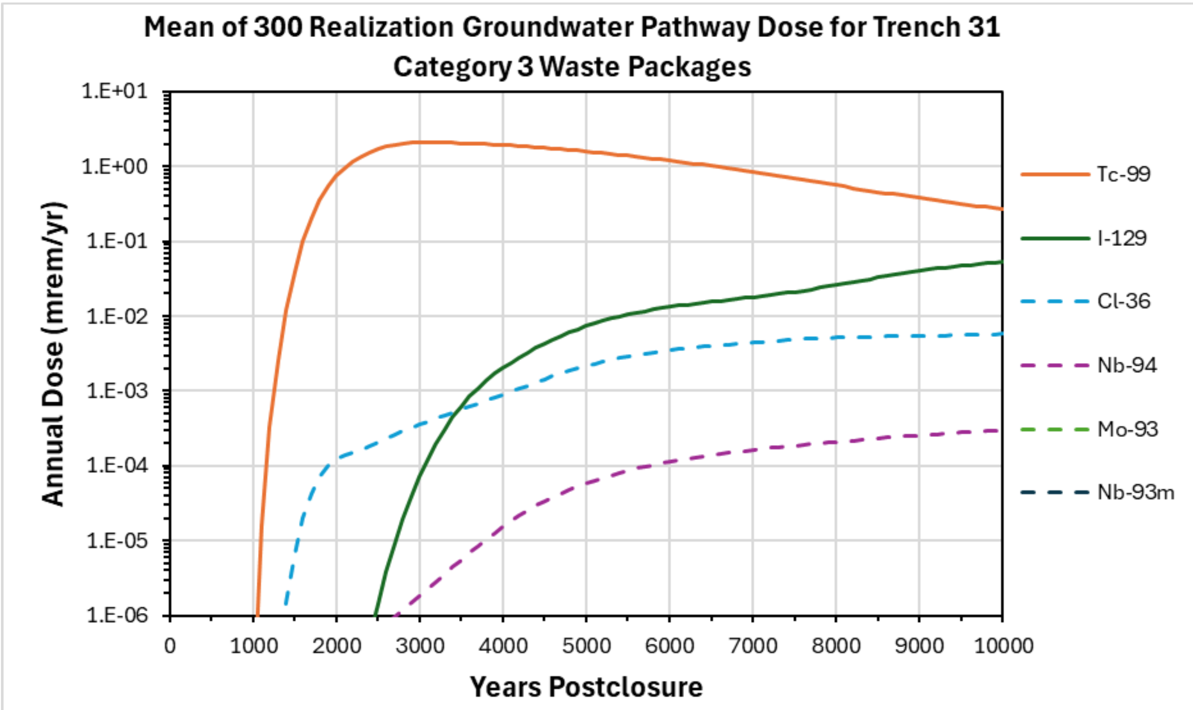

Figure 5. Mean Groundwater Pathway Dose for Selected Radionuclides in Trench 31 CAT3 Waste Packages

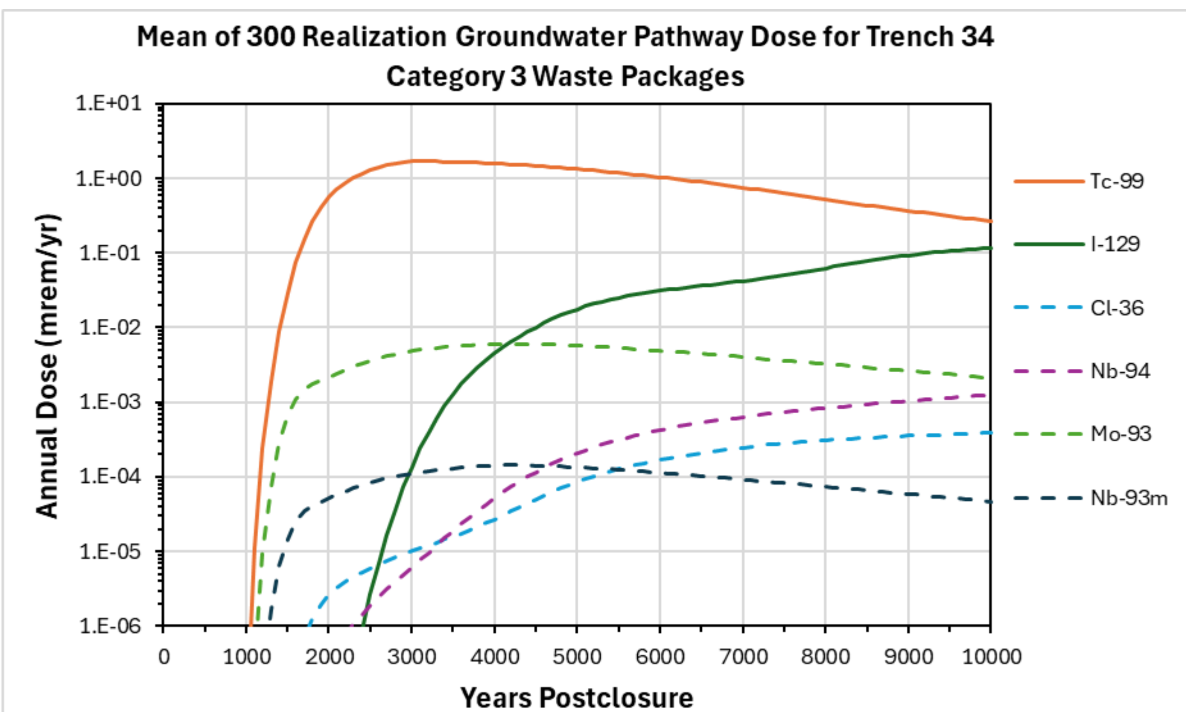

Figure 6. Mean Groundwater Pathway Dose for Selected Radionuclides in Trench 34 CAT3 Waste Packages

5 Calculation of Inventory Thresholds

The inventory threshold is calculated by taking the peak mean dose results presented in Chapter 4 and using that information in Eq 2-1.

5.1 Category 1 Waste Inventory Thresholds for Groundwater Pathway

The Category 1 waste inventory thresholds for the groundwater pathway are presented in Table 2 for Trench 31 and Table 3 for Trench 34, respectively. The first column lists the mobile radionuclides that are the identified as primary dose contributors for the groundwater pathway. The second column lists the inventory in Ci at closure. The third and fourth columns list the peak mean dose estimates from 300 realizations and the years when the peak mean dose occurs. These tables show that all the peak mean dose estimates occur after the compliance period, which warrants “No Limit” for the thresholds for the doses during the compliance period. No inventory thresholds are calculated if either the radionuclide inventory or the peak mean dose estimate is zero (labeled as “N/A” in the tables).

Table 2. Trench 31 Category 1 Waste Inventory Thresholds for Groundwater Pathway

Radionuclide	Inventory (Ci) at closure [a]	Peak Mean Dose (mrem/yr)	Peak Year (Years After Closure)	Threshold (Ci) [b]
Tc-99	8.75E-02	1.90E-01	2,800	1.15E+01
I-129	6.31E-04	3.86E-02	10,000	4.08E-01
Cl-36	3.30E-05	9.01E-05	5,200	9.16E+00
Nb-94	3.40E-03	5.17E-03	4,900	1.64E+01
Mo-93	2.06E-05	1.73E-04	2,100	2.98E+00
Nb-93m	8.16E-03	3.74E-06	2,200	5.46E+04

Note:

a. Table 2-7 in DOE/RL-2021-26, *Performance Assessment of the Active Trenches in 200 East and 200 West Low-Level Burial Grounds at the Hanford Site*, Rev. 0.

b. Eq. 1.

Table 3. Trench 34 Category 1 Waste Inventory Thresholds for Groundwater Pathway

Radionuclide	Inventory (Ci) at closure [a]	Peak Mean Dose (mrem/yr)	Peak Year (Years After Closure)	Threshold (Ci) [b]
Tc-99	6.92E-02	1.52E-01	2,800	1.14E+01
I-129	1.43E-04	8.66E-03	10,000	4.13E-01
Cl-36	1.09E-05	6.74E-04	4,200	4.04E-01
Nb-94	1.94E-03	3.02E-03	4,800	1.60E+01
Mo-93	0.00E+00	0.00E+00	N/A	N/A
Nb-93m	1.63E-02	0.00E+00	N/A	N/A

Note:

a. Table 2-7 in DOE/RL-2021-26, *Performance Assessment of the Active Trenches in 200 East and 200 West Low-Level Burial Grounds at the Hanford Site*, Rev. 0.

b. Eq. 1

N/A: not applicable

5.2 Category 3 Waste Inventory Thresholds for Groundwater Pathway

The CAT3 waste inventory threshold calculation results for the groundwater pathway are presented in Table 4 for Trench 31 and Table 5 for Trench 34, respectively. Note that the Trench 34 inventory thresholds exclude inventory associated with uranium billets. Unlike CAT1 waste inventory thresholds that are almost identical for a given radionuclides in both trenches, the CAT3 waste inventory thresholds among the two trenches are different. The differences are particularly significant for chloride-36, niobium-94, and molybdenum-93. This is attributed to the different configuration and dimension of containers/encasements among the trenches resulting in thickness variations of cementitious barriers. Since the release of radionuclides from CAT 3 waste packages is diffusion-controlled, the variation in wall thickness along with dimensions of the representative containers impacts the release. Therefore, the ratio of peak dose to initial inventory for a given radionuclide (denominator in Eq. 1) is not the same for different trenches. No inventory thresholds are calculated if either the radionuclide inventory or the peak mean dose estimate is zero (labeled as "N/A" in the tables).

Table 4. Trench 31 Category 3 Waste Inventory Thresholds for Groundwater Pathway

Radionuclide	Inventory (Ci) at closure [a]	Peak Mean Dose (mrem/yr)	Peak Year (Years After Closure)	Threshold (Ci) [b]
Tc-99	1.42E+00	2.13E+00	3,100	1.67E+01
I-129	3.04E-03	5.28E-02	10,000	1.44E+00
Cl-36	5.93E-03	5.77E-03	10,000	2.57E+01
Nb-94	2.34E-02	2.99E-04	10,000	1.96E+03
Mo-93	0.00E+00	0.00E+00	N/A	N/A
Nb-93m	2.78E-02	0.00E+00	N/A	N/A

Note:

a. Table 2-7 in DOE/RL-2021-26, *Performance Assessment of the Active Trenches in 200 East and 200 West Low-Level Burial Grounds at the Hanford Site*, Rev. 0.

b. Eq. 1.

N/A = not applicable

Table 5. Trench 34 Category 3 Waste Inventory Thresholds for Groundwater Pathway (Excludes Inventory Associated with Uranium Billets)

Radionuclide	Inventory (Ci) at closure [a]	Peak Mean Dose (mrem/yr)	Peak Year (Years After Closure)	Threshold (Ci) [b]
Tc-99	1.25E+00[c]	1.69E+00	3,100	1.85E+01
I-129	6.11E-03	1.18E-01	10,000	1.30E+00
Cl-36	9.52E-04	3.89E-04	10,000	6.12E+01
Nb-94	3.04E-01	1.25E-03	10,000	6.09E+03
Mo-93	3.92E-02	6.08E-03	4,200	1.61E+02
Nb-93m	2.20E-01	1.43E-04	4,300	3.86E+04

Note:

a. Table 2-7 in DOE/RL-2021-26, *Performance Assessment of the Active Trenches in 200 East and 200 West Low-Level Burial Grounds at the Hanford Site*, Rev. 0

b. Eq. 1

c. Excludes inventory associated with uranium billets).

5.3 Air Pathway Inventory Threshold Calculations

The inventory thresholds are calculated using Eq. 1, where the performance objective is 10 mrem/yr for air pathway. The results are presented in Table 6 for Trench 31 and Table 7 for Trench 34.

Table 6. Trench 31 Inventory Thresholds for Air Pathway

Waste Category	Radionuclide	Inventory (Ci) at closure [a]	Peak Dose (mrem/yr)	Peak Year (Years After Closure)	Threshold (Ci) [b]
1	C-14[c]	1.79E-01	1.70E-03	100	1.05E+03
	H-3	3.85E+03	1.34E-05	100	2.86E+09
3	C-14[c]	3.94E-01	3.16E-06	1,000	1.26E+06
	H-3	1.22E+03	8.18E-09	130	1.49E+12

Note:

a. Table 2-7 in DOE/RL-2021-26, *Performance Assessment of the Active Trenches in 200 East and 200 West Low-Level Burial Grounds at the Hanford Site*, Rev. 0.

b. Eq. 1 with PO = 10 mrem/yr.

c. Includes carbon-14 in activated metal, if any.

Table 7. Trench 34 Inventory Thresholds for Air Pathway

Waste Category	Radionuclide	Inventory (Ci) at closure [a]	Peak Dose (mrem/yr)	Peak Year (Years After Closure)	Threshold (Ci) [b]
1	C-14[c]	8.79E-02	8.35E-04	100	1.05E+03
	H-3	5.27E+03	1.84E-05	100	2.87E+09
3	C-14[c]	7.09E-01	1.80E-06	1,000	3.95E+06
	H-3	2.14E+03	5.96E-10	146	3.59E+13

Note:

a. Table 2-7 in DOE/RL-2021-26, *Performance Assessment of the Active Trenches in 200 East and 200 West Low-Level Burial Grounds at the Hanford Site*, Rev. 0.

b. Eq. 1 with PO = 10 mrem/yr.

c. Includes carbon-14 in activated metal, if any.

6 Summary

The trench-specific and waste category-specific inventory thresholds (inventory limits) are summarized in Table 8 for groundwater pathway and in Table 9 for air pathway. Each inventory threshold in Table 8 would result in 25 mrem/yr dose from that radionuclide for the groundwater pathway. Similarly, each inventory threshold in Table 9 would result in 10 mrem/yr dose from that radionuclide for the air pathway. For assessing compliance, the estimated inventory of the radionuclide (decayed to assumed closure date of Year 2035) should be divided by its inventory threshold value to calculate the fraction of the inventory limit, and then the sum of fractions for all the radionuclides listed in the tables should be performed to demonstrate that the value is less than one.

Table 8. Summary of Inventory Thresholds for Groundwater Pathway (in Curies)

Radionuclide	Trench 31		Trench 34	
	Category 1 (Ci) [a]	Category 3 (Ci) [b]	Category 1 (Ci) [c]	Category 3 (Ci) [d]
Tc-99	1.15E+01	1.67E+01	1.14E+01	1.85E+01
I-129	4.08E-01	1.44E+00	4.13E-01	1.30E+00
Cl-36	9.16E+00	2.57E+01	4.04E-01	3.25E+00
Nb-94	1.64E+01	1.96E+03	1.60E+01	6.09E+03
Mo-93	2.98E+00	N/A	N/A	1.61E+02
Nb-93m	5.46E+04	N/A	N/A	3.86E+04

Note:
a. Table 2.
b. Table 3.
a. Table 4.
b. Table 5.

Table 9. Summary of Inventory Thresholds for Air Pathway (in Curies)

Radionuclide	Trench 31 [a]		Trench 34 [b]	
	Category 1 (Ci)	Category 3 (Ci)	Category 1 (Ci)	Category 3 (Ci)
C-14	1.05E+03	1.26E+06	1.05E+03	3.95E+06
H-3	2.86E+09	1.49E+12	2.87E+09	3.59E+13

Note:
a. Table 6.
b. Table 7.

7 References

CP-68009, 2022, *GoldSim: Version 14 Software Management Plan*, Rev. 0, Central Plateau Cleanup Company, Richland, Washington.

CPCC-PRO-IRM-309, 2021, *Controlled Software Management*, Rev.0 Change 2, Central Plateau Cleanup Company, Richland, Washington.

DOE O 435.1 Chg 2 (AdminChg), 2021, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C. Available at: https://www.directives.doe.gov/directives-documents/400-series/0435.1-BOrder-chg2-AdminChg/@@images/file.

DOE/RL-2021-26, 2023*, Performance Assessment of the Active Trenches in 200 East and 200 West Low-Level Burial Grounds at the Hanford Site*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://www.osti.gov/biblio/2202253.

Ellis, K.G., 2023, *Revised Operating Disposal Authorization Statements for the 200 East and 200 West Low-Level Waste Burial Grounds at Hanford,* Memorandum from U.S. Department of Energy Acting Associate Principal Deputy Assistant Secretary for Regulatory and Policy Affairs to Manager Richland and Office of River Protection Offices at Hanford, on October 2, 2023.

HNF-EP-0063, 2023, *Hanford Site Solid Waste Acceptance Criteria*, Rev. 22, Central Plateau Cleanup Company, Richland, Washington.

Appendix A

Software Installation and Checkout Form

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SOFTWARE INSTALLATION AND CHECKOUT FORM

Software Owner Instructions:
Complete Fields 1-13, then run test cases in Field 14. Compare test case results listed in Field 15 to corresponding Test Report outputs. If results are the same, sign and date Field 19. If not, resolve differences and repeat above steps.

Software Subject Matter Expert Instructions:
Assign test personnel. Approve the installation of the code by signing and dating Field 21, then maintain form as part of the software support documentation.

GENERAL INFORMATION

1. Software Name: GoldSim Pro — Version No.: 14

EXECUTABLE INFORMATION

2. Executable Name *(include path)*:
[redacted]GoldSim.exe

MD5 CheckSum of Executable: 002B3AB2A73E1637464DE5BDE72CEF4E

3. Executable Size *(bytes)*: 3,399,000

COMPILATION INFORMATION

4. Hardware System *(i.e., property number or ID)*:
Compiled by vendor

5. Operating System *(include version number)*:
Windows

INSTALLATION AND CHECKOUT INFORMATION

6. Hardware System *(i.e., property number or ID)*:
PSC-NEON.intera.com Product ID: 00300-52836-12848-AAOEM

7. Operating System *(include version number)*:
Windows 10 Pro

8. Open Problem Report? ☐ Yes ☒ No — PR/CR No.:

TEST CASE INFORMATION

9. Directory/Path:
[redacted]General Examples

10. Procedures:
per CP-68009 Rev 0, GoldSim Pro Software Management Plan

11. Libraries:
N/A

12. Input Files:
FirstModel.gsm

13. Output Files:
FirstModel.gsm

14. Test Cases:
GS-ITC-1

15. Test Case Results:
Match expected results as presented in CP-68009, GoldSim Pro Software Management Plan

16. Test Performed By: Wei Zhou

17. Test Results: ☒ Satisfactory, Accepted for Use ☐ Unsatisfactory

18. Disposition *(include HISI update)*:

SOFTWARE INSTALLATION AND CHECKOUT FORM (Continued)
Accepted, entry added to HISI

SOFTWARE INSTALLATION AND CHECKOUT FORM (Continued)

19. Prepared By *(Software Owner)*: Christopher Farrow *Print First and Last Name*	CHRISTOPHER FARROW (Affiliate) Digitally signed by CHRISTOPHER FARROW (Affiliate) DN: C=US, O=U.S. Government, OU=Department of Energy, OID.0.9.2342.19200300.100.1.1=89001003727219 + CN=CHRISTOPHER FARROW (Affiliate) Reason: I have reviewed this document Location: your signing location here Date: 2023.02.06 12:35:09-08'00' Foxit PhantomPDF Version: 10.1.9 *Signature / Date*
20. Test Personnel: Title: Principal Engineer Wei Zhou *Print First and Last Name*	Wei Zhou (Affiliate) Digitally signed by Wei Zhou (Affiliate) Date: 2023.02.06 12:58:27 -05'00' *Signature / Date*
Title: *Print First and Last Name*	 *Signature / Date*
Title: *Print First and Last Name*	 *Signature / Date*
21. Approved By *(Software SME)*: William Nichols *Print First and Last Name*	WILLIAM NICHOLS (Affiliate) Digitally signed by WILLIAM NICHOLS (Affiliate) Date: 2023.02.06 10:50:48 -08'00' *Signature / Date*

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